

TASMANIA

Osteoporosis costing Tasmania: A burden of disease analysis – 2012 to 2022



osteoporosis australia



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Prepared for Osteoporosis Australia, C2.11, Level 2, 22-36 Mountain Street, Ultimo, NSW 2007

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ISBN 978-0-6481053-2-9

Suggested Citation: Sanders KM, Watts JJ, Abimanyi-Ochom J, Murtaza G. Osteoporosis costing Tasmania: A burden of disease analysis – 2012 to 2022. Osteoporosis Australia 2017 ISBN 978-0-6481053-2-9 <http://osteoporosis.org.au/burdenofdisease>

Acknowledgements

Data obtained from the following people and associated projects has been crucial to the analyses used in this current report. Both Osteoporosis Australia and the authors gratefully acknowledge the expertise from the Investigators of the NHMRC-funded AusICUROS project; the Geelong Osteoporosis Study and the Data Integrity manager at Barwon Health.

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The AusICUROS research is supported by a National Health & Medical Research Council (NHMRC) Project Grant (#628422) with supplemental funding from MSD (Australia).

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Forewords



Professor Peter R Ebeling AO
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In Australia a fracture occurs due to poor bone health every 3.3 minutes. Over 160,000 fractures occur annually. They are costly for our healthcare system and, in particular, for hospitals in all Australian states and territories.

This burden of disease report for osteoporosis shows the number of fractures and associated costs in Tasmania.

- Over a 10-year period an estimated 42,871 fractures costing \$564 million in total direct costs will occur in Tasmania.
- Our hospital system is becoming a revolving door for first fractures and, most importantly, subsequent fractures, which can and should be prevented.
- It's now time to make bone health a priority and to ensure osteoporosis is diagnosed and appropriately managed to reduce fractures.



Professor Graeme Jones
Menzies Institute of Medical Research, Hobart

Tasmania is being impacted by costly fractures, this important burden of disease analysis reviews the common types of fractures associated with poor bone health. Typically these fractures require emergency assistance, surgery, hospital stays, rehabilitation and community services (such as home care). It also shows the most expensive type of fracture remains hip fracture and costs increase with age.

We need to focus on reducing fracture numbers – even small reductions in fracture numbers can offer significant savings. The government and health professionals can collectively reduce the fracture burden by focussing on this costly health issue.



Greg Lyubomirsky
CEO, Osteoporosis Australia

Breaking a bone from poor bone health is serious and painful for any patient and affects their family. It significantly disrupts normal daily tasks such as working, driving, shopping and caring for children or grandchildren.

The estimated number of fractures over a 10-year period is staggering and yet many people leave hospital following a serious fracture without investigation or diagnosis of osteoporosis. We are ignoring the underlying cause! This is an unacceptable burden for the community and places patients at higher risk of further fractures.

List of Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
ALOS	Average Length of Stay
ARDRG	Australian Refined Diagnosis Related Group
AUD	Australian Dollars
AusICUROS	The Australian Study of Cost and Utilities Related to Osteoporotic Fractures
BMD	Bone Mineral Density
BMI	Body Mass Index
BOD	Burden of Disease
COI	Cost if Illness
DALYs	Disability Adjusted Life Years
DRG	Diagnosis Related Group
DXA	Dual-energy X-ray Absorptiometry
ED	Emergency Department
GOS	Geelong Osteoporosis Study
GPs	General Practitioners
HRT	Hormone Replacement Therapy
IHPA	Independent Hospital Pricing Authority
IOF	International Osteoporosis Foundation
MBS	Medicare Benefit Schedule
Med Spec	Medical Specialist
MOW	Meals on wheels
NSAIDs	Non-Steroidal Anti Inflammatory Drugs
OA	Osteoporosis Australia
OPD	Out Patient Department
OTC	Over the counter
PBS	Pharmaceutical Benefit Scheme
Physio	Physiotherapy
RPBS	Repatriation Pharmaceutical Benefits Scheme
SES	Social Economic Status
SERMs	Selective Estrogen Receptor Modulators
WHO	World Health Organisation

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Objectives

The primary aim of this study is to determine the annual burden of disease of osteoporosis from a societal perspective in each of the State and Northern Territory populations in 2012, and then model the assumptions from this analysis to predict the annual fracture burden from 2013 to 2022. The objectives of the analysis are to:

- 1 use the best available Australian data on incidence and prevalence and health service utilisation to estimate the burden of disease relating to osteoporosis and low trauma fractures (prevention and management) and the total disease burden attributable to osteoporosis in each state and territory in 2012;
- 2 model the burden forward 10 years to 2022 to estimate the annual number of fractures projected to occur in adults with osteoporosis and osteopenia and the total direct costs of treating these fractures.

Reports in this Series

Reports have been produced for each state and territory:

- Victoria
- NSW & ACT
- Queensland
- Northern Territory
- Western Australia
- South Australia
- Tasmania

Key findings in each report outline the burden of osteoporosis and fractures in 2012 and predicted annual number and total direct cost of fractures for each year 2013 to 2022.

As Australia does not have adequate data on the state by state prevalence of low bone mass and fracture incidence, the reports for each state and territory are based on the same prevalence, incidence and unit cost data as previously used in the national 2012 report 'Osteoporosis Costing All Australians: A new burden of disease analysis 2012 to 2022'¹. These raw data have been applied to the ABS population estimates for each state and territory for each gender and 5-year age band with results then compiled into two age groups for both women and men (50 to 69 year olds and 70+ year olds). Therefore the differences in the size of the population aged 50 years and over and also the distributions by gender and 5-year age groups between the states and Northern Territory drives the disparities in the estimated burden of osteoporosis and associated fractures. The States with the highest population in the oldest age groups have the largest in number of people with fracture and the highest total cost of osteoporosis management and associated fracture treatment. Table 1 shows the mean direct cost per individual with a fracture.

Table 1: Mean direct cost per fracture (2012\$)*

Fracture Type	Female		Male	
	50-69 years	70+ years	50-69 years	70+ years
Hip	21,859	35,856	23,313	32,427
Wrist	4,848	7,992	4,215	5,323
Vertebral	6,099	9,606	6,228	6,987
Other	8,645	12,391	6,600	13,059

* Mean cost per fracture has been derived from health and non-health service utilisation collected from AusICUROS data, as detailed in the methods. All calculations have been done using gender and 5-year age distributions prior to presenting results in the two broad age groups.

TASMANIA

Burden of Osteoporosis, Osteopenia and Associated Fractures in Tasmania



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Summary – Key Findings

Burden of Osteoporosis, Osteopenia and Associated Fractures in Tasmania

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Poor Bone Health: 2012-2022

- By 2022, it is estimated there will be 155,300 older people in Tasmania with low bone mass, an increase of 25% from 2012.
- 139,000 adults in Tasmania aged 50 years and older (67%) have osteoporosis or osteopenia (poor bone health) in 2017.
- 125,000 adults in Tasmania aged 50 years and older (66%), had osteoporosis or osteopenia (poor bone health) in 2012.
- Among people in Tasmania aged 50 years and older, 15% had osteoporosis and 52% have osteopenia.
- Among people in Tasmania aged 70 years and older, 43% of women and 13% of men had osteoporosis (13,400 women and 3,300 men).

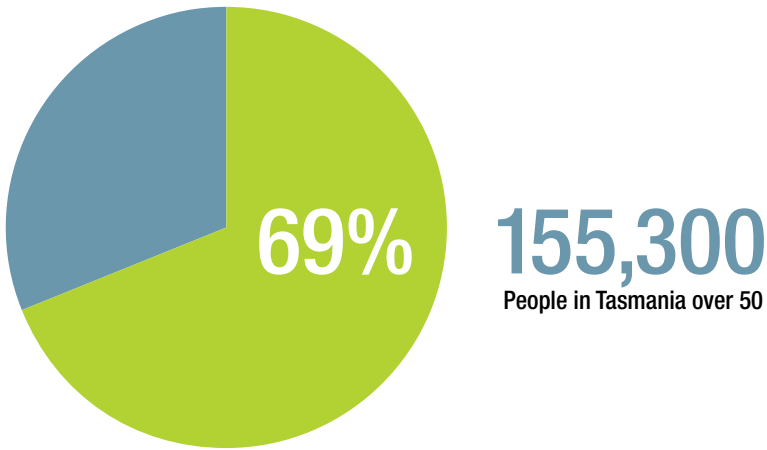
Fracture Impact: 2012-2022

- The total number of fractures over the ten year period 2013 to 2022 is projected to be 42,871.
- In 2022 it is expected there will be a 32% increase in the annual number of fractures (over 10 years) resulting in 4,900 fractures per annum.
- In 2022 there will be 13.4 fractures every day among older adults in Tasmania. Approximately one in six of these fractures will be a hip fracture.
- In 2017 there will be 11.5 fractures every day among older adults in Tasmania.

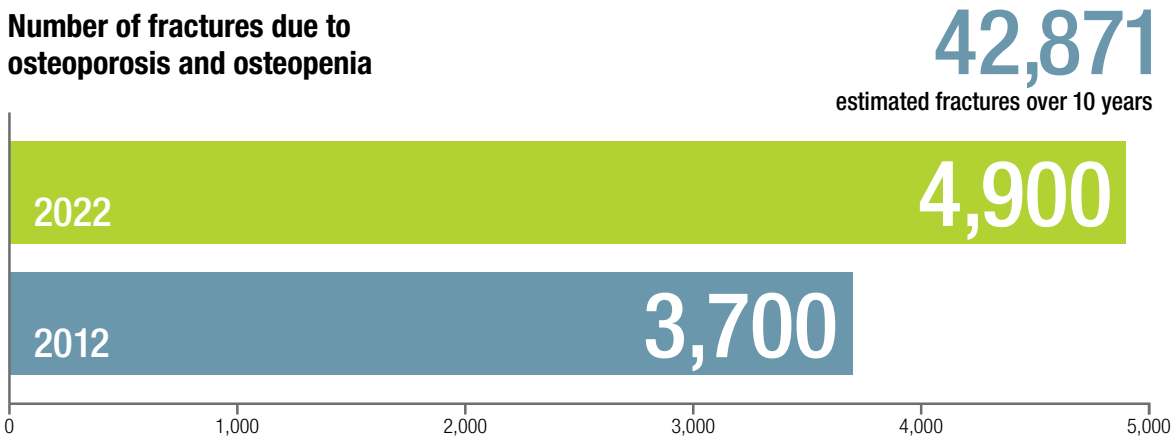
Cost Impact: 2012-2022

- The total direct costs of fractures over the ten years 2013 to 2022 will be \$564 million (2012\$). These costs include ambulance services, hospitalisations and emergency and outpatient departments, rehabilitation, limited aged care and community services.
- In 2017 the total direct costs of osteoporosis and osteopenia in Tasmanian adults aged 50 years and over will be \$78 million of which \$55 million (71%) relates to the treatment of fractures.
- In 2012 the total direct costs of osteoporosis and osteopenia in Tasmania adults aged 50 years and over, were \$67.1 million of which \$47.4 million (71%) relates to the treatment of fractures.

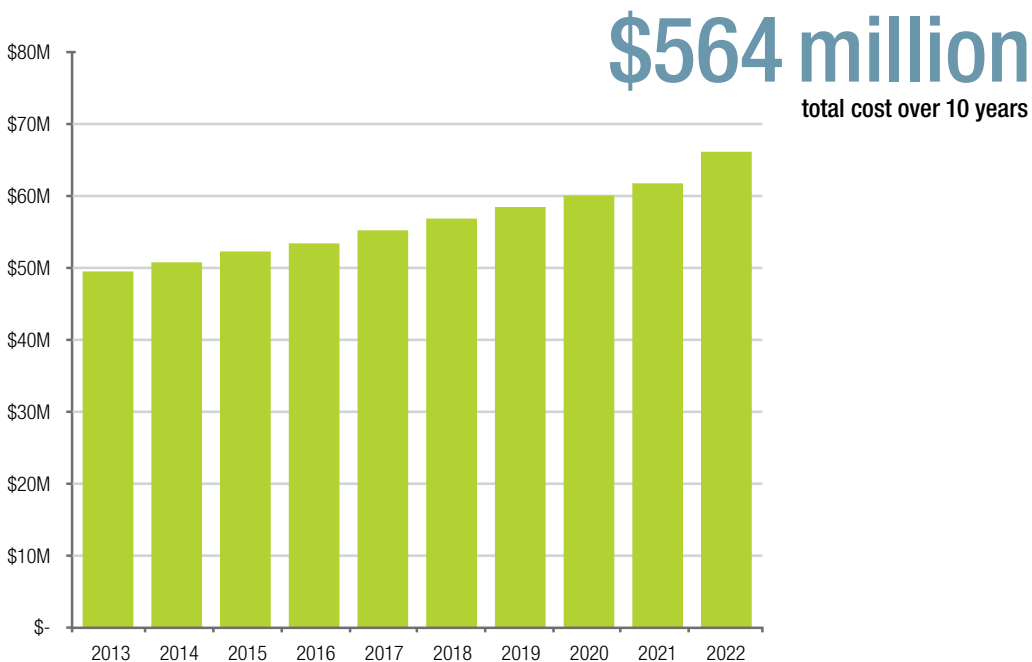
People in Tasmania over 50 estimated to have osteoporosis or osteopenia in 2022



Number of fractures due to osteoporosis and osteopenia



Total direct costs of fractures, 2013-2022 (2012\$) \$millions



Impact of Osteoporosis, Osteopenia and Fractures in Tasmania

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A total of 66% of the Tasmania population aged 50 years and over in 2012 had osteoporosis or osteopenia, the same proportion as reported for the Australian population (Table 2). Among older persons in Tasmania, 52% had osteopenia (n=97,326) and 15% (n=27,331) had osteoporosis. Osteopenia in those aged 50-69 years formed the group with the largest number of people, with almost 4,000 more men than women (Table 2). Although substantially fewer people had osteoporosis, there were four times as many women as men irrespective of the age group. Among adults aged 70 years and older it is estimated that 43% of women and 13% of men had osteoporosis in 2012 (approximately 13,000 women and 3,300 men).

Of the Tasmanian population with osteoporosis and osteopenia aged 50 years and over, 3% (n=3,692) had fractures in 2012. Of these older adults 16% had a hip fracture (n=603) with the remainder sustaining non-hip fractures (14% wrist, 18% vertebral and 51% with 'other' fracture types). Due to the higher prevalence of osteopenia compared to osteoporosis, fracture numbers were highest among those with osteopenia in each age and gender subgroup except for women aged 70+ years, where 58% more fractures occurred in women with osteoporosis compared to osteopenia (Table 3).

Fractures in Men vs Women

Seventy-one percent of all fractures occurred in women – 40% in those aged 70 years and over and 30% in those aged 50-69 years. Approximately 15% and 14% of all fractures occur in men aged 50-69 years and 70 years and over, respectively (Table 3).

Across the two age groups and both bone density categories, absolute fracture numbers were consistently higher in women than men (percentages of fractures in men were: 'All' fractures 29%; Hip 30%; Wrist 11%; Vertebral 23%; 'Other' sites grouped: 37%). There were twice as many fractures in men with osteopenia than osteoporosis (osteopenia: n=730 vs osteoporosis n=354). In women the fracture numbers were more balanced due to the combination of a higher population in the older age group and the very high fracture rate among these older women with osteoporosis (aged 70+ years: 6.8%; n=912/13,386).

Table 2: 2012 Tasmania population by gender, age group and BMD category

Age Group	Osteoporosis		Osteopenia		Normal BMD		Total Population		
	Female	Male	Female	Male	Female	Male	Female	Male	Both
50-69 years	8,561	2,116	32,149	35,958	25,053	27,748	65,763	65,823	131,586
70+ years	13,386	3,266	14,276	14,944	3,292	7,093	30,954	25,303	56,257
Totals	21,948	5,383	46,424	50,902	28,345	34,842	96,717	91,126	187,843

Table 3: 2012 populations by gender, age group BMD category and fracture type

Population	Female				Total	Male				Total	All
	50-69 years		70+ years			50-69 years		70+ years			
	Osteoporosis	Osteopenia	Osteoporosis	Osteopenia	All Women	Osteoporosis	Osteopenia	Osteoporosis	Osteopenia	All Men	Total
Total Population	8,561	32,149	13,386	14,276	68,372	2,116	35,958	3,266	14,944	56,284	124,656
Population with fracture (Total)	472	646	912	576	2,607	181	387	173	343	1,085	3,692
Hip											
Starting population	18	24	235	148	425	11	23	49	96	178	603
Hospitalised	18	24	235	148	425	11	23	49	96	178	603
Wrist											
Starting population	93	127	151	95	466	9	20	10	19	59	525
Hospitalised	42	57	97	61	257	4	9	5	10	27	284
Vertebral											
Starting population	71	97	214	135	517	19	41	31	61	151	668
Hospitalised	33	46	135	85	299	9	20	21	41	91	390
Other											
Starting population	291	398	313	197	1,199	142	303	84	167	697	1,896
Hospitalised	177	243	213	134	767	65	140	62	124	391	1,158
Low BMD population without fracture	8,089	31,502	12,474	13,699	65,765	1,935	35,571	3,093	14,601	55,200	120,964

Total Cost of Osteoporosis and Osteopenia in Tasmania 2012

Table 4: Total costs (direct and indirect) of osteoporosis and osteopenia in 2012

Cost	Total Cost (\$)	% Total Cost (direct and indirect)
Total Direct Fracture Cost (excluding informal care)	\$43,655,073	60.9
- Hip fractures	\$19,204,058	
- Wrist fractures	\$3,124,966	
- Vertebral fractures	\$4,615,498	
- Other fractures	\$16,710,552	
Total Cost Informal Care	\$3,722,541	5.2
- Hip fractures	\$978,752	
- Wrist fractures	\$190,376	
- Vertebral fractures	\$768,755	
- Other fractures	\$1,784,658	
Total Direct Fracture Cost (including informal care)	\$47,377,614	66.1
- Hip fractures	\$20,182,810	
- Wrist fractures	\$3,315,342	
- Vertebral fractures	\$5,384,252	
- Other fractures	\$18,495,210	
Total Direct Non-Fracture Cost	\$19,729,315	27.5
- Routine medical and pathology (includes Vitamin D tests)	\$16,472,110	
- DXA	\$459,702	
- Pharmaceuticals – bone health	\$2,797,503	
TOTAL DIRECT COSTS (fracture treatment + management of osteoporosis)	\$67,106,929	93.6
TOTAL DIRECT COSTS (excluding informal care)*	\$63,384,388	
Total Indirect cost (Productivity Loss due to Fractures)	\$4,595,265	6.4
- Hip fractures	\$2,109,225	
- Wrist fractures	\$227,537	
- Vertebral fractures	\$520,619	
- Other fractures	\$1,737,884	
TOTAL DIRECT and INDIRECT COST	\$71,702,195	
TOTAL DIRECT and INDIRECT COST (DUE TO FRACTURES)	\$51,972,879	72.5

* Total direct cost (excluding informal care) was used as the denominator in percentage calculations in all tables (unless otherwise stated)

The treatment of fractures accounted for 71% of total direct costs (including informal care) associated with osteoporosis (\$47.4/\$67.1 million: Table 4). Of this, hip fractures accounted for the highest proportion (43%) although the direct treatment cost of fractures at 'other' sites was almost 40% of the cost of all fractures. Treatment costs of vertebral fracture accounted for 11% of the cost of all fractures. Informal care includes the cost of non-health community services such as 'meals on wheels' and home help. This cost was 8% of the total direct cost of treating fractures and fractures at 'other' sites accounted for almost half of this expenditure.

The management of osteoporosis accounted for 29% of the total direct costs associated with osteoporosis. This includes the use of bone-active medications (see Appendices A and D2), supplements of calcium and vitamin D but does not include costs associated with exercise therapy or other lifestyle interventions.

Acute Care Fracture Costs

Acute Hospital Services (including Emergency Department and Non-Admitted Services)

In Tasmania the total cost of acute hospital care for fractures associated with osteoporosis or osteopenia in 2012 was \$32 million, of which the total for acute inpatient hospitalisation was \$30.4 million (95% of total hospital costs) (Table 5). The remainder of \$1.5 million was for non-admitted services (including emergency departments). Total costs of hospital care for fractures represented 67% of the direct costs of fractures. Hospital costs alone account for 44% of the direct total costs attributed to osteoporosis in 2012. Fractures accounted for approximately 2,435 acute admissions to hospital in 2012, representing 17,855 bed-days, with an average length of stay of 4.3 days in those aged 50 to 69 years old and 9.2 days in those aged 70 years and older.

Hip fractures represented 43% of total acute inpatient hospital costs and 37% of bed-days, vertebral fractures 9% of hospital costs and 11% of bed-days, wrist fractures 7% of hospital costs and 3% of bed-days and 'other' fractures 41% of total acute hospital costs and 49% of acute bed-days. People aged 70 years and over accounted for 70% of total acute hospital inpatient costs of fractures, and costs for women were 70% of the total. The highest single category was acute inpatient care for women aged over 70 years with a hip fracture, with a total cost of \$8.6 million representing 28% of total hospital costs for all age, sex and fracture categories. See Table 5 below for a summary of costs relating to the hospital management of fractures.

Table 5: Hospital (admitted and non-admitted) costs for fracture management by gender, age group and fracture type

	Female (Total Cost)				Male (Total Cost)				All		% Total Direct Costs
	50-69 years	% Total	70+ years	% Total	50-69 years	% total	70+ years	% Total	Total Cost	% Total	
Hospital Inpatient – Total Cost	\$6,244,742	21	\$15,215,818	50	\$2,956,047	10	\$5,934,827	20	\$30,351,434	100	45.2
- Hip	712,575	2	8,636,679	28	573,465	2	3,272,026	11	\$13,194,746	43	
- Wrist	723,107	2	1,086,595	4	95,547	0	99,307	0	\$2,004,556	7	
- Vertebral	528,505	2	1,468,057	5	198,363	1	408,986	1	\$2,603,911	9	
- Other	4,280,554	14	4,024,487	13	2,088,671	7	2,154,509	7	\$12,548,221	41	
Hospital (Non-admitted services) – Total Cost	\$578,600	38	\$490,330	32	\$319,480	21	\$149,026	10	\$1,537,436	100	2.3
- Hip	8,181	1	22,836	1	5,577	0	13,208	1	\$49,803	3	
- Wrist	130,199	8	122,169	8	18,838	1	15,334	1	\$286,539	19	
- Vertebral	71,038	5	112,944	7	30,877	2	28,595	2	\$243,454	16	
- Other	369,182	24	232,380	15	264,188	17	91,889	6	\$957,639	62	
All Hospital – Total Cost	\$6,823,341	21	\$15,706,148	49	\$3,275,527	10	\$6,083,853	19	\$31,888,869	100	47.5
- Hip	720,757	2	8,659,516	27	579,043	2	3,285,234	10	\$13,244,549	42	
- Wrist	853,306	3	1,208,764	4	114,385	0	114,640	0	\$2,291,095	7	
- Vertebral	599,543	2	1,581,001	5	229,240	1	437,581	1	\$2,847,365	9	
- Other	4,649,736	15	4,256,867	13	2,352,860	7	2,246,398	7	\$13,505,860	42	

Tables 6 to 10 provide more detail on the individual cost categories that are included in the total direct and indirect costs associated with fractures. The costs have been calculated based on utilisation of services in the 12 month period following the fracture event (Appendix B). All costs are restricted to services used as a direct consequence of the fracture.

Table 6: Total cost of all fractures by gender, age group and sector

	Female				Male				All	
	Ages 50-69 years		Age 70+ years		Ages 50-69 years		Age 70+ years		Total Cost	% Direct Total Cost
All Fractures	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost		
Hospital Total	\$6,823,341	10.2	\$15,706,148	23.4	\$3,275,527	4.9	\$6,083,853	9.1	\$31,888,869	47.5
Ambulance	\$292,323	0.4	\$660,263	1.0	\$167,033	0.2	\$274,249	0.4	\$1,393,868	2.1
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$151,654	0.2	\$194,495	0.3	\$75,669	0.1	\$98,186	0.1	\$520,005	0.8
Rehabilitation	\$583,293	0.9	\$4,680,759	7.0	\$196,451	0.3	\$1,243,349	1.9	\$6,703,852	10.0
Nursing Home	\$-	0.0	\$1,231,979	1.8	\$-	0.0	\$402,173	0.6	\$1,634,152	2.4
Community Services (home help and MOW)	\$200,211	0.3	\$826,032	1.2	\$4,595	0.0	\$209,112	0.3	\$1,239,950	1.8
Pharmaceuticals – Fracture Management	\$2,295	0.0	\$2,920	0.0	\$657	0.0	\$499	0.0	\$6,371	0.0
Supplements – Vitamin D and Calcium	\$83,044	0.1	\$106,373	0.2	\$42,092	0.1	\$36,498	0.1	\$268,006	0.4
Total Direct Health Care Cost (excludes informal care)	\$8,136,161	12.1	\$23,408,970	34.9	\$3,762,024	5.6	\$8,347,918	12.4	\$43,655,073	65.1
Informal care	\$822,221		\$1,974,604		\$456,332		\$469,385		\$3,722,541	
Total Direct Cost (includes informal care)	\$8,958,382		\$25,383,573		\$4,218,356		\$8,817,303		\$47,377,614	
Productivity Loss due to Fracture (Indirect)	\$571,859		\$2,794,323		\$254,514		\$974,570		\$4,595,265	
Total Cost (Direct and Indirect)	\$9,530,241		\$28,177,896		\$4,472,869		\$9,791,873		\$51,972,879	

Table 7: Total cost of hip fractures by gender, age group and sector

	Female				Male				All	
	Ages 50-69 years		Age 70+ years		Ages 50-69 years		Age 70+ years		Total Cost	% Direct Total Cost
Hip Fractures	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost		
Hospital Total	\$720,757	1.1	\$8,659,516	12.9	\$579,043	0.9	\$3,285,234	4.9	\$13,244,549	19.7
Ambulance	\$24,927	0.0	\$248,073	0.4	\$20,753	0.0	\$99,982	0.1	\$393,734	0.6
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$14,664	0.0	\$61,893	0.1	\$11,294	0.0	\$50,125	0.1	\$137,977	0.2
Rehabilitation	\$139,046	0.2	\$2,798,622	4.2	\$165,780	0.2	\$790,706	1.2	\$3,894,154	5.8
Nursing Home	\$-	0.0	\$800,065	1.2	\$-	0.0	\$389,708	0.6	\$1,189,773	1.8
Community Services (home help and MOW)	\$2,003	0.0	\$230,205	0.3	\$-	0.0	\$68,702	0.1	\$300,910	0.4
Pharmaceuticals – Fracture Management	\$121	0.0	\$1,036	0.0	\$28	0.0	\$120	0.0	\$1,306	0.0
Supplements – Vitamin D and Calcium	\$3,073	0.0	\$26,294	0.0	\$2,326	0.0	\$9,962	0.0	\$41,654	0.1
Total Direct Health Care Cost (excludes informal care)	\$904,592	1.3	\$12,825,705	19.1	\$779,223	1.2	\$4,694,538	7.0	\$19,204,058	28.6
Informal care	\$5,069		\$918,524		\$1,535		\$53,625		\$978,752	
Total Direct Cost (includes informal care)	\$909,660		\$13,744,229		\$780,758		\$4,748,163		\$20,182,810	
Productivity Loss due to Fracture (Indirect)	\$78,513		\$1,465,293		\$80,036		\$485,383		\$2,109,225	
Total Cost (Direct and Indirect)	\$988,173		\$15,209,522		\$860,794		\$5,233,545		\$22,292,035	

Table 8: Total cost of wrist fractures by gender, age group and sector

Wrist Fractures	Female				Male				All	
	Ages 50-69 years		Age 70+ years		Ages 50-69 years		Age 70+ years		Total Cost	% Direct Total Cost
	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost		
Hospital Total	\$853,306	1.3	\$1,208,764	1.8	\$114,385	0.2	\$114,640	0.2	\$2,291,095	3.4
Ambulance	\$25,729	0.0	\$47,539	0.1	\$3,886	0.0	\$7,945	0.0	\$85,098	0.1
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$23,626	0.0	\$30,160	0.0	\$2,398	0.0	\$2,422	0.0	\$58,607	0.1
Rehabilitation	\$73,448	0.1	\$410,136	0.6	\$1,618	0.0	\$24,989	0.0	\$510,191	0.8
Nursing Home	\$-	0.0	\$94,118	0.1	\$-	0.0	\$688	0.0	\$94,806	0.1
Community Services (home help and MOW)	\$2,817	0.0	\$42,028	0.1	\$-	0.0	\$740	0.0	\$45,584	0.1
Pharmaceuticals – Fracture Management	\$481	0.0	\$526	0.0	\$19	0.0	\$18	0.0	\$1,044	0.0
Supplements – Vitamin D and Calcium	\$16,345	0.0	\$17,881	0.0	\$2,209	0.0	\$2,106	0.0	\$38,540	0.1
Total Direct Health Care Cost (excludes informal care)	\$995,752	1.5	\$1,851,151	2.8	\$124,515	0.2	\$153,548	0.2	\$3,124,966	4.7
Informal care	\$70,014		\$119,673		\$689		\$0		\$190,376	
Total Direct Cost (includes informal care)	\$1,065,766		\$1,970,824		\$125,204		\$153,548		\$3,315,342	
Productivity Loss due to Fracture (Indirect)	\$43,579		\$168,397		\$3,563		\$11,998		\$227,537	
Total Cost (Direct and Indirect)	\$1,109,345		\$2,139,222		\$128,766		\$165,546		\$3,542,879	

Table 9: Total cost of vertebral fractures by gender, age group and sector

Vertebral Fractures	Female				Male				All	
	Ages 50-69 years		Age 70+ years		Ages 50-69 years		Age 70+ years		Total Cost	% Direct Total Cost
	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost		
Hospital Total	\$599,543	0.9	\$1,581,001	2.4	\$229,240	0.3	\$437,581	0.7	\$2,847,365	4.2
Ambulance	\$61,390	0.1	\$168,023	0.3	\$25,745	0.0	\$26,409	0.0	\$281,567	0.4
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$25,060	0.0	\$32,816	0.0	\$7,768	0.0	\$8,528	0.0	\$74,172	0.1
Rehabilitation	\$58,710	0.1	\$570,783	0.9	\$3,673	0.0	\$106,010	0.2	\$739,175	1.1
Nursing Home	\$-	0.0	\$130,984	0.2	\$-	0.0	\$2,919	0.0	\$133,903	0.2
Community Services (home help and MOW)	\$68,661	0.1	\$415,903	0.6	\$-	0.0	\$5,533	0.0	\$490,098	0.7
Pharmaceuticals – Fracture Management	\$104	0.0	\$210	0.0	\$34	0.0	\$51	0.0	\$398	0.0
Supplements – Vitamin D and Calcium	\$12,506	0.0	\$25,292	0.0	\$4,410	0.0	\$6,612	0.0	\$48,820	0.1
Total Direct Health Care Cost (excludes informal care)	\$825,973	1.2	\$2,925,011	4.4	\$270,871	0.4	\$593,643	0.9	\$4,615,498	6.9
Informal care	\$200,026		\$424,364		\$98,772		\$45,592		\$768,755	
Total Direct Cost (includes informal care)	\$1,025,999		\$3,349,376		\$369,642		\$639,235		\$5,384,252	
Productivity Loss due to Fracture (Indirect)	\$80,876		\$335,342		\$25,370		\$79,032		\$520,619	
Total Cost (Direct and Indirect)	\$1,106,875		\$3,684,718		\$395,012		\$718,268		\$5,904,872	

Table 10: Total cost of 'other' fractures by gender, age group and sector

Other Fractures	Female				Male				All	
	Ages 50-69 years		Age 70+ years		Ages 50-69 years		Age 70+ years		Total Cost	% Direct Total Cost
Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost	% Direct Total Cost	Total Cost		
Hospital Total	\$4,649,736	6.9	\$4,256,867	6.3	\$2,352,860	3.5	\$2,246,398	3.3	\$13,505,860	20.1
Ambulance	\$180,277	0.3	\$196,629	0.3	\$116,649	0.2	\$139,914	0.2	\$633,469	0.9
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$88,304	0.1	\$69,626	0.1	\$54,208	0.1	\$37,111	0.1	\$249,249	0.4
Rehabilitation	\$312,089	0.5	\$901,218	1.3	\$25,380	0.0	\$321,645	0.5	\$1,560,332	2.3
Nursing Home	\$-	0.0	\$206,812	0.3	\$-	0.0	\$8,857	0.0	\$215,669	0.3
Community Services (home help and MOW)	\$126,730	0.2	\$137,895	0.2	\$4,595	0.0	\$134,138	0.2	\$403,358	0.6
Pharmaceuticals – Fracture Management	\$1,589	0.0	\$1,147	0.0	\$576	0.0	\$310	0.0	\$3,623	0.0
Supplements – Vitamin D and Calcium	\$51,121	0.1	\$36,907	0.1	\$33,147	0.0	\$17,818	0.0	\$138,992	0.2
Total Direct Health Care Cost (excludes informal care)	\$5,409,845	8.1	\$5,807,103	8.7	\$2,587,415	3.9	\$2,906,190	4.3	\$16,710,552	24.9
Informal care	\$547,112		\$512,042		\$355,337		\$370,167		\$1,784,658	
Total Direct Cost (includes informal care)	\$5,956,957		\$6,319,144		\$2,942,751		\$3,276,357		\$18,495,210	
Productivity Loss due to Fracture (Indirect)	\$368,891		\$825,291		\$145,545		\$398,157		\$1,737,884	
Total Cost (Direct and Indirect)	\$6,325,848		\$7,144,435		\$3,088,297		\$3,674,514		\$20,233,094	

Table 11: Average cost per fracture: annual direct health and non-health care cost of low trauma fracture by gender and age group

Fracture Type		Female		Male	
		50-69 years (\$2012)	70+ years (\$2012)	50-69 years (\$2012)	70+ years (\$2012)
Hip	Average Direct Total Cost	21,859	35,856	23,313	32,427
Wrist	Average Direct Total Cost	4,848	7,992	4,215	5,323
Vertebral	Average Direct Total Cost	6,099	9,606	6,228	6,987
Other Fractures	Average Direct Total Cost	8,645	12,391	6,600	13,059

Table 11 (and Table 1) shows the average annual direct cost for each fracture site categorised by gender and age group. Average direct costs for fractures included acute hospital admitted and non-admitted care, subacute/rehabilitation, ambulance, community health care services following fracture, pharmaceuticals for fracture management and supplements for osteoporosis prevention. The average cost also includes average use of community services such as 'meals-on-wheels' and home help in addition to a proportional cost of nursing home stay (% of fracture cases who then moved into residential care) for the remainder of the 12-month period since the fracture event (Appendix B).

Sensitivity Analysis – Modelling a 25% Change in Hip Fracture Numbers

Table 12: Impact on total cost of a 25% change in the total number of hip fractures

	Change in Total Cost (\$)				
	2012 Results	Hip Fractures Increase by 25%		Hip Fractures Decrease by 25%	
	2012\$	2012\$	%	2012\$	%
Total Direct Fracture Cost (including informal care)	47,377,614	52,423,316	10.65	42,331,911	-10.65
TOTAL DIRECT COSTS	67,106,929	72,152,632	7.52	62,061,227	-7.52
TOTAL DIRECT and INDIRECT COST	71,702,195	77,275,203	7.77	66,129,186	-7.77

A sensitivity analysis was undertaken to estimate the effect on the total cost of all fractures if the number of hip fractures was changed by 25% (both increased and decreased) (Table 12). A 25% change equates to ± 151 hip fractures. The impact of this was an 11% change in the direct cost of all fractures. The total direct cost of all fractures was estimated to be approximately \$52.4 million if hip fracture numbers were 25% higher in 2012. If hip fracture numbers were 25% lower in 2012, the total direct cost of all fractures would be approximately \$42.3 million, a change of \$5 million.

Burden of Osteoporosis and Osteopenia in Tasmania from 2013 - 2022

Fracture Numbers and Costs in Tasmania 2013-2022

As described in the Method (Appendix A), the change in fracture numbers is based on the ABS projection for the Tasmania population using the assumption that the fracture rate remains stable. Although the data are presented as two broad age categories of 50-69 years and 70 years and over, the calculations have been done in 5-year age brackets to increase the precision of the estimates.

All Fractures

The annual total burden of all fractures related to osteoporosis and osteopenia for 2013 to 2022 are shown in Table 13. Over the ten years between 2013 and 2022, the population increases are highest in the older age group of 70+ years. Since this age group has a higher rate of fracture, the increase in fracture numbers is substantially higher in the 70+ year old compared to 50-69 year old groups (70+ vs 50-69 years: women: 145% vs 107%; men: 143% vs 103%).

Over the ten years from 2013 to 2022, 55% of the total direct costs of all fractures will be attributable to women aged 70 years and older. By comparison, 20% of the total costs will be attributable to men aged 70+ years and fractures in adults aged 50-69 years account for 17% and 8% of the costs in women and men, respectively.

Over the same ten year period the total direct cost of all fractures is expected to increase slightly more than the number of fractures (134% compared with a 127% overall increase in fracture numbers; Table 13). The increase in cost is proportionally more because the cost per hip fracture is substantially higher than fractures at other sites and hip fractures are much more common in the older age group where the highest increase in the population is expected.

Table 13: Annual number and total direct costs of all fractures by gender, age group and total, 2013-2022 (2012\$)

Year	All Fractures	Annual Total Number of Fractures and Total Direct Cost (2012\$)				Total All Fractures
		Female		Male		
		50-69 years	70+ years	50-69 years	70+ years	
2013	Annual total number of fractures	1,163	1,548	586	552	3,849
	Total Direct Costs \$	9,314,194	26,425,272	4,346,605	9,365,959	49,452,031
2014	Annual total number of fractures	1,181	1,590	591	574	3,936
	Total Direct Costs \$	9,458,318	27,126,399	4,389,612	9,742,262	50,716,590
2015	Annual total number of fractures	1,195	1,637	596	595	4,022
	Total Direct Costs \$	9,565,388	27,931,364	4,444,793	10,105,609	52,047,154
2016	Annual total number of fractures	1,205	1,687	598	618	4,107
	Total Direct Costs \$	9,647,530	28,782,892	4,438,067	10,488,475	53,356,964
2017	Annual total number of fractures	1,208	1,759	595	652	4,214
	Total Direct Costs \$	9,671,097	30,010,923	4,418,134	11,068,450	55,168,605
2018	Annual total number of fractures	1,214	1,822	595	682	4,313
	Total Direct Costs \$	9,721,771	31,086,734	4,416,596	11,577,988	56,803,089
2019	Annual total number of fractures	1,223	1,884	598	708	4,414
	Total Direct Costs \$	9,796,557	32,152,022	4,439,669	12,019,882	58,408,131
2020	Annual total number of fractures	1,231	1,948	600	736	4,515
	Total Direct Costs \$	9,854,316	33,240,157	4,453,514	12,485,240	60,033,227
2021	Annual total number of fractures	1,241	2,013	602	764	4,619
	Total Direct Costs \$	9,936,321	34,341,525	4,467,102	12,960,277	61,705,226
2022	Annual total number of fractures	1,250	2,237	602	792	4,882
	Total Direct Costs \$	10,007,157	38,166,515	4,469,986	13,446,328	66,089,986
2013-2022	Total number of fractures	12,111	18,125	5,963	6,673	42,871
	Total Direct Costs \$	\$96,972,649	\$309,263,803	\$44,284,078	\$113,260,470	\$563,781,003

Tables 14 to 17 provide the projected site-specific fracture numbers for each year from 2013 to 2022.

Table 14: Annual number and total direct costs of hip fractures by gender, age group and total, 2013-2022 (2012\$)

Year	Hip Fractures	Annual Total Number of Hip Fractures and Total Direct Cost (2012\$)				Total Hip Fractures
		Female		Male		
		50-69 years	70+ years	50-69 years	70+ years	
2013	Annual number of hip fractures	43	399	35	155	631
	Total Direct Costs \$	945,790	14,296,616	805,048	5,012,016	21,059,470
2014	Annual number of hip fractures	44	409	35	161	649
	Total Direct Costs \$	960,425	14,676,160	813,013	5,213,351	21,662,950
2015	Annual number of hip fractures	44	421	35	167	668
	Total Direct Costs \$	971,297	15,112,040	818,838	5,407,808	22,309,983
2016	Annual number of hip fractures	45	434	35	173	688
	Total Direct Costs \$	979,638	15,573,199	821,988	5,612,593	22,987,419
2017	Annual number of hip fractures	45	453	35	183	716
	Total Direct Costs \$	982,031	16,238,463	818,296	5,922,878	23,961,669
2018	Annual number of hip fractures	45	469	35	191	741
	Total Direct Costs \$	987,177	16,821,200	818,011	6,195,484	24,821,872
2019	Annual number of hip fractures	46	485	35	198	764
	Total Direct Costs \$	994,771	17,398,185	822,284	6,431,906	25,647,146
2020	Annual number of hip fractures	46	502	35	206	789
	Total Direct Costs \$	1,000,636	17,987,584	824,849	6,680,880	26,493,948
2021	Annual number of hip fractures	46	518	35	214	814
	Total Direct Costs \$	1,008,963	18,584,100	827,365	6,935,031	27,355,459
2022	Annual number of hip fractures	46	576	36	222	880
	Total Direct Costs \$	1,016,156	20,656,225	827,899	7,195,072	29,695,352
2013-2022	Total number of hip fractures	450	4,666	351	1,870	7,340
	Total Direct Costs \$	\$9,846,884	\$167,343,772	\$8,197,591	\$60,607,019	\$245,995,268

Hip fractures in adults younger than 70 years are not common. The number of 50 to 69 year old women with hip fracture is 23% higher than the number of men. In Tasmania for people aged 70 years and older, the annual number of hip fractures increases dramatically. In women the number of hip fractures is nine times higher than those aged less than 70 years. In men the annual number of hip fractures in the older age group is four times higher than the younger age group. However, using the population projections for the 10 years from 2013 to 2022 the annual number of 70+ year old adults with hip fractures will increase by 43% in men and 44% increase in women. The projected increase in hip fractures in women and men aged 50 to 69 years is approximately 7% and 3% respectively, over the ten year period.

Compared with the younger age group, those aged over 70 years have a longer length of acute care hospital stay and utilise more non-acute services post-discharge. Accordingly, the higher cost of treating hip fractures is greater than that explained by the higher number of patients. In 2022 it is estimated that almost 70% of the total direct cost of all hip fractures will be attributable to treating hip fracture in women aged 70 years and over (Table 14).

Table 15: Annual number and total direct costs of wrist fractures by gender, age group and total, 2013-2022 (2012\$)

Year	Wrist Fractures	Annual Total Number of Wrist Fractures and Total Direct Cost (2012\$)				Total Wrist Fractures
		Female		Male		
		50-69 years	70+ years	50-69 years	70+ years	
2013	Annual number of wrist fractures	229	257	31	31	546
	Total Direct Costs \$	1,108,096	2,050,687	128,937	164,016	3,451,737
2014	Annual number of wrist fractures	232	263	31	32	558
	Total Direct Costs \$	1,125,242	2,105,139	130,213	170,616	3,531,210
2015	Annual number of wrist fractures	235	271	31	33	570
	Total Direct Costs \$	1,137,980	2,167,678	131,236	176,974	3,613,868
2016	Annual number of wrist fractures	237	279	31	35	582
	Total Direct Costs \$	1,147,753	2,233,848	131,651	183,707	3,696,959
2017	Annual number of wrist fractures	237	291	31	36	596
	Total Direct Costs \$	1,150,556	2,329,313	131,059	193,887	3,804,816
2018	Annual number of wrist fractures	239	302	31	38	610
	Total Direct Costs \$	1,156,585	2,412,933	131,014	202,829	3,903,360
2019	Annual number of wrist fractures	240	312	31	40	623
	Total Direct Costs \$	1,165,482	2,495,724	131,698	210,581	4,003,486
2020	Annual number of wrist fractures	242	323	31	41	637
	Total Direct Costs \$	1,172,354	2,580,299	132,109	218,747	4,103,509
2021	Annual number of wrist fractures	244	333	31	43	651
	Total Direct Costs \$	1,182,110	2,665,893	132,512	227,082	4,207,597
2022	Annual number of wrist fractures	246	371	31	44	692
	Total Direct Costs \$	1,190,537	2,963,243	132,597	235,611	4,521,988
2013-2022	Total number of wrist fractures	2,381	3,002	310	373	6,065
	Total Direct Costs \$	\$11,536,695	\$24,004,757	\$1,313,026	\$1,984,050	\$38,838,530

Unlike other fracture sites where the ratio of women to men is about three to one, the annual projected number of wrist fractures in women is eight times the projected number in men. There is less difference in fracture numbers between the older and younger age groups in wrist fractures compared with fractures at other sites. The cost of treating wrist fractures in older adults in Tasmania will increase by 31% over the ten years from 2013 to 2022 from \$3.5 million to a projected \$4.5 million per year in 2022 (Table 15). This is based on the higher number of older people in the population and does not account for inflation.

In 2013, 59% of the total cost of treating wrist fractures is attributable to women aged 70 years and older (Table 15). From our source data (based on service use from 284 individuals with wrist fracture from eight study sites across Australia; Appendix table A1), the mean cost of treating a woman with a wrist fracture aged 70 years and over is 65% higher than treating a woman aged 50 to 69 years. Utilisation rates of services (Appendix B) shows hospitalisation is almost 20% higher in older woman than younger woman (65% vs 45%: 70+ years vs 50 to 69 years old, respectively). The comparable hospitalisation rates in men are 5% higher in older men (50% vs 44%, 70+ years vs 50 to 69 years old, respectively).

Table 16: Annual number and total direct costs of vertebral fractures by gender, age group and total, 2013-2022 (2012\$)

Year	Vertebral Fractures	Annual Total Number of Vertebral Fractures and Total Direct Cost (2012\$)				Total Vertebral Fractures
		Female		Male		
		50-69 years	70+ years	50-69 years	70+ years	
2013	Annual number of vertebral fractures	175	363	61	98	697
	Total Direct Costs \$	1,066,750	3,485,169	381,780	682,870	5,616,569
2014	Annual number of vertebral fractures	178	372	62	102	713
	Total Direct Costs \$	1,083,256	3,577,594	385,558	710,109	5,756,517
2015	Annual number of vertebral fractures	180	383	62	105	731
	Total Direct Costs \$	1,095,519	3,683,682	388,483	736,702	5,904,386
2016	Annual number of vertebral fractures	181	395	63	109	748
	Total Direct Costs \$	1,104,927	3,795,893	389,814	764,068	6,054,701
2017	Annual number of vertebral fractures	182	412	62	116	771
	Total Direct Costs \$	1,107,626	3,957,676	388,063	805,920	6,259,284
2018	Annual number of vertebral fractures	183	427	62	121	792
	Total Direct Costs \$	1,113,430	4,099,419	387,928	842,712	6,443,489
2019	Annual number of vertebral fractures	184	441	63	125	813
	Total Direct Costs \$	1,121,995	4,239,786	389,954	874,658	6,626,392
2020	Annual number of vertebral fractures	185	456	63	130	835
	Total Direct Costs \$	1,128,610	4,383,155	391,170	908,283	6,811,219
2021	Annual number of vertebral fractures	187	471	63	135	856
	Total Direct Costs \$	1,138,002	4,528,278	392,364	942,608	7,001,251
2022	Annual number of vertebral fractures	188	524	63	140	915
	Total Direct Costs \$	1,146,115	5,032,189	392,617	977,711	7,548,632
2013-2022	Total number of vertebral fractures	1,823	4,244	624	1,181	7,871
	Total Direct Costs \$	\$11,106,230	\$40,782,841	\$3,887,731	\$8,245,641	\$64,022,440

Our estimates of the number of individuals with vertebral fracture are based on individuals with a clinically diagnosed vertebral fracture(s). This is likely to represent an underestimate as individuals without confirmation of their vertebral fracture by medical imaging techniques are not included.

Approximately 20% of the total cost and 23% of the number of individuals with clinically diagnosed vertebral fracture are men. This highlights the significant burden of vertebral fractures in men, notwithstanding the majority of these fractures occur in women. In 2013 the total cost of treating individuals with clinically diagnosed vertebral fracture(s) was 63% higher than the total cost of treating individuals with wrist fracture. Our source data, although based on small numbers of hospitalised individuals suggests the length of stay in acute hospital is longer for individuals with clinical vertebral fractures (5.4 vs 2.4 days, vertebral vs wrist fracture patients, respectively;¹ see Table 8 of this reference).

Table 17: Annual number and total direct costs of 'other' fractures by gender, age group and total, 2013-2022 (2012\$)

Year	'Other' Fractures	Annual Total Number of 'Other' Fractures and Total Direct Cost (2012\$)				Total 'Other' Fractures
		Female		Male		
		50-69 years	70+ years	50-69 years	70+ years	
2013	Annual number of 'other' fractures	716	531	459	269	1,975
	Total Direct Costs \$	6,193,558	6,573,008	3,030,839	3,507,058	19,304,463
2014	Annual number of 'other' fractures	728	545	464	279	2,015
	Total Direct Costs \$	6,289,394	6,747,188	3,060,828	3,648,186	19,745,596
2015	Annual number of 'other' fractures	736	561	467	290	2,053
	Total Direct Costs \$	6,360,591	6,947,043	3,083,969	3,784,125	20,175,728
2016	Annual number of 'other' fractures	742	578	469	301	2,090
	Total Direct Costs \$	6,415,213	7,158,392	3,094,615	3,928,107	20,596,327
2017	Annual number of 'other' fractures	744	603	467	317	2,131
	Total Direct Costs \$	6,430,883	7,462,990	3,080,716	4,145,766	21,120,355
2018	Annual number of 'other' fractures	748	624	467	332	2,171
	Total Direct Costs \$	6,464,580	7,729,894	3,079,643	4,336,963	21,611,080
2019	Annual number of 'other' fractures	754	646	469	345	2,213
	Total Direct Costs \$	6,514,309	7,994,240	3,095,732	4,502,737	22,107,018
2020	Annual number of 'other' fractures	758	668	470	358	2,254
	Total Direct Costs \$	6,552,716	8,264,216	3,105,386	4,677,331	22,599,648
2021	Annual number of 'other' fractures	764	690	472	372	2,298
	Total Direct Costs \$	6,607,247	8,537,524	3,114,861	4,855,557	23,115,188
2022	Annual number of 'other' fractures	770	767	472	386	2,394
	Total Direct Costs \$	6,654,350	9,486,259	3,116,872	5,037,934	24,295,414
2013-2022	Total number of 'other' fractures	7,460	6,213	4,676	3,249	21,594
	Total Direct Costs \$	\$64,482,841	\$76,900,754	\$30,863,461	\$42,423,764	\$214,670,817

'Other' fractures refer to a heterogeneous group of fractures at sites other than hip, vertebral, or wrist. The mean cost of fracture treatment per individual for this collective group ranges from \$6,600 in men aged 50 to 69 years to \$13,059 for men aged 70 years and older (Table 1). Fractures of the humerus, ankle /foot, pelvis and other non-hip femoral and rib fractures together contribute 90% of the individuals with fractures grouped as 'other' sites (Appendix table A2). Rib fractures are likely to be significantly underestimated as many individuals with suspected rib fractures are not referred for fracture confirmation by medical imaging techniques and so would not be included in our estimates. Facial and skull fractures as well as those of the fingers and toes were excluded.

When grouped together as fractures at 'other' sites, the total number of individuals with 'other' fracture is three times higher than the number of individuals with hip fracture. However the total cost burden of fracture treatment for this group is almost the same (92%) as that attributed to hip fractures (Tables 14 & 17).

Cost of Management of Osteoporosis and Osteopenia in the Community: 2013-2022

Table 18: Total annual costs of community services for osteoporosis and osteopenia (irrespective of fracture), 2013-2022 (2012\$)

Community Health Care Service	Annual Total Cost (2012\$)									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Bisphosphonates	2,912,291	3,383,768	3,533,744	3,627,923	3,738,820	3,846,607	3,953,059	4,063,020	4,177,081	4,290,153
DXA	679,230	699,395	720,684	742,975	772,695	799,883	826,286	853,856	881,745	909,300
Vitamin D Test	2,531,143	2,581,634	2,664,062	2,672,365	2,720,545	2,768,274	2,819,503	2,869,036	2,921,345	3,029,018
Routine Pathology Test	3,539,063	3,609,660	3,724,911	3,736,521	3,803,886	3,870,622	3,942,250	4,011,507	4,084,647	4,235,196
Community GP Visits	11,079,873	11,300,916	11,661,729	11,698,184	11,909,184	12,118,196	12,342,517	12,559,421	12,788,478	13,260,181
All Total Cost \$	20,741,600	21,575,373	22,305,131	22,477,968	22,945,129	23,403,582	23,883,615	24,356,840	24,853,296	25,723,849

The total cost of managing osteoporosis and osteopenia in Tasmania in 2017 is estimated to be \$22.9 million (Table 18). This is 42% of the estimated cost of fracture management/treatment in 2017 (Table 19: \$55.2 million). The costs related to the management of osteoporosis /osteopenia are detailed in Appendix A and are based on 2.4 visits to a general practitioner each year and twice yearly routine biochemistry to assess renal function and serum calcium. Cost assumptions include serum 25-hydroxyvitamin D levels assessed once every two years and a bone mineral density (BMD) scan once every three years (plus a BMD scan for those people who had a fracture during the year). The number of older adults taking bone active medications is based on assumptions which approximately equal the annual volume of dispensed scripts filled for bone active medications taken from Medicare Australia for 2011/2012² with costs conservatively assigned at the lowest cost bisphosphonate (see Appendix A Methods). In 2017 the cost of management of low bone status is 29% of the total cost burden of osteoporosis in Australia.

Total Cost Burden of Osteoporosis, Osteopenia and Fractures: 2013-2022

Table 19: Total annual costs of osteoporosis and osteopenia management and direct cost of fractures, 2013-2022 (2012\$)

Year	Osteoporosis/Osteopenia and Fractures	Total Cost of Osteoporosis/Osteopenia and Fractures 2013 - 2022 (2012\$)				Total All Fractures
		Female		Male		
		50-69 years	70+ years	50-69 years	70+ years	
2013	Total management cost of osteoporosis/osteopenia* \$					20,741,600
	Total Direct Costs of Fractures \$	9,314,194	26,425,272	4,346,605	9,365,959	49,452,031
	Combined costs \$					70,193,631
2014	Total management cost of osteoporosis/osteopenia* \$					21,575,373
	Total Direct Costs of Fractures \$	9,458,318	27,126,399	4,389,612	9,742,262	50,716,590
	Combined costs \$					72,291,963
2015	Total management cost of osteoporosis/osteopenia* \$					22,305,131
	Total Direct Costs of Fractures \$	9,565,388	27,931,364	4,444,793	10,105,609	52,047,155
	Combined costs \$					74,352,286
2016	Total management cost of osteoporosis/osteopenia* \$					22,477,968
	Total Direct Costs of Fractures \$	9,647,530	28,782,892	4,438,067	10,488,475	53,356,964
	Combined costs \$					75,834,932
2017	Total management cost of osteoporosis/osteopenia* \$					22,945,129
	Total Direct Costs of Fractures \$	9,671,097	30,010,923	4,418,134	11,068,450	55,168,605
	Combined costs \$					78,113,734
2018	Total management cost of osteoporosis/osteopenia* \$					23,403,582
	Total Direct Costs of Fractures \$	9,721,771	31,086,734	4,416,596	11,577,988	56,803,089
	Combined costs \$					80,206,671
2019	Total management cost of osteoporosis/osteopenia* \$					23,883,615
	Total Direct Costs of Fractures \$	9,796,557	32,152,022	4,439,669	12,019,882	58,408,131
	Combined costs \$					82,291,746
2020	Total management cost of osteoporosis/osteopenia* \$					24,356,840
	Total Direct Costs of Fractures \$	9,854,316	33,240,157	4,453,514	12,485,240	60,033,227
	Combined costs \$					84,390,067
2021	Total management cost of osteoporosis/osteopenia* \$					24,853,296
	Total Direct Costs of Fractures \$	9,936,321	34,341,525	4,467,102	12,960,277	61,705,226
	Combined costs \$					86,558,522
2022	Total management cost of osteoporosis/osteopenia* \$					25,723,849
	Total Direct Costs of Fractures \$	10,007,157	38,166,515	4,469,986	13,446,328	66,089,986
	Combined costs \$					91,813,835
2013 - 2022	Total management cost of osteoporosis/osteopenia* \$					232,266,383
	Total Direct Costs of Fractures \$	96,972,649	309,263,803	44,284,078	113,260,470	563,781,000
	Combined costs \$					796,047,387

* Irrespective of fracture

Appendix

Appendix A: Method

Appendix A describes the method used for the determination of the annual burden of disease attributable to osteoporosis in each state and Northern Territory in 2012. There are two major components to the method to determine costs in 2012: the data sources that have been used as a basis for the population rates of osteoporosis, osteopenia and fractures; and the methods used to analyse the cost data. These data were used to determine the average direct health care and non-health care total costs and the indirect costs of a fracture in 2012, as well as the average community health service costs of managing someone with osteoporosis or osteopenia.

The prevalence of osteoporosis and osteopenia and the direct costs of treating fractures were then used as the basis to model the burden of fractures associated with low bone mass for 10 years to 2022.

Population Estimates for Osteoporosis by Age and Gender

The methods to estimate the burden of osteoporosis in each State and the Northern Territory are identical to those used and described in the national report (Costing All Australians: A new burden of disease analysis – 2012 to 2022; Watts JJ, Abimanyi-Ochom J and Sanders KM. www.osteoporosis.org.au)¹ Unlike the national survey, the projected number and cost of fractures in 2013 to 2022 were not categorised into fractures and re-fractures but are simply presented as fracture (categorised by site, gender and age).

State and Territory Population Data

Australian Bureau of Statistics (ABS) population data were used from the estimated resident population for each State and the Northern Territory at June 30th 2012 based on the 2011 census.³ Population data by gender and 5-year age bands from aged 50 years and over were used to generate population estimates for men and women in two age groups (50-69 years and 70+ years). This represents the method for the determination of the annual burden of disease attributable to osteoporosis in each State and the Northern Territory in 2012. There are two major components to the method to determine costs in 2012: the data sources that have been used as a basis for the population rates of osteoporosis, osteopenia and fractures; and the methods used to analyse the cost data. These data were used to determine the average direct health care and non-health care total costs and the indirect costs of a fracture in 2012, as well as the average community health service costs of managing someone with osteoporosis or osteopenia. The costs were then used as the basis to model the burden of fractures associated with low bone mass for 10 years to 2022.

Incidence/Prevalence Data for Osteoporosis and Osteopenia

To determine the proportion of the each State and Territory population in 2012 with osteoporosis and osteopenia, the 5-year age interval data from the Geelong Osteoporosis Study⁴ were used. The 5-year rates were then applied to the 5-year population cohorts from the ABS⁵ to determine the weighted average proportions (by population) for osteoporosis and osteopenia for men and women in two age groups (50-69 years and 70+ years) (refer to Tables A1 and A2).

Fracture Incidence

The Geelong Osteoporosis Study cohort⁶ was followed prospectively for approximately five years after baseline for fracture ascertainment.^{7,8} Fracture cases were categorised according to their BMD scores at baseline (categorised as normal, osteopenia and osteoporosis). The proportion of all fractures in each BMD category was used to estimate the population-standardised number of fractures in each BMD category over a 5-year period. The fractures arising from those with BMD in the normal category (BMD above a t-score of -1) were not attributed to osteoporosis and not included in the analysis of cost and burden of osteoporosis.

Proportion of Each Fracture Type

The next stage of the population analysis was to estimate, from the total fracture numbers, the proportion or distribution of each fracture type (hip, wrist, vertebral and 'other'). This was determined using data from the Sanders et al study.⁹ The number of people with fracture was calculated using gender-specific and 5-years age groups data were from population estimates in 1994 to 1996 and since then Crisp et al have found declining incidence of hip fracture rates by 20% and 13% in women and men respectively.¹⁰ The proportion of hip fractures observed by Sanders et al was reduced by 20% in each 5-year age cohort for females and by 13% in each 5-year age cohort for males to account for these changes. The proportion of non-hip fractures was then increased so that the overall number of fractures remained the same as observed in the prospective population group with osteoporosis and osteopenia.⁷ The fracture distribution was assumed to be the same in both osteoporosis and osteopenia populations but varied by gender and age (in 5-year age bands).

'Other' fractures observed in the Sanders et al study⁹ included humerus, ankle, lower limb, as well as other 'low trauma' fractures such as rib, pelvic, forearm (not classified as wrist), patella, foot and hand fractures. Skull and facial as well as finger and toe fractures were not included.

Cost and Resource Utilisation Estimates for the Management of Osteoporosis and Osteopenia in 2012

For the community management of osteoporosis or osteopenia (irrespective of fracture) the following assumptions were made concerning medication, investigations and medical care. To determine the total utilisation of osteoporosis (bone active) medications for osteoporosis treatment, the volume of dispensed scripts by the Pharmaceutical Benefits Scheme (PBS) and Repatriation Pharmaceutical Benefits Scheme (RPBS) using the Item Reports from Medicare Australia² were used for the 2011/2012 financial year. To determine the annual cost, the reported number of services (scripts) from the PBS and RPBS was multiplied by the scheduled fee for each unit of service to determine the total cost. All medications where osteoporosis was listed under the authority restriction were included.

Other services were included based on the assumed need for likely follow-up investigations for the management of osteoporosis/osteopenia. It was assumed that everyone with a new fracture would have one DXA in the year of the fracture, and that the rest of the population with osteoporosis or osteopenia would have one DXA every three years (an annual rate of 0.33).¹¹ The total cost of DXA in 2012 was determined from the MBS expenditure data and not attributed to individuals. Pathology tests for Vitamin D were assumed once every 2 years for the entire population with osteoporosis or osteopenia, and other relevant routine pathology tests for renal function and serum calcium were based on the assumption of two tests annually. General practitioner visits were assumed at a rate of 2.4 visits annually for the population with osteoporosis or osteopenia irrespective of fracture.

Data Sources for Cost and Service Utilisation Rates

Data from existing sources (published) and from new data collections on fractures (AusICUROS) and associated health service utilisation have been used and combined with cost/price data from the MBS, PBS and hospital costing to attribute costs to treatment of fractures (by fracture type), drug treatment for management of osteoporosis and screening for osteoporosis.

A bottom-up costing approach was used to determine the total burden attributable to fractures based on service utilisation data collected as part of the AusICUROS study. From this study, complete service utilisation data was available for 791 people from the time of the fracture to 12 months later. These adults sustained a low trauma fracture and were at least 50 years old. The distribution of fracture type sustained by these AusICUROS participants is detailed in Tables A1 and A2.

Direct Cost of Fractures, 2013-2022

The average annual direct cost of a fracture (by gender, age group and fracture type) determined from 2012 were attributed to the fractures that occurred each subsequent year to 2022 inclusive. This includes the cost of healthcare as well community services related to the fracture. The total direct cost for each year was determined by fracture site, age and gender.

Table A1: Fracture numbers from AusICUROS on which health care and service utilisation is based

Fracture Type	Age 50-69 years			Age 70+ years			Total
	Men	Women	Both	Men	Women	Both	
Hip	10	30	40	32	102	134	174
Wrist	32	155	187	10	87	97	284
Vertebral	16	19	35	12	27	39	74
Other	50	120	170	27	62	89	259
ALL	108	324	432	81	278	359	791

Table A2: Distribution of 'other' group of fracture in the AusICUROS cohort

Fracture Type	Number	% of all fractures
Foot and ankle	97	11.4
Humeral	57	7.2
Tibia/Fibula	29	3.7
Other femoral and pelvis	22	2.8
Rib	23	2.9
Clavicle	7	0.9
Forearm (not wrist)	15	1.9
Other (not specified)	9	1.1
Total	252	31.9

Appendix B: Utilisation Rates for Service use Following Fractures, by Fracture Type, Age and Gender

Post Fracture Utilisation Rates (AusICUROS)		50-69 years		70+ years		
		Men	Women	Men	Women	
Hospitalisation	Hip	1.00	1.00	1.00	1.00	
	Wrist	0.44	0.45	0.50	0.64	
	Vertebral	0.50	0.47	0.67	0.63	
	Other	0.46	0.61	0.74	0.68	
Ambulance Paramedic	Hip	0.90	0.87	1.00	0.94	
	Wrist	0.19	0.17	0.40	0.28	
	Vertebral	0.63	0.53	0.42	0.70	
	Other	0.38	0.38	0.81	0.56	
ED Presentation (not admitted)	Hip	0.00	0.00	0.00	0.00	
	Wrist	0.45	0.55	0.50	0.36	
	Vertebral	0.50	0.38	0.00	0.25	
	Other	0.53	0.36	0.16	0.27	
Hospital Outpatient Fracture Clinic	Hip	0.55	0.55	0.41	0.43	
	Wrist	1.00	0.82	0.80	0.86	
	Vertebral	0.60	0.50	0.70	0.45	
	Other	0.71	0.75	0.60	0.77	
Non-admitted Fracture Management (GP, X-ray)	Hip	0.00	0.00	0.00	0.00	
	Wrist	0.01	0.00	0.00	0.00	
	Vertebral	0.00	0.15	0.33	0.12	
	Other	0.01	0.03	0.10	0.05	
Orthopaedic Specialist	Hip	0.37	0.37	0.37	0.37	
	Wrist	0.30	0.30	0.30	0.30	
	Vertebral	0.28	0.28	0.28	0.28	
	Other	0.30	0.30	0.30	0.30	
Community Physiotherapy	Hip	0.70	0.83	0.75	0.75	
	Wrist	0.69	0.75	0.30	0.80	
	Vertebral	0.63	0.58	0.33	0.59	
	Other	0.64	0.74	0.70	0.71	
Rehabilitation/Subacute Care	Hip	0.40	0.27	0.44	0.59	
	Non-hip	0.01	0.06	0.14	0.21	
Residential Aged Care	Hip (AIHW)	0.00	0.00	0.09	0.07	
	Non-hip (AusICUROS)	0.00	0.003	0.04	0.02	
Community-based Services	Home help	Hip	0.00	0.17	0.19	0.43
		Wrist	0.09	0.05	0.00	0.16
		Vertebral	0.00	0.21	0.17	0.37
		Other	0.08	0.16	0.37	0.35
	Meals on wheels	Hip	0.00	0.00	0.03	0.09
		Wrist	0.00	0.00	0.00	0.02
		Vertebral	0.00	0.00	0.05	0.04
		Other	0.00	0.00	0.13	0.10
	Informal community care	Hip	0.04	0.17	0.25	0.34
		Wrist	0.06	0.08	0.00	0.18
		Vertebral	0.00	0.21	0.08	0.30
		Other	0.20	0.43	0.44	0.29
Mortality (post fracture)	Hip	0.01	0.01	0.08	0.08	
	Non-hip	0.01	0.01	0.05	0.05	

Appendix C: Unit Costs, Source and Assumptions for Each Component of the Model

Parameter	Unit Cost (2012 AUD)	Units	Assumptions re use	Data Source
Ambulance	\$688.50	per transport	Same average cost for both metropolitan and rural/remote regions	Ambulance Victoria Annual Report 2011-2012 ¹²
Emergency Department (Non-admitted) Wrist fractures	\$251.00	per visit	ED non admitted Triage 5 Injury	Source: ¹³
ED (Non-admitted) Non-wrist, non-hip fractures	\$361.00	per visit	ED non admitted Triage 4 Injury	Source: ¹³
Fracture or Orthopaedic Hospital Outpatient Clinic	\$190.88	per visit	3 visits post-fracture, all age groups, for admitted patients or non-admitted with ED visit, if attended hospital clinic then no community physiotherapy	Source: ¹³
General Practitioner	\$35.60	per visit	2.4 visits per year for osteoporosis/osteopenia management 3 visits post fracture if no hospital attendance	MBS Online 2012 Item 23; ¹⁴ Average number of visits for osteoporosis AusICUROS; Expert opinion for fracture management
Medical specialist	\$83.95	per visit	2.5 visits post fracture to medical specialist if seen in ED but no OPD, fracture population only	MBS Online 2012 Item 104; ¹⁴ Recommended Schedule fee Average number of visits from AusICUROS
Routine pathology test	\$13.65	per group of 3 tests	Based on 3 tests for renal function (urea and creatinine) and serum calcium; 2 groups of 3 tests/year per person	MBS Online 2012 Item 66506; ¹⁴ Expert opinion
Serum Vitamin D Test	\$39.05	per test	Based on full blood examination; assume 1 every two years for everyone (fracture and non-fracture population)	MBS Online 2012 Item 66608; ¹⁴ Expert opinion
Diagnostic Imaging for community managed fractures:				
Hip	\$47.15	per X-ray	Where no ED or admission, 1 X-ray	MBS Online 2012 Item 57712, Diagnostic imaging with referral
Hand, wrist, forearm, elbow, humerus	\$29.75	per X-ray	Where no ED or admission, 1 X-ray	MBS Online 2012 Item 57506, Diagnostic imaging no referral
Spine (4 regions)	\$110.00	per X-ray	Where no ED or admission, 1 X-ray	MBS Online 2012 Item 58108, Diagnostic imaging with referral
Foot, ankle, knee or femur	\$32.50	per X-ray	Where no ED or admission, 1 X-ray	MBS Online 2012 Item 57518, Diagnostic imaging no referral ¹⁴
Physiotherapist (community)	\$62.25	per session	9 sessions for hip fractures, wrist (5), vertebral (4) other (6) if no Outpatient Fracture Clinic	MBS Item No. 10960, number of sessions from AusICUROS
Rehabilitation costs	\$12,375	per episode	Mean episode cost all fractures; both age groups	Barwon cost data (N=30; SD=\$8557)
Residential aged care	\$162.94	per day	Annual cost of Nursing Home was \$42872 for low care in 2010, inflated to 2012 prices, assumed LOS 6 mths	Cost; ¹³ Admission rate and length of stay, AusICUROS
Home help	\$25	per hour	Casual hourly rate for home help Level 3	Source: ¹⁵
Home care (informal care)	\$25	per hour	Cost assumed as for PCA/Home help	Source: ¹⁵
Meals on wheels	\$16.50	per day	Casual	Geelong City Council communication for daily cost
Wage rate (adult population)	\$151.24	per day	Average fulltime adult wage rate (seasonally adjusted), May 2012 (7-day week)	Source: ¹⁶

Appendix D1: Unit Costs, Source and Assumptions for Pharmaceuticals/Supplements used for Osteoporosis/Osteopenia, 2012

Table D1.1: Pharmaceuticals fracture management

Pharmaceuticals – Fracture Management	Unit Cost 2012\$		Assumptions re Use	Data Source
	Cost (as needed)	Cost (routine)		
- Hip	8.77	80.79	Drugs taken as needed were costed for 14 days. Drugs taken on a routine basis were costed over 122 days (4 months)	Pharmaceutical online website (price)
- Wrist	14.37	38.27		
- Vertebral	13.78	43.41		
- Other	9.71	54.45		

Table D1.2: Supplements (calcium and vitamin D) for osteoporosis prevention

Osteoporosis Prevention Supplements	Population Rate of Use		Cost 12 months (2012\$)		Assumptions re Use	Data Source
	Women	Men	Women	Men		
All Fractures	0.39	0.39	191.73	191.73	Osteoporosis supplements (Calcium and Vitamin D) were costed over 12 months	Pharmaceutical online website (price)

Appendix D2: List of Osteoporosis (Bone-Active) Pharmaceuticals used for Osteoporosis/ Osteopenia, 2012

Medication Group	Name, form and strength	Frequency	PBS Item Code (2012)	Unit (Script) Price (\$2012)
Alendronate	Alendronate tablet 70mg	Weekly	8511Y	27.62
Alendronate with Cholecalciferol				
	Alendronate 70mg + Cholecalciferol 70 micrograms, tablet	Weekly	9012H	45.26
	Alendronate 70mg + Cholecalciferol 140 micrograms, tablet	Weekly	9183H	45.26
Alendronate with Cholecalciferol and Calcium Carbonate				
	Alendronate 70mg + Cholecalciferol 140 micrograms tablet and Calcium Carbonate (500mg Ca) tablet	Weekly (alendronate)	9351E	45.26
Denosumab	Denosumab, injection 60mg/ml	6 Monthly	5457F	304.97
Etidronate^a	Disodium Etidronate, tablet 200mg	Daily	2920Q	115.27
	Disodium Etidronate, tablet 200mg and Calcium Carbonate sachets 1.25g (500mg Ca)	Daily (etidronate)	8056B	70.79
Raloxifene	Raloxifene 60mg	Daily	8363E	57.97
Risedronate	Risedronate Sodium, tablet 5mg	Daily	4443W, 8481J	46.65
	Risedronate Sodium, tablet 35mg	Weekly	4444X, 8621R, 8972F	46.65
	Risedronate Sodium, tablet 150mg	Monthly	9391G	49.63
Risedronate Sodium and Calcium Carbonate				
	Risedronate Sodium, tablet 35mg and Calcium Carbonate, tablet 1.25g (500mg Ca)	Weekly (risedronate)	8899J, 8973G	46.65
Risedronate Sodium and Calcium Carbonate with Cholecalciferol				
	Risedronate Sodium, tablet 35mg and Calcium Carbonate with Cholecalciferol, sachets 2.5g (1g calcium) with Cholecalciferol 22 micrograms	Weekly (risedronate)	4380M, 8974H, 9147K	46.65
Strontium Ranelate^b	Strontium, sachets 2g granules	Weekly	3036T	53.44
Teriparatide	Teriparatide, injection 20 microgram	Daily	9411H	488.47
Zoledronic Acid	Zoledronic acid, injection 5mg/100ml	Once a year	9288W	589.27

a: Etidronate was available on the PBS in 2012 but has been removed from the PBS in 2013.
b: Strontium Ranelate was available on the PBS in 2012 but has been removed in 2016.

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This report was prepared for Osteoporosis Australia, C2.11, Level 2, 22-36 Mountain Street, Ultimo, NSW 2007

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