

NORTHERN TERRITORY

Osteoporosis costing the Northern Territory: A burden of disease analysis – 2012 to 2022



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Forewords



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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 the Northern Territory.

- Over a 10-year period an estimated 10,036 fractures costing \$110 million in total direct costs will occur in the Northern Territory.
- 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.



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.*

NORTHERN TERRITORY

Burden of Osteoporosis, Osteopenia and
Associated Fractures in the Northern Territory



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Osteoporosis costing the Northern Territory: A burden of disease analysis – 2012 to 2022



Authors
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Summary – Key Findings

Burden of Osteoporosis, Osteopenia and Associated Fractures in the Northern Territory

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Poor Bone Health: 2012-2022

- By 2022, it is estimated there will be 44,510 older people in the Northern Territory with low bone mass, an increase of 42% from 2012.
- 38,107 adults in the Northern Territory aged 50 years and older (63%) have osteoporosis or osteopenia (poor bone health) in 2017.
- 31,400 adults in the Northern Territory aged 50 years and older (63%), had osteoporosis or osteopenia (poor bone health) in 2012.
- Among people in the Northern Territory aged 50 years and older, 11% had osteoporosis and 52% have osteopenia.
- Among people in the Northern Territory aged 70 years and older, 43% of women and 13% of men had osteoporosis (1,500 women and 500 men).

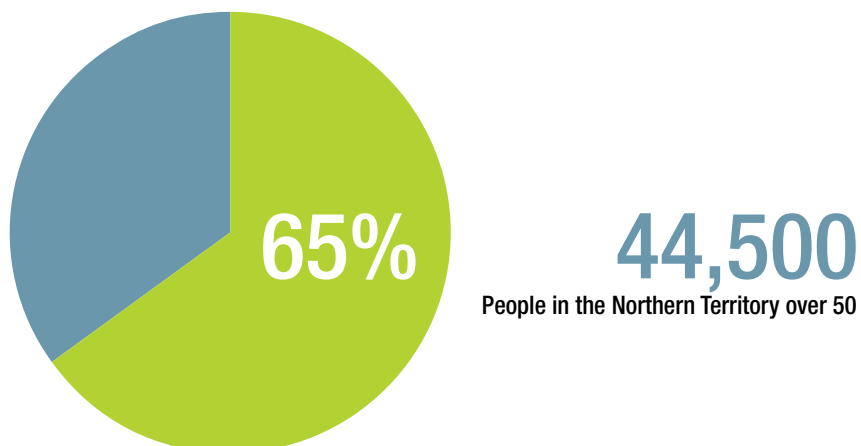
Fracture Impact: 2012-2022

- The total number of fractures over the ten year period 2013 to 2022 is projected to be 10,036.
- In 2022 it is expected there will be a 55% increase in the annual number of fractures (over 10 years) resulting in 1,200 fractures per annum.
- In 2022 there will be 3.3 fractures every day among older adults in the Northern Territory. Approximately one in seven of these fractures will be a hip fracture.
- In 2017 there will be 2.7 fractures every day among older adults in the Northern Territory.

Cost Impact: 2012-2022

- The total direct costs of fractures over the ten years 2013 to 2022 will be \$110 million (2012\$). These costs include ambulance services, hospitalisations and emergency and outpatient departments, rehabilitation, limited aged care and community services.
- In 2017 the total direct costs of osteoporosis and osteopenia in Northern Territory adults aged 50 years and over will be \$16.7 million of which \$10.7 million (64%) relates to the treatment of fractures.
- In 2012 the total direct costs of osteoporosis and osteopenia in Northern Territory adults aged 50 years and over, were \$14.4 million of which \$8.3 million (64%) relates to the treatment of fractures.

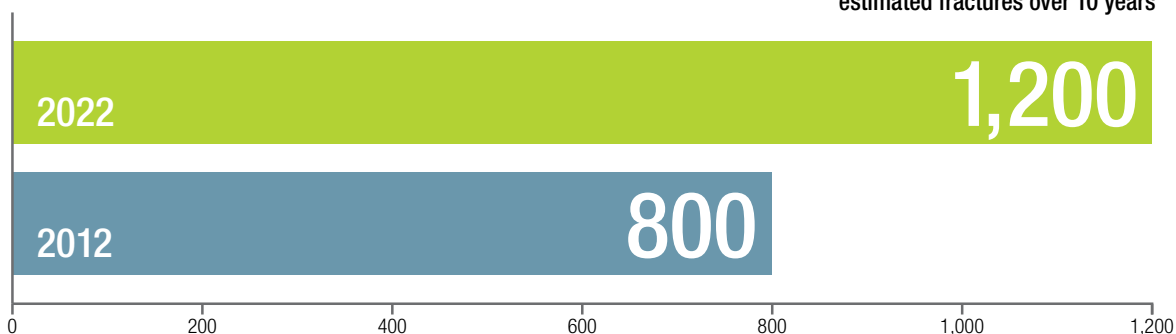
People in the Northern Territory over 50 estimated to have osteoporosis or osteopenia in 2022



Number of fractures due to osteoporosis and osteopenia

10,036

estimated fractures over 10 years



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

\$110 million

total cost over 10 years



Impact of Osteoporosis, Osteopenia and Fractures in the Northern Territory

A total of 63% of the Northern Territory population aged 50 years and over in 2012 had osteoporosis or osteopenia, compared with 66% reported for the Australian population (Table 2). Among older persons in the Northern Territory, 52% had osteopenia (n=26,128) and 11% (n=5,279) had osteoporosis. Osteopenia in those aged 50-69 years formed the group with the largest number of people, with approximately 30% more men than women (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 1,500 women and 500 men).

Of the Northern Territory population with osteoporosis and osteopenia aged 50 years and over, 3% (n=777) had fractures in 2012. Of these older adults 11% had a hip fracture (n=88) with the remainder sustaining non-hip fractures (14% wrist, 16% vertebral and 59% 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 59% more fractures occurred in women with osteoporosis compared to osteopenia (Table 3).

Fractures in Men vs Women

Sixty-five percent of all fractures occurred in women – 21% in those aged 70 years and over and 44% in those aged 50 to 69 years. Approximately 26% and 10% of all fractures occur in men aged 50 to 69 years and 70 years and over, respectively (Table 3).

Across the two age groups and both bone density categories, absolute fracture numbers were consistently higher in women than men (percentages of fractures in men were: 'All' fractures 35%; Hip 38%; Wrist 14%; Vertebral 28%; 'Other' sites grouped: 42%). There were twice as many fractures in men with osteopenia than osteoporosis (osteopenia: n=186 vs osteoporosis n=89). In women the fracture numbers were more balanced due to the very high fracture rate among these older women with osteoporosis (aged 70+ years: 6.8%; n=100/1,467).

Table 2: 2012 Northern Territory 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	2,590	745	9,726	12,653	7,580	9,764	19,896	23,162	43,058
70+ years	1,467	477	1,564	2,183	361	1,036	3,392	3,697	7,089
Totals	4,057	1,222	11,291	14,837	7,940	10,801	23,288	26,859	50,147

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	2,590	9,726	12,316	1,467	1,564	3,031	745	12,653	13,398	477	2,183	2,660	31,406
Population with fracture (Total)	143	196	339	100	63	163	64	136	200	25	50	75	777
Hip													
Starting population	5	7	12	26	16	42	4	8	12	7	14	21	88
Hospitalised	5	7	12	26	16	42	4	8	12	7	14	21	88
Wrist													
Starting population	28	38	66	17	10	27	3	7	10	1	3	4	108
Hospitalised	13	17	30	11	7	18	1	3	4	1	1	2	54
Vertebral													
Starting population	21	29	50	23	15	38	7	14	21	4	9	13	123
Hospitalised	10	14	24	15	9	24	3	7	10	3	6	9	67
Other													
Starting population	88	120	208	34	22	56	50	107	157	12	24	36	458
Hospitalised	54	73	127	23	15	38	23	49	72	9	18	27	264
Low BMD population without fracture	2,447	9,531	11,978	1,367	1,501	2,868	681	12,517	13,198	452	2,133	2,585	30,629

Total Cost of Osteoporosis and Osteopenia in the Northern Territory 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)	\$7,569,520	55.9
- Hip fractures	\$2,635,849	
- Wrist fractures	\$570,331	
- Vertebral fractures	\$754,778	
- Other fractures	\$3,608,561	
Total Cost Informal Care	\$694,409	5.1
- Hip fractures	\$110,532	
- Wrist fractures	\$34,538	
- Vertebral fractures	\$148,533	
- Other fractures	\$400,806	
Total Direct Fracture Cost (including informal care)	\$8,263,929	61.0
- Hip fractures	\$2,746,381	
- Wrist fractures	\$604,869	
- Vertebral fractures	\$903,311	
- Other fractures	\$4,009,368	
Total Direct Non-Fracture Cost	\$4,573,593	33.8
- Routine medical and pathology (includes Vitamin D tests)	\$4,151,668	
- DXA	\$95,812	
- Pharmaceuticals – bone health	\$326,113	
TOTAL DIRECT COSTS (fracture treatment + management of osteoporosis)	\$12,837,522	94.8
TOTAL DIRECT COSTS (excluding informal care)*	\$12,143,113	
Total Indirect cost (Productivity Loss due to Fractures)	\$711,038	5.2
- Hip fractures	\$283,151	
- Wrist fractures	\$34,643	
- Vertebral fractures	\$81,729	
- Other fractures	\$311,515	
TOTAL DIRECT and INDIRECT COST	\$13,548,560	
TOTAL DIRECT and INDIRECT COST (DUE TO FRACTURES)	\$8,974,967	66.2

* 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 64% of the total direct costs (including informal care) associated with osteoporosis (\$8.3/\$12.8mil: Table 4). Of this, fractures at 'other' sites accounted for the highest proportion (49%) although the direct treatment cost of hip fractures was 33% of the cost of all fractures. This differs from other states where the highest proportion was attributed to hip 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 60% of this expenditure.

The management of osteoporosis accounted for 42% 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 the Northern Territory the total cost of acute hospital care for fractures associated with osteoporosis or osteopenia in 2012 was \$5.8 million, of which the total for acute inpatient hospitalisation was \$5.5 million (94% of total hospital costs) (Table 5). The remainder of \$363,000 was for non-admitted services (including emergency departments). Total costs of hospital care for fractures represented 70% of the direct costs of fractures. Hospital costs alone account for 45% of the direct total costs attributed to osteoporosis in 2012. Fractures accounted for almost 500 acute admissions to hospital in 2012, representing 3,100 bed-days, with an average length of stay of 4.2 days in those aged 50 to 69 years old and 10.4 days in those aged 70 years and older.

Hip fractures represented 34% of total acute inpatient hospital costs and 29% of bed-days, vertebral fractures 8% of hospital costs and 16% of bed-days, wrist fractures 7% of hospital costs and 3% of bed-days and 'other' fractures 51% of total acute hospital costs and 52% of acute bed-days. People aged 70 years and over accounted for 46% of total acute hospital inpatient costs of fractures, and costs for women were 65% of the total. The highest single category was acute inpatient care for women aged 50 to 69 years with fracture at 'other' sites. This differs from other states where the cost of hip fracture in women aged 70 and over represents the highest cost category. 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	\$1,889,290	35	\$1,667,379	31	\$1,040,238	19	\$865,902	16	\$5,462,810	100	42.6
- Hip	215,583	4	946,424	17	201,956	4	476,204	9	\$1,840,167	34	
- Wrist	218,770	4	119,071	2	33,606	1	14,505	0	\$385,952	7	
- Vertebral	159,894	3	160,873	3	69,974	1	59,845	1	\$450,586	8	
- Other	1,295,043	24	441,011	8	734,702	13	315,349	6	\$2,786,105	51	
Hospital (Non-admitted services) – Total Cost	\$175,050	48	\$53,731	15	\$112,412	31	\$21,796	6	\$362,989	100	2.8
- Hip	2,475	1	2,502	1	1,964	1	1,922	1	\$8,864	2	
- Wrist	39,390	11	13,388	4	6,626	2	2,240	1	\$61,643	17	
- Vertebral	21,492	6	12,377	3	10,892	3	4,184	1	\$48,945	13	
- Other	111,693	31	25,465	7	92,930	26	13,449	4	\$243,536	67	
All Hospital – Total Cost	\$2,064,340	35	\$1,721,111	30	\$1,152,650	20	\$887,698	15	\$5,825,799	100	45.4
- Hip	218,058	4	948,927	16	203,920	4	478,127	8	\$1,849,031	32	
- Wrist	258,160	4	132,459	2	40,232	1	16,744	0	\$447,595	8	
- Vertebral	181,386	3	173,249	3	80,866	1	64,029	1	\$499,530	9	
- Other	1,406,736	24	466,476	8	827,632	14	328,798	6	\$3,029,641	52	

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	\$2,064,340	16.1	\$1,721,111	13.4	\$1,152,650	9.0	\$887,698	6.9	\$5,825,799	45.4
Ambulance	\$88,440	0.7	\$72,353	0.6	\$58,789	0.5	\$40,055	0.3	\$259,636	2.0
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$45,882	0.4	\$24,451	0.2	\$26,629	0.2	\$12,190	0.1	\$109,152	0.9
Rehabilitation	\$176,470	1.4	\$512,927	4.0	\$69,174	0.5	\$181,318	1.4	\$939,889	7.3
Nursing Home	\$-	0.0	\$135,003	1.1	\$-	0.0	\$58,541	0.5	\$193,544	1.5
Community Services (home help and MOW)	\$60,572	0.5	\$90,518	0.7	\$1,616	0.0	\$30,550	0.2	\$183,256	1.4
Pharmaceuticals – Fracture Management	\$694	0.0	\$320	0.0	\$231	0.0	\$73	0.0	\$1,319	0.0
Supplements – Vitamin D and Calcium	\$25,124	0.2	\$11,657	0.1	\$14,811	0.1	\$5,333	0.0	\$56,925	0.4
Total Direct Health Care Cost (excludes informal care)	\$2,461,522	19.2	\$2,568,339	20.0	\$1,323,902	10.3	\$1,215,757	9.5	\$7,569,520	59.0
Informal care	\$248,755		\$216,381		\$160,617		\$68,656		\$694,409	
Total Direct Cost (includes informal care)	\$2,710,277		\$2,784,719		\$1,484,519		\$1,284,413		\$8,263,929	
Productivity Loss due to Fracture (Indirect)	\$173,011		\$306,207		\$89,585		\$142,235		\$711,038	
Total Cost (Direct and Indirect)	\$2,883,288		\$3,090,927		\$1,574,104		\$1,426,649		\$8,974,967	

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	\$218,058	1.7	\$948,927	7.4	\$203,920	1.6	\$478,127	3.7	\$1,849,031	14.4
Ambulance	\$7,542	0.1	\$27,184	0.2	\$7,308	0.1	\$14,551	0.1	\$56,585	0.4
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$4,436	0.0	\$7,977	0.1	\$3,977	0.0	\$5,157	0.0	\$21,548	0.2
Rehabilitation	\$42,067	0.3	\$306,679	2.4	\$58,382	0.5	\$115,078	0.9	\$522,206	4.1
Nursing Home	\$-	0.0	\$87,673	0.7	\$-	0.0	\$56,717	0.4	\$144,390	1.1
Community Services (home help and MOW)	\$606	0.0	\$25,226	0.2	\$-	0.0	\$9,999	0.1	\$35,831	0.3
Pharmaceuticals – Fracture Management	\$37	0.0	\$114	0.0	\$10	0.0	\$17	0.0	\$178	0.0
Supplements – Vitamin D and Calcium	\$930	0.0	\$2,881	0.0	\$819	0.0	\$1,450	0.0	\$6,080	0.0
Total Direct Health Care Cost (excludes informal care)	\$273,676	2.1	\$1,406,661	11.0	\$274,417	2.1	\$681,096	5.3	\$2,635,849	20.5
Informal care	\$1,533		\$100,654		\$540		\$7,804		\$110,532	
Total Direct Cost (includes informal care)	\$275,209		\$1,507,314		\$274,957		\$688,900		\$2,746,381	
Productivity Loss due to Fracture (Indirect)	\$23,753		\$160,570		\$28,186		\$70,642		\$283,151	
Total Cost (Direct and Indirect)	\$298,963		\$1,667,884		\$303,144		\$759,542		\$3,029,532	

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	\$258,160	2.0	\$132,459	1.0	\$40,232	0.3	\$16,744	0.1	\$447,595	3.5
Ambulance	\$7,784	0.1	\$5,209	0.0	\$1,367	0.0	\$1,160	0.0	\$15,521	0.1
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$7,148	0.1	\$3,305	0.0	\$844	0.0	\$354	0.0	\$11,650	0.1
Rehabilitation	\$22,221	0.2	\$44,944	0.4	\$569	0.0	\$3,650	0.0	\$71,383	0.6
Nursing Home	\$-	0.0	\$10,314	0.1	\$-	0.0	\$101	0.0	\$10,414	0.1
Community Services (home help and MOW)	\$852	0.0	\$4,605	0.0	\$-	0.0	\$108	0.0	\$5,566	0.0
Pharmaceuticals – Fracture Management	\$146	0.0	\$58	0.0	\$7	0.0	\$3	0.0	\$212	0.0
Supplements – Vitamin D and Calcium	\$4,945	0.0	\$1,959	0.0	\$777	0.0	\$308	0.0	\$7,989	0.1
Total Direct Health Care Cost (excludes informal care)	\$301,256	2.3	\$202,853	1.6	\$43,795	0.3	\$22,427	0.2	\$570,331	4.4
Informal care	\$21,182		\$13,114		\$242		\$-		\$34,538	
Total Direct Cost (includes informal care)	\$322,438		\$215,967		\$44,038		\$22,427		\$604,869	
Productivity Loss due to Fracture (Indirect)	\$13,184		\$18,453		\$1,253		\$1,752		\$34,643	
Total Cost (Direct and Indirect)	\$335,622		\$234,420		\$45,291		\$24,180		\$639,513	

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	\$181,386	1.4	\$173,249	1.3	\$80,866	0.6	\$64,029	0.5	\$499,530	3.9
Ambulance	\$18,573	0.1	\$18,412	0.1	\$9,082	0.1	\$3,864	0.0	\$49,931	0.4
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$7,582	0.1	\$5,539	0.0	\$2,740	0.0	\$1,248	0.0	\$17,109	0.1
Rehabilitation	\$17,762	0.1	\$62,548	0.5	\$1,296	0.0	\$15,512	0.1	\$97,117	0.8
Nursing Home	\$-	0.0	\$14,353	0.1	\$-	0.0	\$427	0.0	\$14,781	0.1
Community Services (home help and MOW)	\$20,773	0.2	\$45,575	0.4	\$-	0.0	\$810	0.0	\$67,158	0.5
Pharmaceuticals – Fracture Management	\$31	0.0	\$23	0.0	\$12	0.0	\$7	0.0	\$74	0.0
Supplements – Vitamin D and Calcium	\$3,783	0.0	\$2,772	0.0	\$1,556	0.0	\$968	0.0	\$9,078	0.1
Total Direct Health Care Cost (excludes informal care)	\$249,891	1.9	\$322,472	2.5	\$95,551	0.7	\$86,865	0.7	\$754,778	5.9
Informal care	\$60,516		\$46,503		\$34,842		\$6,671		\$148,533	
Total Direct Cost (includes informal care)	\$310,407		\$368,974		\$130,394		\$93,536		\$903,311	
Productivity Loss due to Fracture (Indirect)	\$24,468		\$36,747		\$8,949		\$11,564		\$81,729	
Total Cost (Direct and Indirect)	\$334,875		\$405,722		\$139,343		\$105,100		\$985,040	

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	\$1,406,736	11.0	\$466,476	3.6	\$827,632	6.4	\$328,798	2.6	\$3,029,641	23.6
Ambulance	\$54,541	0.4	\$21,547	0.2	\$41,032	0.3	\$20,479	0.2	\$137,599	1.1
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	\$26,716	0.2	\$7,630	0.1	\$19,068	0.1	\$5,432	0.0	\$58,845	0.5
Rehabilitation	\$94,420	0.7	\$98,757	0.8	\$8,928	0.1	\$47,078	0.4	\$249,183	1.9
Nursing Home	\$-	0.0	\$22,663	0.2	\$-	0.0	\$1,296	0.0	\$23,959	0.2
Community Services (home help and MOW)	\$38,341	0.3	\$15,111	0.1	\$1,616	0.0	\$19,633	0.2	\$74,701	0.6
Pharmaceuticals – Fracture Management	\$481	0.0	\$126	0.0	\$203	0.0	\$45	0.0	\$855	0.0
Supplements – Vitamin D and Calcium	\$15,466	0.1	\$4,044	0.0	\$11,660	0.1	\$2,608	0.0	\$33,778	0.3
Total Direct Health Care Cost (excludes informal care)	\$1,636,700	12.7	\$636,354	5.0	\$910,138	7.1	\$425,370	3.3	\$3,608,561	28.1
Informal care	\$165,524		\$56,111		\$124,992		\$54,180		\$400,806	
Total Direct Cost (includes informal care)	\$1,802,223		\$692,464		\$1,035,130		\$479,550		\$4,009,368	
Productivity Loss due to Fracture (Indirect)	\$111,605		\$90,437		\$51,196		\$58,277		\$311,515	
Total Cost (Direct and Indirect)	\$1,913,828		\$782,901		\$1,086,326		\$537,827		\$4,320,883	

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)	8,263,929	8,950,524	8.31	7,577,334	-8.31
TOTAL DIRECT COSTS	12,837,522	13,524,117	5.35	12,150,927	-5.35
TOTAL DIRECT and INDIRECT COST	13,548,560	14,305,943	5.59	12,791,177	-5.59

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 ± 194 hip fractures. The impact of this was 8% change in the direct cost of all fractures. The total direct cost of all fractures was estimated to be almost \$9 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 \$7.6 million, a change of almost \$700,000.

Burden of Osteoporosis and Osteopenia in the Northern Territory from 2013-2022

Fracture Numbers and Costs in the Northern Territory 2013-2022

As described in the Method (Appendix A), the change in fracture numbers is based on the ABS projection for the Northern Territory 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: 199% vs 122%; men: 178% vs 115%).

The highest proportional increase is projected in women aged 70+ years where fracture numbers will double over the next ten year period. In older men fracture numbers are projected to increase by almost 80%. Over the ten years from 2013 to 2022, almost 40% of the total direct costs of all fractures will be attributable to women aged 70 years and older. By comparison, almost 20% of the total costs will be attributable to men aged 70+ years and fractures in adults aged 50 to 69 years account for 28% and 15% 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 (156% compared with a 142% 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\$)				
		Female		Male		Total
		50-69 years	70+ years	50-69 years	70+ years	All Fractures
2013	Annual total number of fractures	363	184	212	86	845
	Total Direct Costs \$	2,838,716	3,071,528	1,526,606	1,441,197	8,878,047
2014	Annual total number of fractures	373	198	216	92	879
	Total Direct Costs \$	2,920,654	3,295,096	1,558,282	1,532,774	9,306,806
2015	Annual total number of fractures	383	211	220	99	912
	Total Direct Costs \$	2,991,726	3,515,116	1,585,394	1,643,533	9,735,769
2016	Annual total number of fractures	391	225	223	105	944
	Total Direct Costs \$	3,058,376	3,748,942	1,610,189	1,753,654	10,171,161
2017	Annual total number of fractures	398	241	225	114	979
	Total Direct Costs \$	3,116,029	4,019,258	1,625,749	1,905,629	10,666,664
2018	Annual total number of fractures	406	257	228	122	1,013
	Total Direct Costs \$	3,174,525	4,288,524	1,645,914	2,031,176	11,140,140
2019	Annual total number of fractures	415	273	231	130	1,048
	Total Direct Costs \$	3,242,147	4,555,133	1,667,040	2,162,212	11,626,532
2020	Annual total number of fractures	424	289	235	137	1,085
	Total Direct Costs \$	3,314,642	4,822,069	1,692,363	2,291,670	12,120,745
2021	Annual total number of fractures	434	309	239	146	1,127
	Total Direct Costs \$	3,390,418	5,156,351	1,723,500	2,430,327	12,700,596
2022	Annual total number of fractures	442	366	243	153	1,203
	Total Direct Costs \$	3,453,385	6,097,920	1,750,521	2,547,614	13,849,441
2013-2022	Total number of fractures	4,028	2,553	2,272	1,183	10,036
	Total Direct Costs \$	\$31,500,619	\$42,569,938	\$16,385,559	\$19,739,787	\$110,195,903

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\$)

		Annual Total Number of Hip Fractures and Total Direct Cost (2012\$)				
Year	Hip Fractures	Female		Male		Total Hip Fractures
		50-69 years	70+ years	50-69 years	70+ years	
2013	Annual number of hip fractures	14	47	12	24	98
	Total Direct Costs \$	295,097	1,700,792	290,946	784,951	3,071,786
2014	Annual number of hip fractures	14	51	13	26	103
	Total Direct Costs \$	303,622	1,824,506	297,008	834,903	3,260,038
2015	Annual number of hip fractures	14	54	13	28	109
	Total Direct Costs \$	311,054	1,946,427	302,136	895,234	3,454,850
2016	Annual number of hip fractures	15	58	13	29	115
	Total Direct Costs \$	318,048	2,075,878	307,032	955,240	3,656,198
2017	Annual number of hip fractures	15	62	13	32	122
	Total Direct Costs \$	323,950	2,225,410	309,830	1,037,952	3,897,142
2018	Annual number of hip fractures	15	66	13	34	129
	Total Direct Costs \$	330,071	2,374,583	313,793	1,106,392	4,124,839
2019	Annual number of hip fractures	15	70	14	36	136
	Total Direct Costs \$	337,066	2,522,322	317,756	1,177,751	4,354,895
2020	Annual number of hip fractures	16	74	14	38	143
	Total Direct Costs \$	344,716	2,670,061	322,652	1,248,137	4,585,567
2021	Annual number of hip fractures	16	80	14	41	151
	Total Direct Costs \$	352,586	2,855,094	328,480	1,323,713	4,859,873
2022	Annual number of hip fractures	16	94	14	43	168
	Total Direct Costs \$	359,143	3,376,483	333,609	1,387,612	5,456,848
2013-2022	Total number of hip fractures	150	657	134	331	1,273
	Total Direct Costs \$	3,275,353	23,571,555	3,123,243	10,751,885	40,722,036

Hip fractures in adults younger than 70 years are not common. In the Northern Territory for people aged 70 years and older, the annual number of hip fractures increases substantially. Using the population projections for the 10 years from 2013 to 2022 the annual number of adults with hip fractures will increase by 58% in men and 80% increase in women. There is only a small projected increase in hip fractures in women and men aged 50 to 69 years 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 62% 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	71	31	11	5	118
	Total Direct Costs \$	345,849	243,905	46,622	25,694	662,070
2014	Annual number of wrist fractures	73	33	11	5	123
	Total Direct Costs \$	355,837	261,652	47,592	27,290	692,371
2015	Annual number of wrist fractures	75	35	11	6	127
	Total Direct Costs \$	364,467	279,160	48,393	29,258	721,278
2016	Annual number of wrist fractures	77	37	12	6	132
	Total Direct Costs \$	372,613	297,706	49,151	31,227	750,697
2017	Annual number of wrist fractures	78	40	12	6	136
	Total Direct Costs \$	379,643	319,211	49,657	33,940	782,451
2018	Annual number of wrist fractures	80	43	12	7	141
	Total Direct Costs \$	386,771	340,556	50,247	36,174	813,748
2019	Annual number of wrist fractures	81	45	12	7	146
	Total Direct Costs \$	395,013	361,740	50,922	38,515	846,190
2020	Annual number of wrist fractures	83	48	12	8	151
	Total Direct Costs \$	403,838	382,925	51,681	40,802	879,246
2021	Annual number of wrist fractures	85	51	12	8	157
	Total Direct Costs \$	413,050	409,466	52,608	43,303	918,427
2022	Annual number of wrist fractures	87	61	13	9	169
	Total Direct Costs \$	420,711	484,293	53,451	45,377	1,003,832
2013-2022	Total number of wrist fractures	792	423	119	66	1,399
	Total Direct Costs \$	3,837,791	3,380,615	500,325	351,580	8,070,310

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 seven 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 the Northern Territory will increase by 52% over the ten years from 2013 to 2022 from \$662,000 to a projected \$1 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, 52% of the total cost of treating wrist fractures is attributable to women aged 50 to 69 years (Table 15). However 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	55	43	22	15	135
	Total Direct Costs \$	264,684	344,873	93,413	81,392	784,361
2014	Annual number of vertebral fractures	56	46	23	16	141
	Total Direct Costs \$	272,344	369,975	95,352	86,552	824,223
2015	Annual number of vertebral fractures	58	49	23	17	147
	Total Direct Costs \$	278,938	394,677	96,996	92,829	863,440
2016	Annual number of vertebral fractures	59	53	23	19	153
	Total Direct Costs \$	285,145	420,898	98,514	99,053	903,609
2017	Annual number of vertebral fractures	60	56	24	20	160
	Total Direct Costs \$	290,526	451,276	99,483	107,618	948,904
2018	Annual number of vertebral fractures	61	60	24	22	167
	Total Direct Costs \$	296,005	481,495	100,706	114,693	992,899
2019	Annual number of vertebral fractures	62	64	24	23	173
	Total Direct Costs \$	302,309	511,393	102,012	122,141	1,037,855
2020	Annual number of vertebral fractures	64	68	25	24	180
	Total Direct Costs \$	309,048	541,372	103,530	129,429	1,083,378
2021	Annual number of vertebral fractures	65	72	25	26	188
	Total Direct Costs \$	316,127	578,945	105,469	137,249	1,137,789
2022	Annual number of vertebral fractures	66	86	25	27	205
	Total Direct Costs \$	321,994	684,629	107,113	143,898	1,257,634
2013-2022	Total number of vertebral fractures	606	598	238	210	1,651
	Total Direct Costs \$	\$2,937,120	\$4,779,531	\$1,002,588	\$1,114,854	\$9,834,093

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

Approximately 20% of the total cost and 27% 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 58% higher than the total cost of treating individuals with wrist fracture. Our source data, although based on small numbers of hospitalised individuals suggests the length of stay in acute hospital is longer for individuals with clinical vertebral fractures (5.4 vs 2.4 days, vertebral vs wrist fracture patients, respectively;¹ see Table 8 of this reference).

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

Year	'Other' Fractures	Annual Total Number of 'Other' Fractures and Total Direct Cost (2012\$)				Total 'Other' Fractures
		Female 50-69 years	70+ years	Male 50-69 years	70+ years	
2013	Annual number of 'other' fractures	224	63	166	42	495
	Total Direct Costs \$	1,933,087	781,958	1,095,625	549,160	4,359,830
2014	Annual number of 'other' fractures	230	68	169	45	512
	Total Direct Costs \$	1,988,851	838,963	1,118,331	584,029	4,530,175
2015	Annual number of 'other' fractures	236	72	172	48	528
	Total Direct Costs \$	2,037,267	894,853	1,137,868	626,212	4,696,200
2016	Annual number of 'other' fractures	241	77	175	51	544
	Total Direct Costs \$	2,082,571	954,460	1,155,492	668,134	4,860,656
2017	Annual number of 'other' fractures	245	83	177	56	560
	Total Direct Costs \$	2,121,908	1,023,361	1,166,779	726,119	5,038,167
2018	Annual number of 'other' fractures	250	88	179	59	576
	Total Direct Costs \$	2,161,679	1,091,891	1,181,168	773,917	5,208,655
2019	Annual number of 'other' fractures	255	94	181	63	593
	Total Direct Costs \$	2,207,760	1,159,677	1,196,349	823,805	5,387,592
2020	Annual number of 'other' fractures	261	99	184	67	611
	Total Direct Costs \$	2,257,040	1,227,711	1,214,501	873,301	5,572,554
2021	Annual number of 'other' fractures	267	106	187	71	631
	Total Direct Costs \$	2,308,655	1,312,847	1,236,943	926,063	5,784,507
2022	Annual number of 'other' fractures	272	125	190	74	662
	Total Direct Costs \$	2,351,538	1,552,515	1,256,348	970,727	6,131,128
2013-2022	Total number of 'other' fractures	2,481	875	1,782	576	5,713
	Total Direct Costs \$	\$21,450,356	\$10,838,237	\$11,759,404	\$7,521,467	\$51,569,464

'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 five times higher than the number of individuals with hip fracture. However the total cost burden of fracture treatment for this group is only 42% higher than 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	343,658	399,294	416,991	428,105	441,191	453,910	466,472	479,447	492,907	506,250
DXA	462,587	476,320	490,819	506,000	526,241	544,757	562,739	581,515	600,509	619,275
Vitamin D Test	660,663	682,465	721,643	723,301	743,522	763,467	784,630	806,923	832,427	868,289
Routine Pathology Test	923,744	954,228	1,009,006	1,011,325	1,039,597	1,067,485	1,097,076	1,128,246	1,163,906	1,214,048
Community GP Visits	2,891,482	2,986,919	3,158,390	3,165,681	3,254,203	3,341,521	3,434,170	3,531,761	3,643,413	3,800,475
All Total Cost \$	5,282,134	5,499,225	5,796,849	5,834,413	6,004,754	6,171,140	6,345,087	6,527,893	6,733,163	7,008,336

The total cost of managing osteoporosis and osteopenia in the Northern Territory in 2017 is estimated to be \$6 million. This is 56% of the estimated cost of fracture management/treatment in 2017 (Table 13: \$10.7 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 36% 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* \$					5,282,134
	Total Direct Costs of Fractures \$	2,838,716	3,071,528	1,526,606	1,441,197	8,878,047
	Combined costs \$					14,160,181
2014	Total management cost of osteoporosis/osteopenia* \$					5,499,225
	Total Direct Costs of Fractures \$	2,920,654	3,295,096	1,558,282	1,532,774	9,306,806
	Combined costs \$					14,806,031
2015	Total management cost of osteoporosis/osteopenia* \$					5,796,849
	Total Direct Costs of Fractures \$	2,991,726	3,515,116	1,585,394	1,643,533	9,735,769
	Combined costs \$					15,532,618
2016	Total management cost of osteoporosis/osteopenia* \$					5,834,413
	Total Direct Costs of Fractures \$	3,058,376	3,748,942	1,610,189	1,753,654	10,171,161
	Combined costs \$					16,005,574
2017	Total management cost of osteoporosis/osteopenia* \$					6,004,754
	Total Direct Costs of Fractures \$	3,116,029	4,019,258	1,625,749	1,905,629	10,666,664
	Combined costs \$					16,671,418
2018	Total management cost of osteoporosis/osteopenia* \$					6,171,140
	Total Direct Costs of Fractures \$	3,174,525	4,288,524	1,645,914	2,031,176	11,140,140
	Combined costs \$					17,311,280
2019	Total management cost of osteoporosis/osteopenia* \$					6,345,087
	Total Direct Costs of Fractures \$	3,242,147	4,555,133	1,667,040	2,162,212	11,626,532
	Combined costs \$					17,971,619
2020	Total management cost of osteoporosis/osteopenia* \$					6,527,893
	Total Direct Costs of Fractures \$	3,314,642	4,822,069	1,692,363	2,291,670	12,120,745
	Combined costs \$					18,648,638
2021	Total management cost of osteoporosis/osteopenia* \$					6,733,163
	Total Direct Costs of Fractures \$	3,390,418	5,156,351	1,723,500	2,430,327	12,700,596
	Combined costs \$					19,433,759
2022	Total management cost of osteoporosis/osteopenia* \$					7,008,336
	Total Direct Costs of Fractures \$	3,453,385	6,097,920	1,750,521	2,547,614	13,849,441
	Combined costs \$					20,857,777
2013 - 2022	Total management cost of osteoporosis/osteopenia* \$					61,202,994
	Total Direct Costs of Fractures \$	31,500,619	42,569,938	16,385,559	19,739,787	110,195,903
	Combined costs \$					171,398,897

* 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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