



SOUTH AUSTRALIA

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



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

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Authors

Kerrie M Sanders

Professorial Research Fellow
Institute for Health and Ageing
Australian Catholic University, Melbourne

Jennifer J Watts

Associate Professor – Health Economics
School of Health and Social Development
Deakin University, Melbourne

Julie Abimanyi-Ochom

Research Fellow – Health Economics
School of Health and Social Development
Deakin University, Melbourne

Ghulam Murtaza

eResearch Analyst (ACU)
Intersect Australia

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Australian Study of Cost and Utilities Related to Osteoporotic Fractures (AusICUROS) Team:

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First name	Last name	Affiliation at time data was collected	City
Kerrie M	Sanders*	NorthWest Academic Centre, Department of Medicine, University of Melbourne, Western Health	Melbourne, Australia
Jennifer J	Watts	School of Health and Social Development, Deakin University	Melbourne, Australia
Geoffrey C	Nicholson	Rural Clinical School, University of Queensland	Toowoomba, Australia
Catherine	Shore-Lorenti*	NorthWest Academic Centre, Department of Medicine, University of Melbourne, Western Health	Melbourne, Australia
Amanda L	Stuart	Barwon Health	Geelong, Australia
Yu	Zhang*	Barwon Health and NorthWest Academic Centre, Department of Medicine, University of Melbourne	Melbourne, Australia
Sandra	Iuliano	Austin Hospital, University of Melbourne	Melbourne, Australia
Ego	Seeman	Austin Hospital, University of Melbourne	Melbourne, Australia
Richard	Prince	Sir Charles Gairdner Hospital	Perth, Australia
Gustavo	Duque*	Ageing Bone Research Program, Sydney Medical School Nepean Hospital, University of Sydney	Sydney, Australia
Tania	Winzenberg	Menzies Research Institute Tasmania, University of Tasmania	Hobart, Australia
Laura L	Laslett	Menzies Research Institute Tasmania, University of Tasmania	Hobart, Australia
Lyn	March	Royal North Shore Hospital, University of Sydney	Sydney, Australia
Marita	Cross	Royal North Shore Hospital, University of Sydney	Sydney, Australia
Peter	Ebeling*	NorthWest Academic Centre, Department of Medicine, University of Melbourne, Western Health	Melbourne, Australia
Fredrik	Borgstrom*	LIME/MMC, Karolinska Institutet	Stockholm, Sweden

*Researchers have since moved to other academic positions

Julie Pasco, Geelong Osteoporosis Study, Barwon Health/Deakin University, Geelong, Victoria

Ross Arblaster, Decision Support and Data Integrity Operations Manager, Barwon Health, Geelong, Victoria

Forewords



Professor Peter R Ebeling AO
Medical Director, Osteoporosis Australia

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 South Australia.

- Over a 10-year period an estimated 135,000 fractures costing \$1.8 billion in total direct costs will occur in South Australia
- 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.



Associate Professor Mellick Chehade
Orthopaedic Trauma Consultant, Royal Adelaide Hospital

This important burden of disease analysis reviews the common types of fractures associated with poor bone health and shows they are a costly to the health system in South Australia. Health Professionals and government can collectively reduce the fracture burden by focussing on this health issue and we know even small reductions in fracture numbers can deliver savings.

This analysis shows these fractures are common in South Australia and typically require emergency assistance, surgery, hospitals 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.



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.*

SOUTH AUSTRALIA

Burden of Osteoporosis, Osteopenia and
Associated Fractures in South Australia



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



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

Summary – Key Findings

Burden of Osteoporosis, Osteopenia and Associated Fractures in South Australia

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Poor Bone Health: 2012-2022

- By 2022, it is estimated there will be 483,098 older people in South Australia with low bone mass, an increase of 25% from 2012.
- 433,000 adults in South Australia aged 50 years and older (67%) have osteoporosis or osteopenia (poor bone health) in 2017.
- Almost 400,000 adults in South Australia aged 50 years and older (67%), had osteoporosis or osteopenia (poor bone health) in 2012.
- Among people in South Australia aged 50 years and older, 15% had osteoporosis and 52% had osteopenia.
- Among people in South Australia aged 70 years and older, 43% of women and 13% of men had osteoporosis (45,000 women and 10,000 men).

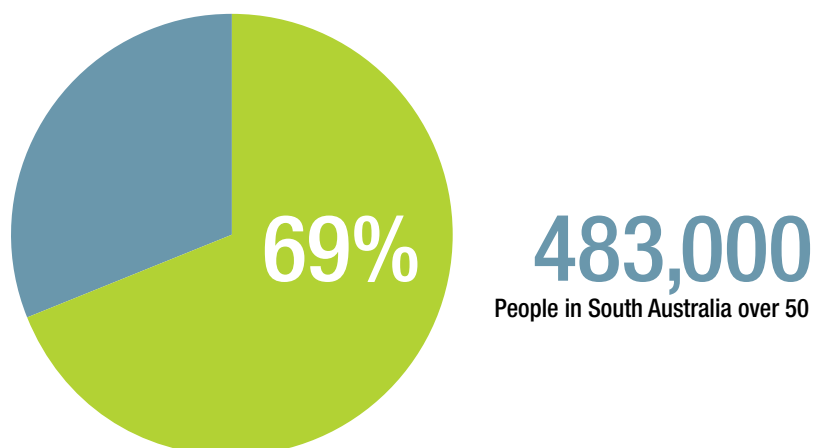
Fracture Impact: 2012-2022

- The total number of fractures over the ten year period 2013 to 2022 is projected to be 135,000.
- In 2022 it is expected there will be a 31% increase in the annual number of fractures (over 10 years) resulting in 15,300 fractures per annum.
- In 2022 there will be 42 fractures every day among older adults in South Australia. Approximately one in six of these fractures will be a hip fracture.
- In 2017 there will be 36 fractures each day among older adults in South Australia.

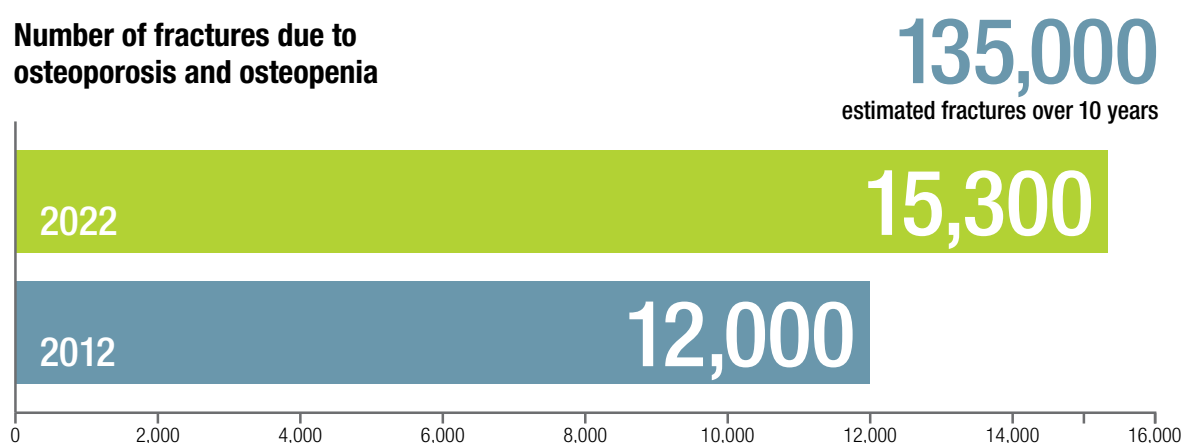
Cost Impact: 2012-2022

- The total direct costs of fractures over the ten years 2013 to 2022 will be \$1.8 billion (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 South Australian adults aged 50 years and over will be \$255 million, of which \$176 million (69%) relates to the treatment of fractures.
- In 2012 the total direct costs of osteoporosis and osteopenia in South Australian adults aged 50 years and over, were \$221 million of which \$154 million (70%) relates to the treatment of fractures.

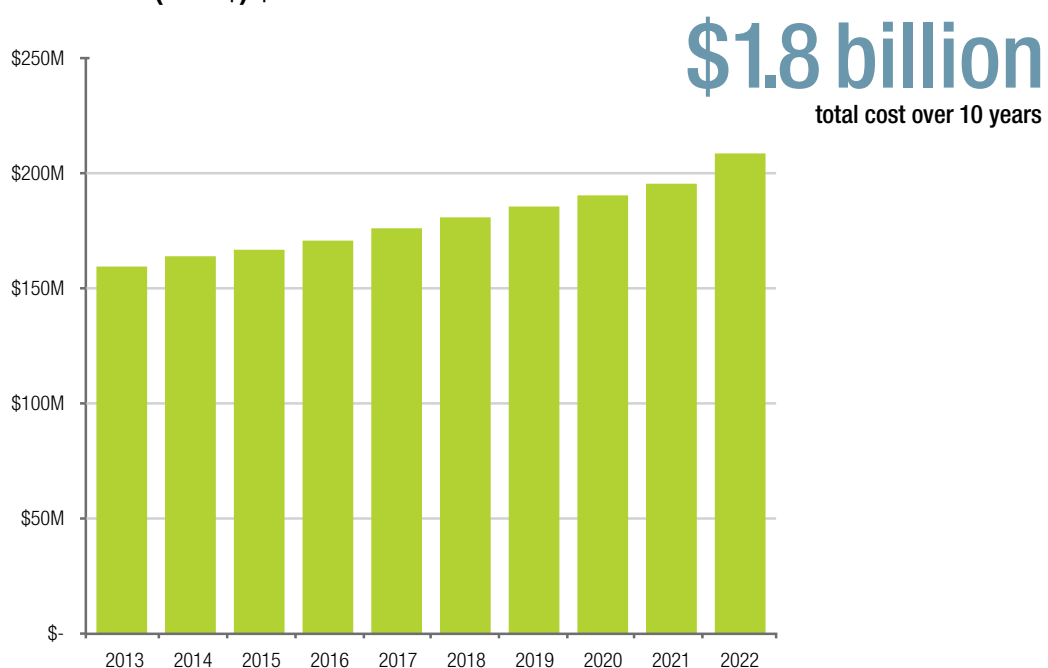
People in South Australia over 50 estimated to have osteoporosis or osteopenia in 2022



Number of fractures due to osteoporosis and osteopenia



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



Impact of Osteoporosis, Osteopenia and Fractures in South Australia

A total of 67% of the South Australia population aged 50 years and over in 2012 had osteoporosis or osteopenia, similar to that reported for the Australian population (Table 2). Among older persons in South Australia, 52% had osteopenia (almost 300,000 adults) and 15% (almost 90,000 adults) 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 three 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 45,000 women and 10,000 men).

Of the South Australia population with osteoporosis and osteopenia aged 50 years and over, 3% (almost 12,000 adults) had fractures in 2012. Of these older adults 17% had a hip fracture (almost 2,000 adults) with the remainder sustaining non-hip fractures (14% wrist, 18% vertebral and 50% 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-two percent of all fractures occurred in women – 43% in those aged 70 years and over and 29% in those aged 50 to 69 years. Approximately 14% of all fractures occur in both age groups of men (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 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=2,224 vs osteoporosis n=1,082). In women the fracture numbers were slightly higher in those with osteoporosis (osteopenia: n=3,911 vs osteoporosis n=4,520). This was mainly due to 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=3,086/45,281).

Table 2: 2012 South Australia 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	25,986	6,211	97,579	105,522	76,042	81,429	199,607	193,162	392,769
70+ years	45,281	10,358	48,290	47,391	11,136	22,495	104,707	80,243	184,950
Totals	71,267	16,569	145,869	152,912	87,178	103,924	304,314	273,405	577,719

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

Population	Female 50-69 years			70+ years			Male 50-69 years			70+ years			All Total
	Osteoporosis	Osteopenia	Total	Osteoporosis	Osteopenia	All Women	Osteoporosis	Osteopenia	Total	Osteoporosis	Osteopenia	All Men	
Total Population	25,986	97,579	123,565	45,281	48,290	93,571	6,211	105,522	111,733	10,358	47,391	57,749	386,617
Population with fracture (Total)	1,434	1,962	3,396	3,086	1,949	5,035	532	1,136	1,668	550	1,088	1,638	11,736
Hip													
Starting population	53	73	126	795	502	1,297	31	67	98	154	305	557	1,980
Hospitalised	53	73	126	795	502	1,297	31	67	98	154	305	557	1,980
Wrist													
Starting population	282	386	668	511	323	834	28	59	87	31	61	179	1,680
Hospitalised	127	173	300	327	207	534	12	26	38	15	30	84	918
Vertebral													
Starting population	216	295	511	723	457	1,178	56	119	175	97	193	465	2,155
Hospitalised	101	139	240	455	288	743	28	59	87	65	129	282	1,265
Other													
Starting population	883	1,208	2,091	1,057	668	1,725	417	890	1,307	268	529	1,191	5,921
Hospitalised	539	737	1,276	719	454	1,173	192	410	602	198	392	1,191	3,640
Low BMD population without fracture	24,552	95,617	120,169	42,195	46,341	88,540	5,679	104,386	110,065	9,808	46,303	56,111	374,881

Total Cost of Osteoporosis and Osteopenia in South Australia 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)	\$141,747,118	60.0
- Hip fractures	\$63,582,445	
- Wrist fractures	\$10,136,518	
- Vertebral fractures	\$15,155,160	
- Other fractures	\$52,872,995	
Total Cost Informal Care	\$12,002,754	5.1
- Hip fractures	\$3,297,007	
- Wrist fractures	\$619,345	
- Vertebral fractures	\$2,477,050	
- Other fractures	\$5,609,352	
Total Direct Fracture Cost (including informal care)	\$153,749,872	65.1
- Hip fractures	\$66,879,452	
- Wrist fractures	\$10,755,863	
- Vertebral fractures	\$17,632,210	
- Other fractures	\$58,482,347	
Total Direct Non-Fracture Cost	\$67,311,638	28.5
- Routine medical and pathology (includes Vitamin D tests)	\$51,084,831	
- DXA	\$2,021,312	
- Pharmaceuticals – bone health	\$14,205,495	
TOTAL DIRECT COSTS (fracture treatment + management of osteoporosis)	\$221,061,511	93.6
TOTAL DIRECT COSTS (excluding informal care)*	\$209,058,757	
Total Indirect cost (Productivity Loss due to Fractures)	\$15,109,374	6.4
- Hip fractures	\$7,052,917	
- Wrist fractures	\$750,410	
- Vertebral fractures	\$1,704,909	
- Other fractures	\$5,601,139	
TOTAL DIRECT and INDIRECT COST	\$236,170,885	
TOTAL DIRECT and INDIRECT COST (DUE TO FRACTURES)	\$168,859,246	71.5

* 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 70% of the total direct costs (including informal care) associated with osteoporosis (\$153.7/\$221.1 mil: Table 4). Of this, hip fractures accounted for the highest proportion (43%) although the direct treatment cost of fractures at 'other' sites was 38% 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 36% 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 South Australia the total cost of acute hospital care for fractures associated with osteoporosis or osteopenia in 2012 was \$102.7 million, of which the total for acute inpatient hospitalisation was \$98 million (95% of total hospital costs) (Table 5). The remainder of \$4.8 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 46% of the direct total costs attributed to osteoporosis in 2012. Fractures accounted for approximately 7,803 acute admissions to hospital in 2012, representing 56,361 bed-days, with an average length of stay of 4.2 days in those aged 50 to 69 years old and 9.2 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 11% of bed-days, wrist fractures 7% of hospital costs and 3% of bed-days and 'other' fractures 40% of total acute hospital costs and 48% of acute bed-days. People aged 70 years and over accounted for 72% of total acute hospital inpatient costs of fractures, and costs for women were 73% 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 \$29 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	\$18,954,338	19	\$51,470,010	53	\$8,674,717	9	\$18,821,021	19	\$97,920,087	100	44.3
- Hip	2,162,842	2	29,214,990	30	1,682,872	2	10,376,523	11	\$43,437,227	44	
- Wrist	2,194,810	2	3,675,585	4	280,389	0	314,929	0	\$6,465,714	7	
- Vertebral	1,604,143	2	4,965,945	5	582,109	1	1,297,010	1	\$8,449,208	9	
- Other	12,992,543	13	13,613,490	14	6,129,346	6	6,832,559	7	\$39,567,938	40	
Hospital (Non-admitted services) – Total Cost	\$1,756,193	36	\$1,658,622	34	\$937,536	19	\$472,603	10	\$4,824,955	100	2.2
- Hip	24,833	1	77,248	2	16,367	0	41,886	1	\$160,334	3	
- Wrist	395,186	8	413,258	9	55,281	1	48,627	1	\$912,351	19	
- Vertebral	215,617	4	382,052	8	90,611	2	90,684	2	\$778,964	16	
- Other	1,120,558	23	786,064	16	775,278	16	291,406	6	\$2,973,306	62	
All Hospital – Total Cost	\$20,710,532	20	\$53,128,632	52	\$9,612,253	9	\$19,293,625	19	\$102,745,042	100	46.5
- Hip	2,187,675	2	29,292,238	29	1,699,239	2	10,418,410	10	\$43,597,561	42	
- Wrist	2,589,995	3	4,088,843	4	335,670	0	363,556	0	\$7,378,065	7	
- Vertebral	1,819,761	2	5,347,997	5	672,720	1	1,387,694	1	\$9,228,172	9	
- Other	14,113,101	14	14,399,554	14	6,904,624	7	7,123,965	7	\$42,541,244	41	

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	\$20,710,532	9.4	\$53,128,632	24.0	\$9,612,253	4.3	\$19,293,625	8.7	\$102,745,042	46.5
Ambulance	\$887,271	0.4	\$2,233,449	1.0	\$490,170	0.2	\$869,721	0.4	\$4,480,612	2.0
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$460,309	0.2	\$1,010,996	0.5	\$222,562	0.1	\$311,415	0.1	\$2,005,282	0.9
Rehabilitation	\$1,770,439	0.8	\$15,833,439	7.2	\$576,497	0.3	\$3,943,012	1.8	\$22,123,388	10.0
Nursing Home	\$-	0.0	\$4,167,371	1.9	\$-	0.0	\$1,275,405	0.6	\$5,442,776	2.5
Community Services (home help and MOW)	\$607,691	0.3	\$2,794,188	1.3	\$13,483	0.0	\$663,154	0.3	\$4,078,516	1.8
Pharmaceuticals – Fracture Management	\$6,967	0.0	\$9,877	0.0	\$1,929	0.0	\$1,582	0.0	\$20,355	0.0
Supplements – Vitamin D and Calcium	\$252,058	0.1	\$359,825	0.2	\$123,521	0.1	\$115,744	0.1	\$851,148	0.4
Total Direct Health Care Cost (excludes informal care)	\$24,695,266	11.2	\$79,537,777	36.0	\$11,040,417	5.0	\$26,473,658	12.0	\$141,747,118	64.1
Informal care	\$2,495,643		\$6,679,422		\$1,339,137		\$1,488,552		\$12,002,754	
Total Direct Cost (includes informal care)	\$27,190,909		\$86,217,200		\$12,379,553		\$27,962,210		\$153,749,872	
Productivity Loss due to Fracture (Indirect)	\$1,735,734		\$9,536,116		\$746,887		\$3,090,637		\$15,109,374	
Total Cost (Direct and Indirect)	\$28,926,644		\$95,753,315		\$13,126,440		\$31,052,848		\$168,859,246	

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	\$2,187,675	1.0	\$29,292,238	13.3	\$1,699,239	0.8	\$10,418,410	4.7	\$43,597,561	19.7
Ambulance	\$75,660	0.0	\$839,147	0.4	\$60,900	0.0	\$317,071	0.1	\$1,292,778	0.6
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$44,509	0.0	\$486,696	0.2	\$33,144	0.0	\$158,961	0.1	\$723,310	0.3
Rehabilitation	\$422,040	0.2	\$9,466,800	4.3	\$486,493	0.2	\$2,507,552	1.1	\$12,882,886	5.8
Nursing Home	\$-	0.0	\$2,706,351	1.2	\$-	0.0	\$1,235,876	0.6	\$3,942,227	1.8
Community Services (home help and MOW)	\$6,081	0.0	\$778,707	0.4	\$-	0.0	\$217,873	0.1	\$1,002,660	0.5
Pharmaceuticals – Fracture Management	\$368	0.0	\$3,506	0.0	\$82	0.0	\$381	0.0	\$4,337	0.0
Supplements – Vitamin D and Calcium	\$9,327	0.0	\$88,944	0.0	\$6,825	0.0	\$31,591	0.0	\$136,686	0.1
Total Direct Health Care Cost (excludes informal care)	\$2,745,660	1.2	\$43,662,388	19.8	\$2,286,683	1.0	\$14,887,714	6.7	\$63,582,445	28.8
Informal care	\$15,384		\$3,107,060		\$4,503		\$170,059		\$3,297,007	
Total Direct Cost (includes informal care)	\$2,761,044		\$46,769,449		\$2,291,187		\$15,057,773		\$66,879,452	
Productivity Loss due to Fracture (Indirect)	\$238,307		\$5,040,453		\$234,872		\$1,539,286		\$7,052,917	
Total Cost (Direct and Indirect)	\$2,999,350		\$51,809,901		\$2,526,058		\$16,597,059		\$73,932,369	

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

Wrist Fractures	Female Ages 50-69 years		Age 70+ years		Male Ages 50-69 years		Age 70+ years		All	
	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	\$2,589,995	1.2	\$4,088,843	1.9	\$335,670	0.2	\$363,556	0.2	\$7,378,065	3.3
Ambulance	\$78,094	0.0	\$160,807	0.1	\$11,404	0.0	\$25,194	0.0	\$275,499	0.1
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$71,712	0.0	\$102,020	0.0	\$7,038	0.0	\$7,682	0.0	\$188,452	0.1
Rehabilitation	\$222,934	0.1	\$1,387,353	0.6	\$4,747	0.0	\$79,247	0.0	\$1,694,281	0.8
Nursing Home	\$-	0.0	\$318,370	0.1	\$-	0.0	\$2,182	0.0	\$320,553	0.1
Community Services (home help and MOW)	\$8,550	0.0	\$142,166	0.1	\$-	0.0	\$2,346	0.0	\$153,061	0.1
Pharmaceuticals – Fracture Management	\$1,460	0.0	\$1,780	0.0	\$56	0.0	\$57	0.0	\$3,353	0.0
Supplements – Vitamin D and Calcium	\$49,610	0.0	\$60,484	0.0	\$6,483	0.0	\$6,679	0.0	\$123,255	0.1
Total Direct Health Care Cost (excludes informal care)	\$3,022,355	1.4	\$6,261,823	2.8	\$365,397	0.2	\$486,944	0.2	\$10,136,518	4.6
Informal care	\$212,509		\$404,814		\$2,022		\$-		\$619,345	
Total Direct Cost (includes informal care)	\$3,234,863		\$6,666,637		\$367,419		\$486,944		\$10,755,863	
Productivity Loss due to Fracture (Indirect)	\$132,274		\$569,632		\$10,455		\$38,049		\$750,410	
Total Cost (Direct and Indirect)	\$3,367,137		\$7,236,269		\$377,874		\$524,993		\$11,506,273	

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

Vertebral Fractures	Female Ages 50-69 years		Age 70+ years		Male Ages 50-69 years		Age 70+ years		All	
	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	\$1,819,761	0.8	\$5,347,997	2.4	\$672,720	0.3	\$1,387,694	0.6	\$9,228,172	4.2
Ambulance	\$186,333	0.1	\$568,364	0.3	\$75,551	0.0	\$83,750	0.0	\$913,999	0.4
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$76,064	0.0	\$186,758	0.1	\$23,304	0.0	\$27,083	0.0	\$313,208	0.1
Rehabilitation	\$178,198	0.1	\$1,930,768	0.9	\$10,777	0.0	\$336,186	0.2	\$2,455,929	1.1
Nursing Home	\$-	0.0	\$443,073	0.2	\$-	0.0	\$9,258	0.0	\$452,331	0.2
Community Services (home help and MOW)	\$208,404	0.1	\$1,406,861	0.6	\$-	0.0	\$17,547	0.0	\$1,632,812	0.7
Pharmaceuticals – Fracture Management	\$315	0.0	\$710	0.0	\$99	0.0	\$161	0.0	\$1,285	0.0
Supplements – Vitamin D and Calcium	\$37,958	0.0	\$85,553	0.0	\$12,943	0.0	\$20,970	0.0	\$157,423	0.1
Total Direct Health Care Cost (excludes informal care)	\$2,507,032	1.1	\$9,970,085	4.5	\$795,394	0.4	\$1,882,648	0.9	\$15,155,160	6.9
Informal care	\$607,129		\$1,435,483		\$289,852		\$144,586		\$2,477,050	
Total Direct Cost (includes informal care)	\$3,114,161		\$11,405,568		\$1,085,247		\$2,027,235		\$17,632,210	
Productivity Loss due to Fracture (Indirect)	\$245,478		\$1,134,349		\$74,449		\$250,634		\$1,704,909	
Total Cost (Direct and Indirect)	\$3,359,639		\$12,539,917		\$1,159,695		\$2,277,868		\$19,337,119	

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	\$14,113,101	6.4	\$14,399,554	6.5	\$6,904,624	3.1	\$7,123,965	3.2	\$42,541,244	19.3
Ambulance	\$547,184	0.2	\$665,131	0.3	\$342,315	0.2	\$443,706	0.2	\$1,998,336	0.9
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$268,024	0.1	\$235,522	0.1	\$159,077	0.1	\$117,689	0.1	\$780,313	0.4
Rehabilitation	\$947,267	0.4	\$3,048,518	1.4	\$74,480	0.0	\$1,020,027	0.5	\$5,090,292	2.3
Nursing Home	\$-	0.0	\$699,575	0.3	\$-	0.0	\$28,089	0.0	\$727,664	0.3
Community Services (home help and MOW)	\$384,656	0.2	\$466,454	0.2	\$13,483	0.0	\$425,389	0.2	\$1,289,982	0.6
Pharmaceuticals – Fracture Management	\$4,824	0.0	\$3,881	0.0	\$1,692	0.0	\$983	0.0	\$11,380	0.0
Supplements – Vitamin D and Calcium	\$155,164	0.1	\$124,844	0.1	\$97,271	0.0	\$56,505	0.0	\$433,783	0.2
Total Direct Health Care Cost (excludes informal care)	\$16,420,220	7.4	\$19,643,480	8.9	\$7,592,942	3.4	\$9,216,353	4.2	\$52,872,995	23.9
Informal care	\$1,660,621		\$1,732,066		\$1,042,759		\$1,173,906		\$5,609,352	
Total Direct Cost (includes informal care)	\$18,080,841		\$21,375,546		\$8,635,701		\$10,390,259		\$58,482,347	
Productivity Loss due to Fracture (Indirect)	\$1,119,676		\$2,791,682		\$427,112		\$1,262,668		\$5,601,139	
Total Cost (Direct and Indirect)	\$19,200,518		\$24,167,228		\$9,062,813		\$11,652,927		\$64,083,486	

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)	153,749,872	170,469,735	10.87	137,030,009	-10.87
TOTAL DIRECT COSTS	221,061,511	237,781,374	7.56	204,341,648	-7.56
TOTAL DIRECT and INDIRECT COST	236,170,885	254,653,977	7.83	217,687,793	-7.83

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 ± 495 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 \$170 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 \$137 million, a change of almost \$17 million.

Burden of Osteoporosis and Osteopenia in South Australia from 2013-2022

Fracture Numbers and Costs in South Australia 2013-2022

As described in the Method (Appendix A), the change in fracture numbers is based on the ABS projection for the South Australia 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: 139% vs 108%; men: 138% vs 108%).

The highest proportional increase is projected in both women and men aged 70+ years where fracture numbers will increase by 39% and 37%, respectively over the next ten year period. Over the ten years from 2013 to 2022, 57% of the total direct costs of all fractures will be attributable to women aged 70 years and older. By comparison, 19% of the total costs will be 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 (131% compared with a 126% 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	3,538	5,201	1,731	1,729	12,198
	Total Direct Costs \$	28,327,547	88,737,391	12,848,365	29,347,715	159,261,019
2014	Annual total number of fractures	3,592	5,315	1,757	1,783	12,447
	Total Direct Costs \$	29,194,772	91,232,910	13,037,956	30,268,100	163,733,738
2015	Annual total number of fractures	3,635	5,450	1,777	1,843	12,704
	Total Direct Costs \$	29,108,782	92,989,588	13,185,821	31,277,139	166,561,330
2016	Annual total number of fractures	3,671	5,596	1,793	1,906	12,966
	Total Direct Costs \$	29,396,483	95,473,119	13,308,305	32,358,658	170,536,565
2017	Annual total number of fractures	3,679	5,811	1,796	2,000	13,286
	Total Direct Costs \$	29,463,641	99,147,366	13,327,661	33,945,454	175,884,123
2018	Annual total number of fractures	3,702	5,998	1,807	2,077	13,585
	Total Direct Costs \$	29,645,770	102,324,988	13,415,662	35,257,047	180,643,466
2019	Annual total number of fractures	3,732	6,177	1,822	2,155	13,886
	Total Direct Costs \$	29,887,292	105,380,046	13,519,687	36,566,291	185,353,316
2020	Annual total number of fractures	3,762	6,363	1,836	2,234	14,194
	Total Direct Costs \$	30,123,910	108,550,579	13,624,673	37,904,923	190,204,086
2021	Annual total number of fractures	3,795	6,560	1,854	2,310	14,519
	Total Direct Costs \$	30,387,636	111,912,116	13,761,899	39,198,416	195,260,067
2022	Annual total number of fractures	3,826	7,237	1,870	2,385	15,318
	Total Direct Costs \$	30,636,514	123,438,064	13,879,191	40,472,806	208,426,574
2013-2022	Total number of fractures	36,932	59,708	18,043	20,422	135,103
	Total Direct Costs \$	\$296,172,347	\$1,019,186,167	\$133,909,220	\$346,596,549	\$1,795,864,284

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\$)				
		Female		Male		Total Hip Fractures
		50-69 years	70+ years	50-69 years	70+ years	
2013	Annual number of hip fractures	132	1,339	102	484	2,057
	Total Direct Costs \$	2,876,461	48,015,052	2,379,684	15,704,666	68,975,864
2014	Annual number of hip fractures	134	1,369	104	500	2,105
	Total Direct Costs \$	2,937,016	49,176,079	2,414,799	16,197,129	70,725,022
2015	Annual number of hip fractures	135	1,403	105	516	2,160
	Total Direct Costs \$	2,955,790	50,315,689	2,442,185	16,737,011	72,450,676
2016	Annual number of hip fractures	137	1,441	106	534	2,217
	Total Direct Costs \$	2,985,004	51,662,006	2,464,871	17,315,664	74,427,544
2017	Annual number of hip fractures	137	1,496	106	560	2,300
	Total Direct Costs \$	2,991,824	53,652,470	2,468,456	18,164,615	77,277,364
2018	Annual number of hip fractures	138	1,545	107	582	2,371
	Total Direct Costs \$	3,010,318	55,373,630	2,484,755	18,866,349	79,735,052
2019	Annual number of hip fractures	139	1,591	107	604	2,441
	Total Direct Costs \$	3,034,842	57,028,263	2,504,022	19,566,831	82,133,958
2020	Annual number of hip fractures	140	1,639	108	626	2,513
	Total Direct Costs \$	3,058,869	58,745,467	2,523,466	20,283,036	84,610,838
2021	Annual number of hip fractures	141	1,689	109	647	2,587
	Total Direct Costs \$	3,085,649	60,566,094	2,548,882	20,975,100	87,175,724
2022	Annual number of hip fractures	142	1,864	110	668	2,784
	Total Direct Costs \$	3,110,921	66,810,009	2,570,606	21,656,938	94,148,473
2013-2022	Total number of hip fractures	1,375	15,376	1,064	5,721	23,535
	Total Direct Costs \$	\$30,046,694	\$551,344,759	\$24,801,726	\$185,467,339	\$791,660,515

Hip fractures in adults younger than 70 years are not common. The number of 50 to 69 year old women with hip fracture is approximately 30% higher than the number of men. In South Australia for people 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 in the older age group is five times higher than the younger age group. However, using the population projections for the 10 years from 2013 to 2022 the annual number of adults with hip fractures will increase by 33% in men and 36% increase in women. The projected increase in hip fractures in women and men aged 50 to 69 years is approximately 8% 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 71% 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\$)

		Annual Total Number of Wrist Fractures and Total Direct Cost (2012\$)				
Year	Wrist Fractures	Female		Male		Total Wrist Fractures
		50-69 years	70+ years	50-69 years	70+ years	
2013	Annual number of wrist fractures	695	862	90	97	1,744
	Total Direct Costs \$	3,370,087	6,887,506	381,133	513,996	11,152,723
2014	Annual number of wrist fractures	706	880	92	100	1,778
	Total Direct Costs \$	3,506,804	7,114,926	386,757	530,133	11,538,620
2015	Annual number of wrist fractures	714	903	93	103	1,813
	Total Direct Costs \$	3,463,030	7,229,707	391,144	547,828	11,631,709
2016	Annual number of wrist fractures	721	927	94	106	1,849
	Total Direct Costs \$	3,497,257	7,410,750	394,777	566,798	11,869,582
2017	Annual number of wrist fractures	723	963	94	112	1,891
	Total Direct Costs \$	3,505,247	7,696,382	395,351	594,642	12,191,622
2018	Annual number of wrist fractures	727	994	94	116	1,932
	Total Direct Costs \$	3,526,914	7,943,356	397,962	617,652	12,485,884
2019	Annual number of wrist fractures	733	1,023	95	120	1,972
	Total Direct Costs \$	3,555,648	8,180,777	401,047	640,619	12,778,091
2020	Annual number of wrist fractures	739	1,054	96	125	2,014
	Total Direct Costs \$	3,583,798	8,427,178	404,162	664,102	13,079,239
2021	Annual number of wrist fractures	746	1,087	97	129	2,058
	Total Direct Costs \$	3,615,173	8,688,417	408,232	686,790	13,398,613
2022	Annual number of wrist fractures	752	1,199	98	133	2,182
	Total Direct Costs \$	3,644,782	9,584,415	411,712	709,145	14,350,053
2013-2022	Total number of wrist fractures	7,256	9,892	943	1,141	19,233
	Total Direct Costs \$	\$35,268,740	\$79,163,414	\$3,972,277	\$6,071,705	\$124,476,136

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 for wrist fractures compared with fractures at other sites. The cost of treating wrist fractures in older adults in South Australia will increase by 29% over the ten years from 2013 to 2022 from \$11 million to a projected \$14 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, 62% 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\$)

		Annual Total Number of Vertebral Fractures and Total Direct Cost (2012\$)				
Year	Vertebral Fractures	Female		Male		Total Vertebral Fractures
		50-69 years	70+ years	50-69 years	70+ years	
2013	Annual number of vertebral fractures	532	1,218	181	306	2,238
	Total Direct Costs \$	3,244,340	11,702,083	1,128,525	2,138,577	18,213,525
2014	Annual number of vertebral fractures	540	1,245	184	316	2,285
	Total Direct Costs \$	3,357,917	12,065,313	1,145,177	2,205,326	18,773,733
2015	Annual number of vertebral fractures	547	1,276	186	326	2,336
	Total Direct Costs \$	3,333,814	12,279,047	1,158,165	2,278,413	19,049,439
2016	Annual number of vertebral fractures	552	1,311	188	338	2,388
	Total Direct Costs \$	3,366,764	12,589,873	1,168,923	2,356,697	19,482,257
2017	Annual number of vertebral fractures	553	1,361	188	354	2,457
	Total Direct Costs \$	3,374,456	13,073,924	1,170,623	2,471,314	20,090,317
2018	Annual number of vertebral fractures	557	1,405	189	368	2,519
	Total Direct Costs \$	3,395,315	13,492,604	1,178,353	2,566,160	20,632,431
2019	Annual number of vertebral fractures	561	1,447	191	382	2,580
	Total Direct Costs \$	3,422,976	13,895,163	1,187,490	2,660,860	21,166,490
2020	Annual number of vertebral fractures	566	1,490	192	396	2,644
	Total Direct Costs \$	3,450,076	14,312,933	1,196,711	2,757,685	21,717,405
2021	Annual number of vertebral fractures	571	1,537	194	409	2,711
	Total Direct Costs \$	3,480,281	14,755,876	1,208,764	2,851,298	22,296,218
2022	Annual number of vertebral fractures	575	1,695	196	423	2,889
	Total Direct Costs \$	3,508,784	16,274,340	1,219,067	2,943,502	23,945,692
2013-2022	Total number of vertebral fractures	5,554	13,985	1,889	3,618	25,047
	Total Direct Costs \$	\$33,934,723	\$134,441,156	\$11,761,798	\$25,229,832	\$205,367,507

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 18% of the total cost and 22% 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\$)				
		Female		Male		Total
		50-69 years	70+ years	50-69 years	70+ years	'Other' Fractures
2013	Annual number of 'other' fractures	2,179	1,782	1,357	842	6,160
	Total Direct Costs \$	18,836,659	22,077,621	8,959,023	10,990,475	60,863,778
2014	Annual number of 'other' fractures	2,213	1,821	1,377	868	6,279
	Total Direct Costs \$	19,393,034	22,716,475	9,091,222	11,335,513	62,536,244
2015	Annual number of 'other' fractures	2,239	1,867	1,393	897	6,396
	Total Direct Costs \$	19,356,148	23,137,229	9,194,327	11,713,886	63,401,590
2016	Annual number of 'other' fractures	2,261	1,917	1,406	928	6,512
	Total Direct Costs \$	19,547,458	23,754,746	9,279,734	12,119,500	64,701,436
2017	Annual number of 'other' fractures	2,266	1,991	1,408	974	6,639
	Total Direct Costs \$	19,592,115	24,670,212	9,293,231	12,714,883	66,270,441
2018	Annual number of 'other' fractures	2,280	2,055	1,417	1,011	6,764
	Total Direct Costs \$	19,713,223	25,461,792	9,354,593	13,206,886	67,736,493
2019	Annual number of 'other' fractures	2,299	2,116	1,428	1,049	6,892
	Total Direct Costs \$	19,873,825	26,222,760	9,427,128	13,697,980	69,221,694
2020	Annual number of 'other' fractures	2,317	2,180	1,439	1,087	7,024
	Total Direct Costs \$	20,031,167	27,012,508	9,500,334	14,200,100	70,744,109
2021	Annual number of 'other' fractures	2,337	2,248	1,454	1,125	7,163
	Total Direct Costs \$	20,206,534	27,813,103	9,596,020	14,685,228	72,300,884
2022	Annual number of 'other' fractures	2,356	2,479	1,466	1,161	7,463
	Total Direct Costs \$	20,372,027	30,721,549	9,677,806	15,163,221	75,934,604
2013-2022	Total number of 'other' fractures	22,747	20,456	14,145	9,942	67,292
	Total Direct Costs \$	\$196,922,190	\$253,587,995	\$93,373,418	\$129,827,672	\$673,711,273

'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 (88%) 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	14,788,381	17,182,502	17,944,069	18,422,299	18,985,426	19,532,762	20,073,315	20,631,687	21,210,881	21,785,052
DXA	2,986,577	3,075,244	3,168,850	3,266,863	3,397,542	3,517,088	3,633,185	3,754,410	3,877,037	3,998,195
Vitamin D Test	7,845,370	7,996,256	8,142,527	8,286,174	8,437,906	8,590,196	8,747,874	8,908,929	9,080,281	9,419,267
Routine Pathology Test	10,969,454	11,180,424	11,384,942	11,585,790	11,797,942	12,010,876	12,231,342	12,456,531	12,696,116	13,170,089
Community GP Visits	34,343,415	35,003,956	35,644,355	36,273,292	36,937,770	37,604,628	38,295,041	39,000,251	39,750,545	41,235,529
All Total Cost \$	70,933,197	74,438,382	76,284,744	77,834,418	79,556,586	81,255,552	82,980,757	84,751,808	86,614,861	89,608,132

The total cost of managing osteoporosis and osteopenia in South Australia in 2017 is estimated to be \$80 million. This is 45% of the estimated cost of fracture management/treatment in 2017 (Table 13: \$176 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 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 50-69 years	70+ years	Male 50-69 years	70+ years	
2013	Total management cost of osteoporosis/osteopenia* \$					70,933,197
	Total Direct Costs of Fractures \$	28,327,547	88,737,391	12,848,365	29,347,715	159,261,019
	Combined costs \$					230,194,216
2014	Total management cost of osteoporosis/osteopenia* \$					74,438,382
	Total Direct Costs of Fractures \$	29,194,772	91,232,910	13,037,956	30,268,100	163,733,738
	Combined costs \$					238,172,120
2015	Total management cost of osteoporosis/osteopenia* \$					76,284,744
	Total Direct Costs of Fractures \$	29,108,782	92,989,588	13,185,821	31,277,139	166,561,330
	Combined costs \$					242,846,074
2016	Total management cost of osteoporosis/osteopenia* \$					77,834,418
	Total Direct Costs of Fractures \$	29,396,483	95,473,119	13,308,305	32,358,658	170,536,565
	Combined costs \$					248,370,983
2017	Total management cost of osteoporosis/osteopenia* \$					79,556,586
	Total Direct Costs of Fractures \$	29,463,641	99,147,366	13,327,661	33,945,454	175,884,123
	Combined costs \$					255,440,709
2018	Total management cost of osteoporosis/osteopenia* \$					81,255,552
	Total Direct Costs of Fractures \$	29,645,770	102,324,988	13,415,662	35,257,047	180,643,466
	Combined costs \$					261,899,018
2019	Total management cost of osteoporosis/osteopenia* \$					82,980,757
	Total Direct Costs of Fractures \$	29,887,292	105,380,046	13,519,687	36,566,291	185,353,316
	Combined costs \$					268,334,073
2020	Total management cost of osteoporosis/osteopenia* \$					84,751,808
	Total Direct Costs of Fractures \$	30,123,910	108,550,579	13,624,673	37,904,923	190,204,086
	Combined costs \$					274,955,894
2021	Total management cost of osteoporosis/osteopenia* \$					86,614,861
	Total Direct Costs of Fractures \$	30,387,636	111,912,116	13,761,899	39,198,416	195,260,067
	Combined costs \$					281,874,928
2022	Total management cost of osteoporosis/osteopenia* \$					89,608,132
	Total Direct Costs of Fractures \$	30,636,514	123,438,064	13,879,191	40,472,806	208,426,574
	Combined costs \$					298,034,706
2013 - 2022	Total management cost of osteoporosis/osteopenia* \$					804,258,437
	Total Direct Costs of Fractures \$	296,172,347	1,019,186,167	133,909,220	346,596,549	1,795,864,284
	Combined costs \$					2,600,122,721

* 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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