

VICTORIA

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



osteoporosis 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 Victoria.

- Over a 10-year period an estimated 419,000 fractures costing \$5.5 billion in total direct costs will occur in Victoria.
- 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 Kerrie Sanders

Institute for Health & Ageing, ACU, Victoria

This important burden of disease analysis reviews the common types of fractures associated with poor bone health and shows they are a costly expense to the health system in Victoria.

Typically 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.

Even small reductions in fracture numbers can offer significant savings. Health Professionals and government can collectively reduce the fracture burden by focusing on this 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.

RESULTS FOR VICTORIA

Burden of Osteoporosis, Osteopenia and Associated Fractures in Victoria



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Authors
Kerrie M Sanders, Jennifer J Watts, Julie Abimanyi-Ochom, Ghulam Murtaza

Summary – Key Findings

Burden of Osteoporosis, Osteopenia and Associated Fractures in Victoria

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Poor Bone Health: 2012-2022

- By 2022, it is estimated there will be 1.53 million older Victorians with low bone mass, an increase of 30% from 2012.
- 1.36 million Victorians aged 50 years and older (67%) have osteoporosis or osteopenia (poor bone health) in 2017.
- 1.18 million Victorians aged 50 years and older (67%), had osteoporosis or osteopenia (poor bone health) in 2012.
- Among Victorians aged 50 years and older, 15% had osteoporosis and 52% had osteopenia.
- Among Victorians aged 70 years and older, 43% of women and 13% of men had osteoporosis (132,000 women and 31,000 men).

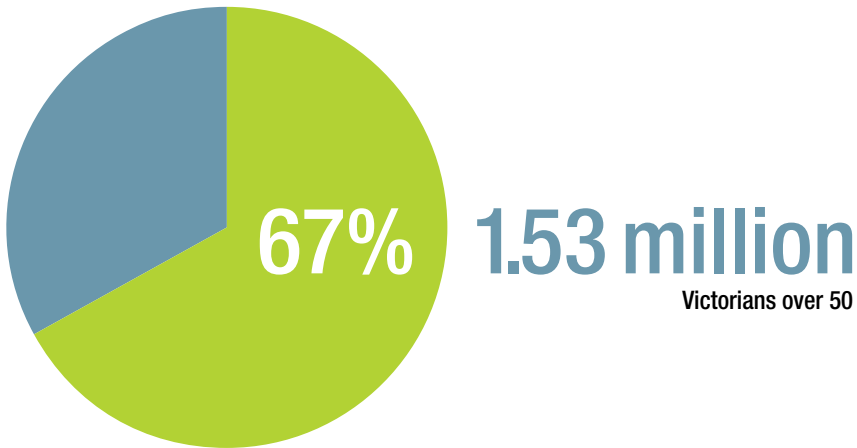
Fracture Impact: 2012-2022

- The total number of fractures over the ten year period 2013 to 2022 is projected to be 419,019.
- In 2022 it is expected there will be a 34% increase in the annual number of fractures (over 10 years) resulting in 47,171 fractures per annum.
- In 2022 there will be 130 fractures every day among older Victorians. More than one in six of these fractures will be a hip fracture.
- In 2017 there will be 113 fractures each day among older Victorians.

Cost Impact: 2012-2022

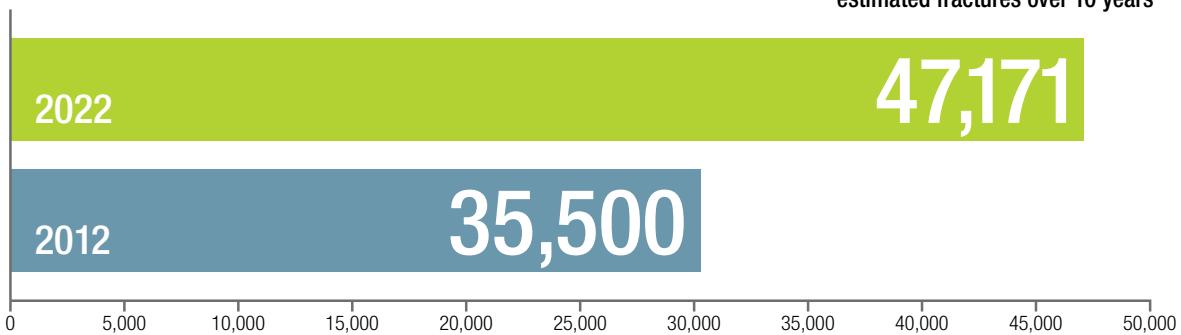
- The total direct costs of fractures over the ten years 2013 to 2022 will be \$5.5 billion (2012\$). These costs include ambulance services, hospitalisations and emergency and outpatient departments, rehabilitation, limited aged care and community services.
- In 2017 the total costs of osteoporosis and osteopenia in Victorians aged 50 years and over will be \$777 million of which \$539 million (69%) relates to the treatment of fractures.
- In 2012 the total costs of osteoporosis and osteopenia in Victorians over 50 years of age were \$655 million of which \$457 million (70%) relates to the treatment of fractures.

Victorians over 50 estimated to have osteoporosis or osteopenia in 2022



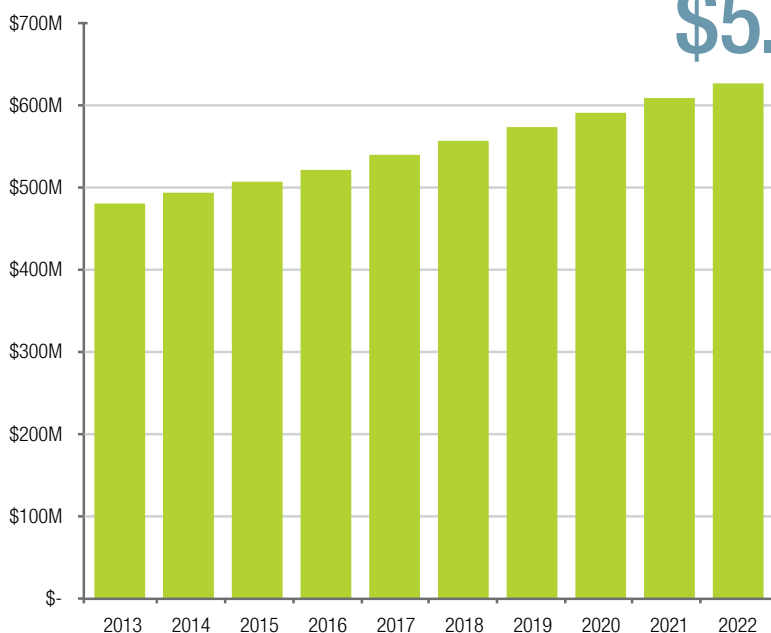
Number of fractures due to osteoporosis and osteopenia

419,019
estimated fractures over 10 years



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

\$5.5 billion
total cost over 10 years



Impact of Osteoporosis, Osteopenia and Fractures in Victoria

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A total of 67% of the Victorian population aged 50 years and over in 2012 had osteoporosis or osteopenia comparable to the 66% reported for the Australian population (Table 2). Among older Victorians, 52% had osteopenia (n=912,907) and 15% (n=263,020) had osteoporosis. Osteopenia in those aged 50-69 years formed the group with the largest number of people, with approximately equal numbers of women and men (Table 2). Although substantially fewer people had osteoporosis, there were over 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 132,000 women and 31,000 men).

Of the Victorian population with osteoporosis and osteopenia aged 50 years and over, 3% (n=35,300) had fractures in 2012. Of these older adults 16.5% had a hip fracture (n=5,847) 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

While 41% of all fractures occurred in women aged 70 years and over, the number and proportion of all fractures occurring in men was approximately the same across the two age categories (approximately 15% in both 50 to 69 year old group and 70 years and older group) (Table 3).

Across the two age groups and bone density categories, absolute fracture numbers were consistently higher in women than men (% of fractures in men: 'All' fractures 28%; Hip 28%; Wrist 11%; Vertebral 22%; 'Other' sites grouped: 36%). There were twice as many fractures in men with osteopenia than osteoporosis (osteopenia: n=6,765 vs osteoporosis n=3,290). In women the fracture numbers were more balanced due to the combination of 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=9,000/132,070).

Table 2: 2012 Victorian 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	80,804	19,268	303,425	327,361	236,456	252,618	620,685	599,248	1,219,933
70+ years	132,070	30,877	140,846	141,274	32,479	67,058	305,396	239,210	544,606
Totals	212,874	50,146	444,271	468,636	268,936	319,677	926,081	838,458	1,764,539

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

Population	Female					Male					All
	50-69 years		70+ years		Total	50-69 years		70+ years		Total	
	Osteoporosis	Osteopenia	Osteoporosis	Osteopenia		All Women	Osteoporosis	Osteopenia	Osteoporosis		
Total Population	80,804	303,425	132,070	140,846	657,145	19,268	327,361	30,877	141,274	518,781	1,175,927
Population with fracture (Total)	4,458	6,101	9,000	5,686	25,245	1,652	3,523	1,638	3,242	10,055	35,300
Hip											
Starting population	166	227	2,318	1,464	4,175	97	208	459	908	1,673	5,847
Hospitalised	166	227	2,318	1,464	4,175	97	208	459	908	1,673	5,847
Wrist											
Starting population	876	1,199	1,491	942	4,508	86	184	92	181	543	5,051
Hospitalised	394	539	954	603	2,491	38	81	46	91	255	2,746
Vertebral											
Starting population	670	917	2,108	1,332	5,027	173	369	290	574	1,406	6,434
Hospitalised	315	431	1,328	839	2,913	86	184	194	385	850	3,763
Other											
Starting population	2,746	3,758	3,084	1,948	11,535	1,295	2,763	798	1,578	6,434	17,969
Hospitalised	1,675	2,292	2,097	1,325	7,389	596	1,271	590	1,168	3,625	11,013
Low BMD population without fracture	76,346	297,324	123,070	135,161	631,901	17,617	323,838	29,239	138,032	508,726	1,140,627

Total Cost of Osteoporosis and Osteopenia in Victoria 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)	\$420,858,560	60.2
- Hip fractures	\$186,382,635	
- Wrist fractures	\$30,246,006	
- Vertebral fractures	\$44,806,905	
- Other fractures	\$159,423,014	
Total Cost Informal Care	\$35,839,765	5.1
- Hip fractures	\$9,629,073	
- Wrist fractures	\$1,847,784	
- Vertebral fractures	\$7,407,824	
- Other fractures	\$16,955,084	
Total Direct Fracture Cost (including informal care)	\$456,698,325	65.3
- Hip fractures	\$196,011,708	
- Wrist fractures	\$32,093,790	
- Vertebral fractures	\$52,214,728	
- Other fractures	\$176,378,098	
Total Direct Non-Fracture Cost	\$198,016,412	28.3
- Routine medical and pathology (includes Vitamin D tests)	\$155,383,720	
- DXA	\$4,705,423	
- Pharmaceuticals – bone health	\$37,927,270	
TOTAL DIRECT COSTS (fracture treatment + management of osteoporosis)	\$654,714,737	93.6
TOTAL DIRECT COSTS (excluding informal care)*	\$618,874,972	
Total Indirect cost (Productivity Loss due to Fractures)	\$44,487,377	6.4
- Hip fractures	\$20,497,798	
- Wrist fractures	\$2,218,549	
- Vertebral fractures	\$5,051,640	
- Other fractures	\$16,719,390	
TOTAL DIRECT and INDIRECT COST	\$699,202,114	
TOTAL DIRECT and INDIRECT COST (DUE TO FRACTURES)	\$501,185,701	71.7

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

The treatment of fractures (direct costs) accounted for 70% of the total direct costs associated with osteoporosis (\$457mil/\$655mil: Table 4). Of this, hip fractures accounted for the highest proportion (43%) although the direct treatment cost of fractures at 'other' sites was 39% 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 cost of treating fractures and fractures at 'other' sites accounted for almost half of this expenditure.

The management of osteoporosis accounted for 30% of the total 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 Victoria the total cost of acute hospital care for fractures associated with osteoporosis or osteopenia in 2012 was \$306.6 million, of which the total for acute inpatient hospitalisation was \$292 million (95% of total hospital costs) (Table 5). The remainder of \$14.6 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 accounted for 43% of the direct total costs attributed to osteoporosis in 2012. Fractures accounted for approximately 23,500 acute admissions to hospital in 2012, representing 168,450 bed-days, with an average length of stay of 4.3 days in those aged 50 to 69 years old and 8.8 days in those aged 70 years and older.

Hip fractures represented 44% of total acute inpatient hospital costs and 38% of bed-days, vertebral fractures 9% of hospital costs and 12% of bed-days, wrist fractures 7% of hospital costs and 3% of bed-days and 'other' fractures 41% of total acute hospital costs and 48% of acute bed-days. People aged 70 years and over accounted for 71% of total acute hospital inpatient costs, and costs for women were 72% 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 \$85 million representing 28% of total hospital costs. See Table 5 below for a summary of costs relating to 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	\$58,939,183	20	\$150,121,149	51	\$26,913,081	9	\$56,027,186	19	\$292,000,599	100	44.6
- Hip	6,725,433	2	85,210,549	29	5,225,005	2	30,812,233	11	\$127,973,221	44	
- Wrist	6,824,838	2	10,720,477	4	869,468	0	938,515	0	\$19,353,298	7	
- Vertebral	4,988,141	2	14,484,034	5	1,810,367	1	3,872,182	1	\$25,154,725	9	
- Other	40,400,771	14	39,706,088	14	19,008,241	7	20,404,255	7	\$119,519,355	41	
Hospital (Non-admitted services) – Total Cost	\$5,460,945	37	\$4,837,658	33	\$2,908,319	20	\$1,410,258	10	\$14,617,180	100	2.2
- Hip	77,218	1	225,307	2	50,815	0	124,378	1	\$477,719	3	
- Wrist	1,228,843	8	1,205,337	8	171,422	1	144,912	1	\$2,750,515	19	
- Vertebral	670,469	5	1,114,321	8	281,801	2	270,734	2	\$2,337,326	16	
- Other	3,484,414	24	2,292,692	16	2,404,280	16	870,233	6	\$9,051,620	62	
All Hospital – Total Cost	64,400,128	21	\$154,958,806	51	\$29,821,401	10	\$57,437,443	19	\$306,617,778	100	46.8
- Hip	6,802,652	2	85,435,856	28	5,275,820	2	30,936,611	10	\$128,450,939	42	
- Wrist	8,053,682	3	11,925,814	4	1,040,890	0	1,083,428	0	\$22,103,814	7	
- Vertebral	5,658,609	2	15,598,356	5	2,092,168	1	4,142,916	1	\$27,492,050	9	
- Other	43,885,185	14	41,998,780	14	21,412,522	7	21,274,488	7	\$128,570,975	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

All 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	\$64,400,128	9.8	\$154,958,806	23.7	\$29,821,401	4.6	\$57,437,443	8.8	\$306,617,778	46.8
Ambulance	\$2,759,002	0.4	\$6,514,239	1.0	\$1,520,993	0.2	\$2,591,682	0.4	\$13,385,915	2.0
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$1,431,347	0.2	\$1,911,954	0.3	\$688,956	0.1	\$921,284	0.1	\$4,953,540	0.8
Rehabilitation	\$5,505,242	0.8	\$46,180,953	7.1	\$1,789,684	0.3	\$11,731,940	1.8	\$65,207,819	10.0
Nursing Home	\$-	0.0	\$12,154,854	1.9	\$-	0.0	\$3,787,857	0.6	\$15,942,711	2.4
Community Services (home help and MOW)	\$1,889,636	0.3	\$8,149,731	1.2	\$41,814	0.0	\$1,976,682	0.3	\$12,057,863	1.8
Pharmaceuticals – Fracture Management	\$21,663	0.0	\$28,809	0.0	\$5,983	0.0	\$4,717	0.0	\$61,172	0.0
Supplements – Vitamin D and Calcium	\$783,783	0.1	\$1,119,722	0.2	\$383,200	0.1	\$345,057	0.1	\$2,631,762	0.4
Total Direct Health Care Cost (excludes informal care)	\$76,790,800	11.7	\$231,019,069	35.3	\$34,252,031	5.2	\$78,796,660	12.0	\$420,858,560	64.3
Informal care	\$7,760,290		\$19,481,686		\$4,155,486		\$4,442,302		\$35,839,765	
Total Direct Cost (includes informal care)	\$84,551,090		\$250,500,755		\$38,407,517		\$83,238,963		\$456,698,325	
Productivity Loss due to Fracture (Indirect)	\$5,397,327		\$27,569,135		\$2,317,742		\$9,203,173		\$44,487,377	
Total Cost (Direct and Indirect)	\$89,948,417		\$278,069,890		\$40,725,259		\$92,442,136		\$501,185,701	

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

Hip 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	\$6,802,652	1.0	\$85,435,856	13.0	\$5,275,820	0.8	\$30,936,611	4.7	\$128,450,939	19.6
Ambulance	\$235,268	0.0	\$2,447,515	0.4	\$189,083	0.0	\$941,515	0.1	\$3,813,382	0.6
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$138,403	0.0	\$607,999	0.1	\$102,906	0.0	\$472,021	0.1	\$1,321,328	0.2
Rehabilitation	\$1,312,349	0.2	\$27,611,553	4.2	\$1,510,470	0.2	\$7,445,971	1.1	\$37,880,343	5.8
Nursing Home	\$-	0.0	\$7,893,540	1.2	\$-	0.0	\$3,669,831	0.6	\$11,563,372	1.8
Community Services (home help and MOW)	\$18,908	0.0	\$2,271,233	0.3	\$-	0.0	\$646,955	0.1	\$2,937,096	0.4
Pharmaceuticals – Fracture Management	\$1,143	0.0	\$10,225	0.0	\$256	0.0	\$1,132	0.0	\$12,756	0.0
Supplements – Vitamin D and Calcium	\$29,002	0.0	\$259,419	0.0	\$21,191	0.0	\$93,806	0.0	\$403,418	0.1
Total Direct Health Care Cost (excludes informal care)	\$8,537,725	1.3	\$126,537,342	19.3	\$7,099,726	1.1	\$44,207,842	6.8	\$186,382,635	28.5
Informal care	\$47,838		\$9,062,276		\$13,982		\$504,977		\$9,629,073	
Total Direct Cost (includes informal care)	\$8,585,563		\$135,599,617		\$7,113,708		\$44,712,819		\$196,011,708	
Productivity Loss due to Fracture (Indirect)	\$741,023		\$14,456,760		\$729,233		\$4,570,783		\$20,497,798	
Total Cost (Direct and Indirect)	\$9,326,586		\$150,056,377		\$7,842,941		\$49,283,602		\$216,509,506	

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	\$8,053,682	1.2	\$11,925,814	1.8	\$1,040,890	0.2	\$1,083,428	0.2	\$22,103,814	3.4
Ambulance	\$242,837	0.0	\$469,021	0.1	\$35,362	0.0	\$75,081	0.0	\$822,302	0.1
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$222,990	0.0	\$297,558	0.0	\$21,824	0.0	\$22,894	0.0	\$565,266	0.1
Rehabilitation	\$693,221	0.1	\$4,046,455	0.6	\$14,719	0.0	\$236,162	0.0	\$4,990,557	0.8
Nursing Home	\$-	0.0	\$928,582	0.1	\$-	0.0	\$6,503	0.0	\$935,085	0.1
Community Services (home help and MOW)	\$26,585	0.0	\$414,652	0.1	\$-	0.0	\$6,991	0.0	\$448,228	0.1
Pharmaceuticals – Fracture Management	\$4,540	0.0	\$5,191	0.0	\$172	0.0	\$171	0.0	\$10,074	0.0
Supplements – Vitamin D and Calcium	\$154,263	0.0	\$176,413	0.0	\$20,102	0.0	\$19,903	0.0	\$370,681	0.1
Total Direct Health Care Cost (excludes informal care)	\$9,398,118	1.4	\$18,263,686	2.8	\$1,133,069	0.2	\$1,451,133	0.2	\$30,246,006	4.6
Informal care	\$660,803		\$1,180,710		\$6,271		\$0		\$1,847,784	
Total Direct Cost (includes informal care)	\$10,058,921		\$19,444,396		\$1,139,340		\$1,451,133		\$32,093,790	
Productivity Loss due to Fracture (Indirect)	\$411,310		\$1,661,430		\$32,419		\$113,390		\$2,218,549	
Total Cost (Direct and Indirect)	\$10,470,231		\$21,105,826		\$1,171,760		\$1,564,523		\$34,312,339	

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	\$5,658,609	0.9	\$15,598,356	2.4	\$2,092,168	0.3	\$4,142,916	0.6	\$27,492,050	4.2
Ambulance	\$579,408	0.1	\$1,657,733	0.3	\$234,966	0.0	\$250,033	0.0	\$2,722,140	0.4
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$236,523	0.0	\$319,456	0.0	\$70,899	0.0	\$74,910	0.0	\$701,787	0.1
Rehabilitation	\$554,113	0.1	\$5,631,416	0.9	\$33,518	0.0	\$1,003,674	0.2	\$7,222,721	1.1
Nursing Home	\$-	0.0	\$1,292,300	0.2	\$-	0.0	\$27,639	0.0	\$1,319,939	0.2
Community Services (home help and MOW)	\$648,040	0.1	\$4,103,352	0.6	\$-	0.0	\$52,386	0.0	\$4,803,779	0.7
Pharmaceuticals – Fracture Management	\$980	0.0	\$2,072	0.0	\$308	0.0	\$479	0.0	\$3,839	0.0
Supplements – Vitamin D and Calcium	\$118,031	0.0	\$319,763	0.0	\$40,252	0.0	\$62,605	0.0	\$540,650	0.1
Total Direct Health Care Cost (excludes informal care)	\$7,795,704	1.2	\$28,924,447	4.4	\$2,472,111	0.4	\$5,614,642	0.9	\$44,806,905	6.8
Informal care	\$1,887,890		\$4,186,833		\$901,444		\$431,658		\$7,407,824	
Total Direct Cost (includes informal care)	\$9,683,594		\$33,111,280		\$3,373,555		\$6,046,300		\$52,214,728	
Productivity Loss due to Fracture (Indirect)	\$763,321		\$3,308,524		\$231,536		\$748,259		\$5,051,640	
Total Cost (Direct and Indirect)	\$10,446,915		\$36,419,804		\$3,605,091		\$6,794,559		\$57,266,369	

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		
Hospital Total	\$43,885,185	6.7	\$41,998,780	6.4	\$21,412,522	3.3	\$21,274,488	3.2	\$128,570,975	19.6
Ambulance	\$1,701,488	0.3	\$1,939,970	0.3	\$1,061,581	0.2	\$1,325,052	0.2	\$6,028,091	0.9
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$833,431	0.1	\$686,941	0.1	\$493,328	0.1	\$351,459	0.1	\$2,365,159	0.4
Rehabilitation	\$2,945,559	0.4	\$8,891,529	1.4	\$230,977	0.0	\$3,046,133	0.5	\$15,114,198	2.3
Nursing Home	\$-	0.0	\$2,040,432	0.3	\$-	0.0	\$83,883	0.0	\$2,124,315	0.3
Community Services (home help and MOW)	\$1,196,102	0.2	\$1,360,493	0.2	\$41,814	0.0	\$1,270,350	0.2	\$3,868,760	0.6
Pharmaceuticals – Fracture Management	\$15,000	0.0	\$11,321	0.0	\$5,246	0.0	\$2,935	0.0	\$34,502	0.0
Supplements – Vitamin D and Calcium	\$482,487	0.1	\$364,128	0.1	\$301,655	0.0	\$168,743	0.0	\$1,317,013	0.2
Total Direct Health Care Cost (excludes informal care)	\$51,059,253	7.8	\$57,293,594	8.8	\$23,547,124	3.6	\$27,523,043	4.2	\$159,423,014	24.3
Informal care	\$5,163,760		\$5,051,868		\$3,233,789		\$3,505,667		\$16,955,084	
Total Direct Cost (includes informal care)	\$56,223,013		\$62,345,462		\$26,780,913		\$31,028,710		\$176,378,098	
Productivity Loss due to Fracture (Indirect)	\$3,481,673		\$8,142,421		\$1,324,554		\$3,770,741		\$16,719,390	
Total Cost (Direct and Indirect)	\$59,704,686		\$70,487,883		\$28,105,467		\$34,799,451		\$193,097,488	

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 a nursing home) 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)	456,698,325	505,701,251	10.73	407,695,398	-10.73
TOTAL DIRECT COSTS	654,714,737	703,717,664	7.48	605,711,810	-7.48
TOTAL DIRECT and INDIRECT COST	699,202,114	753,329,490	7.74	645,074,738	-7.74

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 $\pm 1,462$ 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 \$505,701,251 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 \$408 million, a saving of almost \$49 million.

Burden of Osteoporosis and Osteopenia in Victoria from 2013-2022

Fracture Numbers and Costs in Victoria 2013-2022

As described in the Method (Appendix A), the change in fracture numbers is based on the ABS projection for the Victorian population using the assumption that the fracture rate remains stable. Although the data is presented as the 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: 134% vs 117%; men: 141% vs 116%).

The highest proportional increase is projected in men aged 70+ year age group where fracture numbers will increase by 41% over the ten year period. In older women fracture numbers are projected to increase by 34% however as the population of women in this age group is higher and women have higher fracture rates than men, 56% of the total direct costs of all fractures are attributable to women aged 70 years and older. By comparison, almost 20% of the total costs are attributable to men aged 70+ years and fractures in adults aged 50 to 69 years account for 17% and 7% 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 (130% compared with a 127% overall increase in fracture numbers). The increase in cost is proportionally more because the cost per hip fracture is substantially higher than fracture 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	11,123	15,346	5,430	5,192	37,090
	Total Direct Costs \$	89,068,083	262,320,694	40,281,395	88,125,195	479,795,367
2014	Annual total number of fractures	11,367	15,772	5,538	5,373	38,049
	Total Direct Costs \$	91,022,736	269,590,512	41,100,912	91,215,635	492,929,795
2015	Annual total number of fractures	11,594	16,220	5,635	5,566	39,016
	Total Direct Costs \$	92,840,349	277,232,092	41,825,047	94,497,751	506,395,239
2016	Annual total number of fractures	11,806	16,707	5,722	5,782	40,017
	Total Direct Costs \$	94,538,359	285,529,591	42,466,886	98,148,691	520,683,527
2017	Annual total number of fractures	11,957	17,405	5,786	6,071	41,219
	Total Direct Costs \$	95,609,474	297,417,612	42,876,575	103,047,903	538,951,565
2018	Annual total number of fractures	12,120	18,036	5,859	6,325	42,340
	Total Direct Costs \$	97,052,749	308,165,584	43,483,738	107,354,458	556,056,529
2019	Annual total number of fractures	12,340	18,631	5,960	6,563	43,494
	Total Direct Costs \$	98,817,235	318,302,076	44,233,383	111,388,215	572,740,909
2020	Annual total number of fractures	12,554	19,264	6,060	6,805	44,683
	Total Direct Costs \$	100,529,412	329,078,465	44,980,976	115,496,978	590,085,831
2021	Annual total number of fractures	12,806	19,913	6,173	7,049	45,941
	Total Direct Costs \$	102,548,362	340,136,425	45,817,917	119,641,057	608,143,761
2022	Annual total number of fractures	13,040	20,555	6,277	7,298	47,171
	Total Direct Costs \$	104,418,420	351,089,643	46,592,943	123,857,107	625,958,113
2013-2022	Total number of fractures	120,707	177,849	58,439	62,024	419,019
	Total Direct Costs \$	\$966,445,179	\$3,038,862,694	\$433,659,772	\$1,052,772,989	\$5,491,740,635

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	414	3,952	320	1,455	6,140
	Total Direct Costs \$	9,044,232	141,672,668	7,463,132	47,164,247	205,344,279
2014	Annual number of hip fractures	423	4,061	327	1,505	6,316
	Total Direct Costs \$	9,242,713	145,609,300	7,612,423	48,811,987	211,276,423
2015	Annual number of hip fractures	431	4,177	332	1,560	6,500
	Total Direct Costs \$	9,427,279	149,747,750	7,746,542	50,568,135	217,489,705
2016	Annual number of hip fractures	439	4,302	337	1,620	6,699
	Total Direct Costs \$	9,599,699	154,242,013	7,865,419	52,521,584	224,228,715
2017	Annual number of hip fractures	461	4,482	350	1,701	6,994
	Total Direct Costs \$	9,708,464	160,683,959	7,941,298	55,142,804	233,476,524
2018	Annual number of hip fractures	451	4,644	345	1,772	7,213
	Total Direct Costs \$	9,855,018	166,507,114	8,053,753	57,447,001	241,862,886
2019	Annual number of hip fractures	459	4,798	351	1,839	7,447
	Total Direct Costs \$	10,034,189	171,998,113	8,192,597	59,605,288	249,830,187
2020	Annual number of hip fractures	467	4,961	357	1,907	7,692
	Total Direct Costs \$	10,208,048	177,836,098	8,331,061	61,803,703	258,178,911
2021	Annual number of hip fractures	476	5,128	364	1,975	7,943
	Total Direct Costs \$	10,413,058	183,826,061	8,486,073	64,021,037	266,746,230
2022	Annual number of hip fractures	485	5,293	370	2,045	8,193
	Total Direct Costs \$	10,602,950	189,759,564	8,629,618	66,276,859	275,268,991
2013-2022	Total number of hip fractures	4,507	45,798	3,455	17,378	71,137
	Total Direct Costs \$	\$98,135,649	\$1,641,882,641	\$80,321,916	\$563,362,645	\$2,383,702,850

Hip fractures in adults younger than 70 years old are not common. The number of 50 to 69 year old women with hip fracture is approximately 1.3 times more than the number of men but the total annual number of younger Victorians with hip fracture is less than 1,000. For Victorians aged 70 years and older, the annual number of hip fractures increases dramatically. In women the number of hip fractures is ten times higher than those aged less than 70 years. In men the annual number of hip fractures increases in the older age group by 6-fold compared with those younger. However, the population projections for the 10 years from 2013 to 2022 mean there is likely to be a greater proportional increase in older men with hip fracture. Numbers will increase by 41% in men compared to a 34% increase in older women with hip fracture. The projected increase in hip fractures in women and men aged 50 to 69 years is approximately 16% 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 attributable to both the higher number of patients and higher cost per patient. In 2022 it is estimated that 75% of the total direct cost of all hip fractures will be spent in treating hip fracture in women aged 70 years and over.

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	2,186	2,542	284	290	5,301
	Total Direct Costs \$	10,596,301	20,862,346	1,194,475	1,542,401	34,195,524
2014	Annual number of wrist fractures	2,234	2,613	289	300	5,436
	Total Direct Costs \$	10,828,843	21,424,907	1,219,215	1,597,460	35,070,425
2015	Annual number of wrist fractures	2,278	2,687	294	311	5,571
	Total Direct Costs \$	11,045,082	22,016,331	1,240,696	1,654,999	35,957,109
2016	Annual number of wrist fractures	2,320	2,768	299	323	5,709
	Total Direct Costs \$	11,247,092	22,658,632	1,259,735	1,719,017	36,884,477
2017	Annual number of wrist fractures	2,346	3,203	302	339	6,190
	Total Direct Costs \$	11,374,521	23,579,422	1,271,888	1,804,959	38,030,791
2018	Annual number of wrist fractures	2,382	2,988	306	353	6,029
	Total Direct Costs \$	11,546,225	24,411,718	1,289,899	1,880,486	39,128,328
2019	Annual number of wrist fractures	2,425	3,087	311	367	6,189
	Total Direct Costs \$	11,756,144	25,196,499	1,312,137	1,951,213	40,215,992
2020	Annual number of wrist fractures	2,467	3,191	317	380	6,355
	Total Direct Costs \$	11,959,839	26,030,887	1,334,313	2,023,257	41,348,297
2021	Annual number of wrist fractures	2,516	3,299	322	394	6,531
	Total Direct Costs \$	12,200,030	26,886,972	1,359,140	2,095,914	42,542,056
2022	Annual number of wrist fractures	2,562	3,405	328	408	6,703
	Total Direct Costs \$	12,422,508	27,734,999	1,382,131	2,169,839	43,709,477
2013-2022	Total number of wrist fractures	23,715	29,783	3,052	3,464	60,015
	Total Direct Costs \$	\$114,976,585	\$240,802,714	\$12,863,631	\$18,439,546	\$387,082,476

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 almost ten 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 Victoria will increase by 26% over the ten years from 2013 to 2022 from \$34 million to a projected \$43 million per year in 2022 (Table 15). This does not account for inflation but is based on the higher number of older people in the population.

In 2013, 61% 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 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	1,673	3,594	568	920	6,755
	Total Direct Costs \$	10,200,922	34,655,536	3,537,767	6,421,880	54,816,105
2014	Annual number of vertebral fractures	1,709	3,694	580	952	6,935
	Total Direct Costs \$	10,424,788	35,618,006	3,610,063	6,648,664	56,301,520
2015	Annual number of vertebral fractures	1,743	3,799	590	986	7,119
	Total Direct Costs \$	10,632,958	36,629,591	3,673,666	6,886,763	57,822,979
2016	Annual number of vertebral fractures	1,775	3,913	599	1,024	7,312
	Total Direct Costs \$	10,827,430	37,727,887	3,730,042	7,151,372	59,436,731
2017	Annual number of vertebral fractures	1,796	4,077	605	1,075	7,552
	Total Direct Costs \$	10,950,105	39,300,850	3,766,026	7,505,774	61,522,755
2018	Annual number of vertebral fractures	1,823	4,224	613	1,120	7,781
	Total Direct Costs \$	11,115,402	40,723,174	3,819,356	7,817,675	63,475,607
2019	Annual number of vertebral fractures	1,856	4,364	624	1,163	8,006
	Total Direct Costs \$	11,317,488	42,064,753	3,885,200	8,110,090	65,377,532
2020	Annual number of vertebral fractures	1,888	4,512	634	1,206	8,240
	Total Direct Costs \$	11,513,583	43,490,952	3,950,865	8,407,919	67,363,318
2021	Annual number of vertebral fractures	1,926	4,664	646	1,249	8,485
	Total Direct Costs \$	11,744,812	44,954,530	4,024,377	8,708,432	69,432,150
2022	Annual number of vertebral fractures	1,961	4,814	657	1,293	8,725
	Total Direct Costs \$	11,958,989	46,404,188	4,092,450	9,014,049	71,469,676
2013-2022	Total number of vertebral fractures	18,149	41,655	6,117	10,988	76,909
	Total Direct Costs \$	\$110,686,477	\$401,569,468	\$38,089,811	\$76,672,618	\$627,018,374

Our estimates of the number of individuals with vertebral fracture relates only to individuals with a clinically diagnosed vertebral fracture(s). This represents an underestimate since individuals without confirmation of their vertebral fracture by medical imaging techniques are not included.

Approximately 22% of the total cost and 18% of the number of individuals with clinically diagnosed vertebral fracture are men. In 2013 the total cost of treating individuals with clinically diagnosed vertebral fracture(s) was 61% 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

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	6,851	5,258	4,257	2,528	18,893
	Total Direct Costs \$	59,226,628	65,111,627	28,086,021	32,996,667	185,394,365
2014	Annual number of 'other' fractures	7,001	5,404	4,342	2,616	19,362
	Total Direct Costs \$	60,526,392	66,911,094	28,659,212	34,157,524	190,177,316
2015	Annual number of 'other' fractures	7,141	5,557	4,419	2,710	19,827
	Total Direct Costs \$	61,735,030	68,802,889	29,164,143	35,387,854	193,518,187
2016	Annual number of 'other' fractures	7,272	5,724	4,486	2,815	20,297
	Total Direct Costs \$	62,864,137	70,857,422	29,611,690	36,756,718	199,967,081
2017	Annual number of 'other' fractures	7,354	5,963	4,530	2,955	20,802
	Total Direct Costs \$	63,576,385	73,802,761	29,897,362	38,594,366	200,926,354
2018	Annual number of 'other' fractures	7,465	6,179	4,594	3,079	21,317
	Total Direct Costs \$	64,536,104	76,465,031	30,320,730	40,209,296	204,840,206
2019	Annual number of 'other' fractures	7,601	6,383	4,673	3,195	21,852
	Total Direct Costs \$	65,709,415	78,975,316	30,843,449	41,721,623	208,810,134
2020	Annual number of 'other' fractures	7,732	6,600	4,752	3,313	22,397
	Total Direct Costs \$	66,847,942	81,644,282	31,364,737	43,262,098	212,908,425
2021	Annual number of 'other' fractures	7,888	6,822	4,840	3,432	22,982
	Total Direct Costs \$	68,190,461	84,382,646	31,948,327	44,815,674	217,287,936
2022	Annual number of 'other' fractures	8,032	7,043	4,922	3,553	23,549
	Total Direct Costs \$	69,433,974	87,095,239	32,488,744	46,396,360	221,542,439
2013-2022	Total number of 'other' fractures	74,336	60,933	45,815	30,194	211,278
	Total Direct Costs \$	\$642,646,468	\$754,048,307	\$302,384,414	\$394,298,180	\$2,035,372,443

'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 3 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 (~90%) 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	39,483,519	45,875,585	47,908,893	49,185,721	50,689,215	52,150,548	53,593,770	55,084,569	56,630,959	58,163,941
DXA	6,952,467	7,158,876	7,376,782	7,604,945	7,909,153	8,187,447	8,457,710	8,739,909	9,025,373	9,307,416
Vitamin D Test	24,119,159	24,712,102	25,296,071	25,883,856	26,502,143	27,139,897	27,807,131	28,486,001	29,215,188	29,920,983
Routine Pathology Test	33,723,587	34,552,645	35,369,154	36,190,999	37,055,493	37,947,205	38,880,137	39,829,338	40,848,893	41,835,741
Community GP Visits	105,581,064	108,176,776	110,733,263	113,306,541	116,013,787	118,806,064	121,727,264	124,699,468	127,891,899	130,981,954
All Total Cost \$	209,859,795	220,475,985	226,684,164	232,172,062	238,169,791	244,231,161	250,466,012	256,839,284	263,612,311	270,210,036

The total cost of managing osteoporosis and osteopenia in Victoria in 2017 is estimated to be \$238 million. This is equivalent to 44% of the estimated cost of fracture treatment in 2017 (Table 13: \$539 million). Therefore the cost of managing osteoporosis with treatments/tests is less than half the cost of treating fractures. The costs related to the management of osteoporosis/osteopenia is detailed in Appendix A and is 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 vitamin D status which is assessed once every two years with serum 25-hydroxyvitamin D levels 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 the 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 31% 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* \$					209,206,231
	Total Direct Costs of Fractures \$	89,068,083	262,320,694	40,281,395	88,125,195	479,795,367
	Combined costs \$					689,001,598
2014	Total management cost of osteoporosis/osteopenia* \$					220,475,985
	Total Direct Costs of Fractures \$	91,022,736	269,590,512	41,100,912	91,215,635	492,929,795
	Combined costs \$					713,405,780
2015	Total management cost of osteoporosis/osteopenia* \$					226,684,164
	Total Direct Costs of Fractures \$	92,840,349	277,232,092	41,825,047	94,497,751	506,395,239
	Combined costs \$					733,079,403
2016	Total management cost of osteoporosis/osteopenia* \$					232,172,062
	Total Direct Costs of Fractures \$	94,538,359	285,529,591	42,466,886	98,148,691	520,683,527
	Combined costs \$					752,855,589
2017	Total management cost of osteoporosis/osteopenia* \$					238,169,791
	Total Direct Costs of Fractures \$	95,609,474	297,417,612	42,876,575	103,047,903	538,951,565
	Combined costs \$					777,121,356
2018	Total management cost of osteoporosis/osteopenia* \$					244,231,161
	Total Direct Costs of Fractures \$	97,052,749	308,165,584	43,483,738	107,354,458	556,056,529
	Combined costs \$					800,287,690
2019	Total management cost of osteoporosis/osteopenia* \$					250,466,012
	Total Direct Costs of Fractures \$	98,817,235	318,302,076	44,233,383	111,388,215	572,740,909
	Combined costs \$					823,206,921
2020	Total management cost of osteoporosis/osteopenia* \$					256,839,284
	Total Direct Costs of Fractures \$	100,529,412	329,078,465	44,980,976	115,496,978	590,085,831
	Combined costs \$					846,925,115
2021	Total management cost of osteoporosis/osteopenia* \$					263,612,311
	Total Direct Costs of Fractures \$	102,548,362	340,136,425	45,817,917	119,641,057	608,143,761
	Combined costs \$					871,756,072
2022	Total management cost of osteoporosis/osteopenia* \$					270,210,036
	Total Direct Costs of Fractures \$	104,418,420	351,089,643	46,592,943	123,857,107	625,958,113
	Combined costs \$					896,168,149
2013 - 2022	Total management cost of osteoporosis/osteopenia* \$					2,412,720,601
	Total Direct Costs of Fractures \$	966,445,179	3,038,862,694	433,659,772	1,052,772,989	5,491,740,635
	Combined costs \$					7,904,461,236

* 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)! 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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