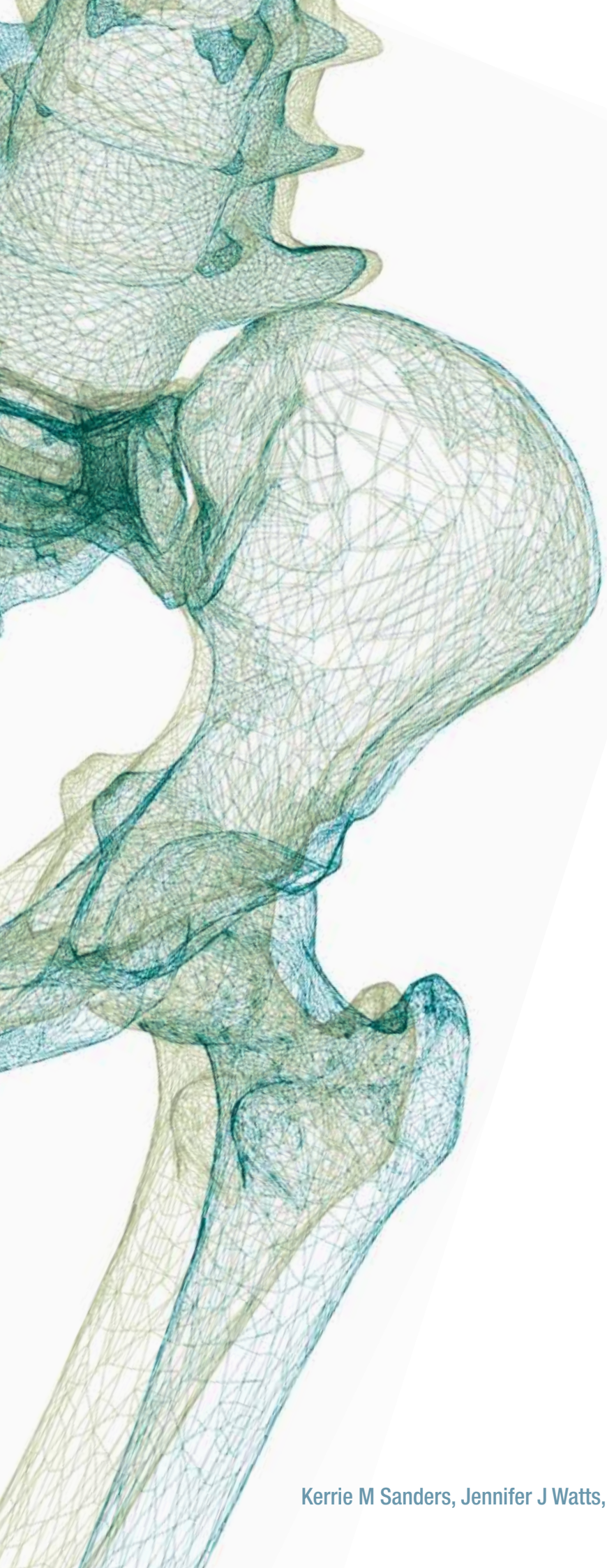

NSW & ACT

Osteoporosis costing NSW & ACT: A burden of disease analysis – 2012 to 2022

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Osteoporosis costing NSW & ACT *A burden of disease analysis – 2012 to 2022*
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Australian Study of Cost and Utilities Related to Osteoporotic Fractures (AusICUROS) Team:

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www.osteoporosis.org.au

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 NSW & ACT.

- Over a 10-year period an estimated 569,080 fractures costing $7.5 billion in total direct costs will occur in NSW & ACT
- Our hospital system is becoming a revolving door for first fractures and, most importantly, subsequent fractures, which can and should be prevented
- It's now time to make bone health a priority and to ensure osteoporosis is diagnosed and appropriately managed to reduce fractures.

Professor Markus Seibel
Past President, Australian and New Zealand Bone & Mineral Society
Director, Dept of Endocrinology, Concord Repatriation Hospital
Bone Research Program, ANZAC Research Institute

It is important to note that when we reduce fracture numbers we offer savings to the healthcare system. Health Professionals and government can collectively reduce the fracture burden by focussing on this major health issue.

This burden of disease analysis reviews the common types of fractures associated with poor bone health and shows they are expensive for the health system in NSW & ACT.

Typically fractures require emergency assistance, surgery, hospitals stays, rehabilitation and community services (such as home care). The report shows the most expensive type of fracture remains hip fracture and costs increase with age. The focus must shift to fracture prevention.

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.

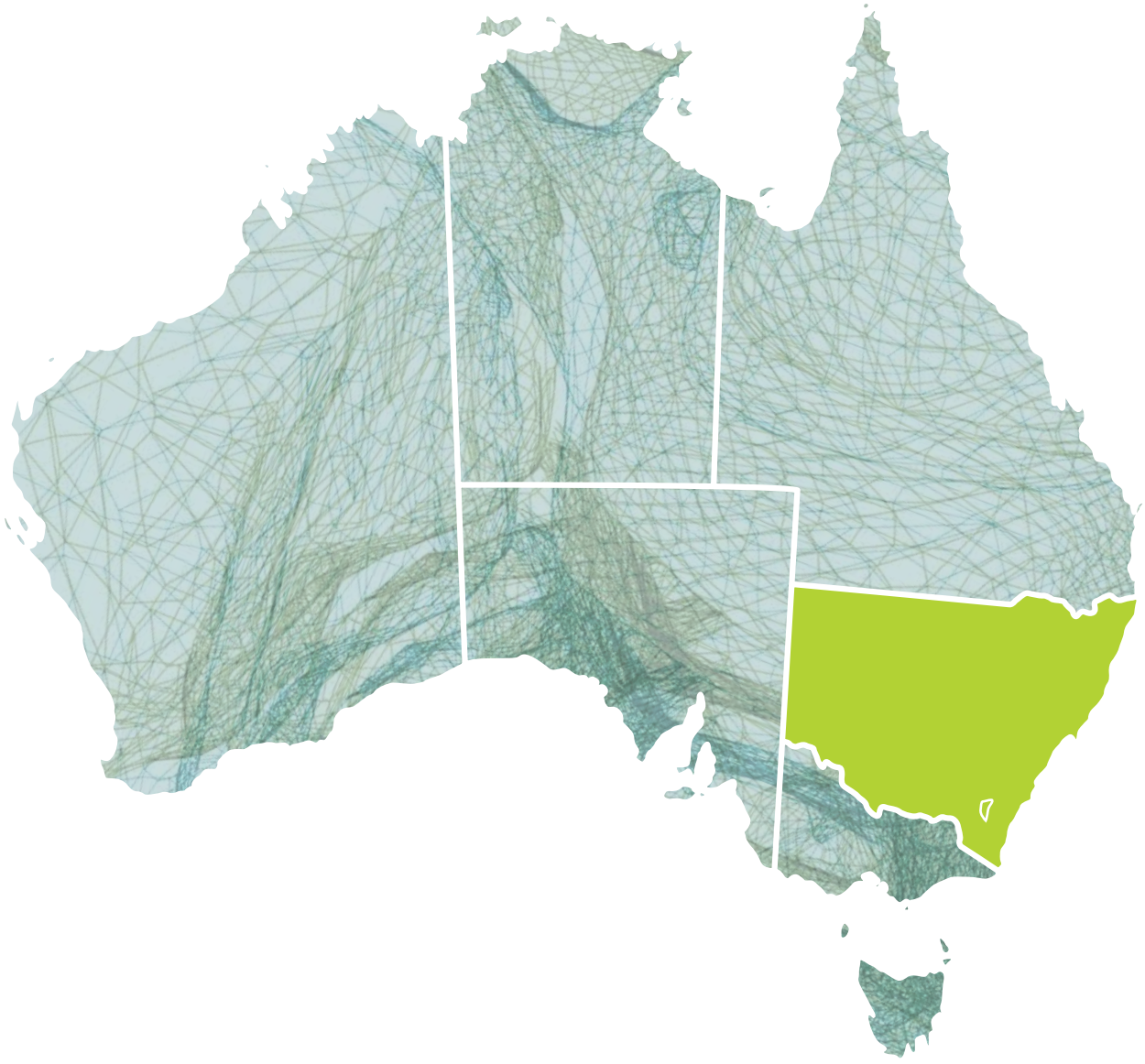
***Table 1:** Mean direct cost per fracture (2012$)**

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

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

RESULTS FOR NSW & ACT

Burden of Osteoporosis, Osteopenia and Associated Fractures in NSW & ACT



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

Summary – Key Findings

Burden of Osteoporosis, Osteopenia and Associated Fractures in NSW & ACT

Poor Bone Health: 2012-2022

- By 2022, it is estimated there will be 2.07 million older people in NSW & ACT with low bone mass, an increase of 26% from 2012.
- 1.9 million people in NSW & ACT aged 50 years and older (70%) have osteoporosis or osteopenia (poor bone health) in 2017.
- 1.6 million people in NSW & ACT aged 50 years and older (66%), had osteoporosis or osteopenia (poor bone health) in 2012.
- Among people in NSW & ACT aged 50 years and older, 15% had osteoporosis and 52% have osteopenia.
- Among people in NSW & ACT aged 70 years and older, 43% of women and 13% of men had osteoporosis (183,000 women and 43,100 men).

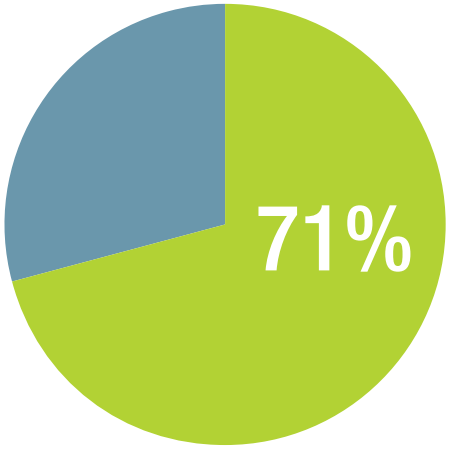
Fracture Impact: 2012-2022

- The total number of fractures over the ten year period 2013 to 2022 is projected to be 569,080.
- In 2022 it is expected there will be a 29% increase in the annual number of fractures (over 10 years) resulting in 63,685 fractures per annum.
- In 2022 there will be 174 fractures every day among older people in NSW & ACT. More than one in six of these fractures will be a hip fracture.
- In 2017 there will be 155 fractures each day among older people in NSW & ACT.

Cost Impact: 2012-2022

- The total direct costs of fractures over the ten years 2013 to 2022 will be $7.5 billion (2012$). These costs include ambulance services, hospitalisations and emergency and outpatient departments, rehabilitation, limited aged care and community services.
- In 2017 the total costs of osteoporosis and osteopenia in people in NSW & ACT over 50 years of age will be $1.1 billion of which $740 million (67%) relates to the treatment of fractures.
- In 2012 the total costs of osteoporosis and osteopenia in people in NSW & ACT over 50 years of age were $938 million of which $635 million (68%) relates to the treatment of fractures.

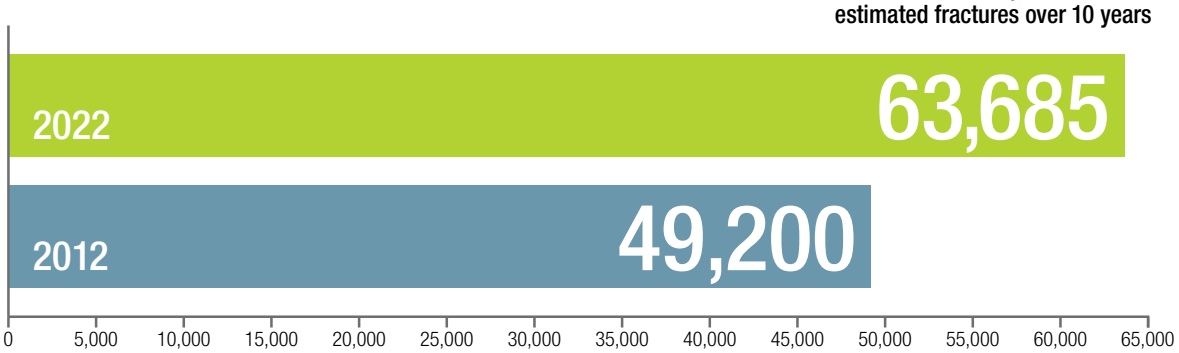
People in NSW & ACT over 50 estimated to have osteoporosis or osteopenia in 2022



2.07 million
People in NSW & ACT over 50

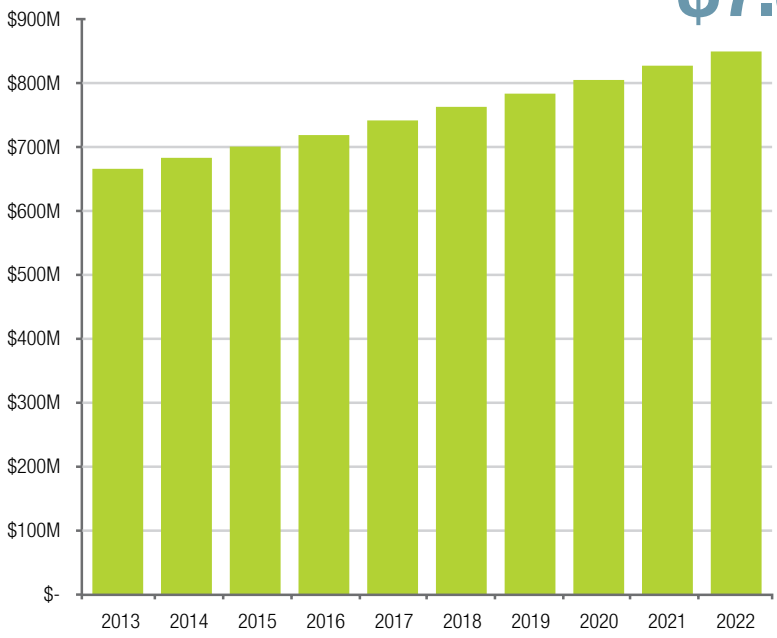
Number of fractures due to osteoporosis and osteopenia

569,080
estimated fractures over 10 years



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

$7.5 billion
total cost over 10 years



Impact of Osteoporosis, Osteopenia and Fractures in NSW & ACT

A total of 66% of the NSW & ACT population aged 50 years and over in 2012 had osteoporosis or osteopenia, the same proportion as reported for the Australian population (Table 2). Among older people in NSW & ACT, 52% had osteopenia (n=1,278,043) and 15% (n=365,730) had osteoporosis. Osteopenia in those aged 50-69 years formed the group with the largest number of people, with approximately equal numbers of women and men (Table 2). Although substantially fewer people had osteoporosis, there were over four times as many women as men irrespective of the age group. Among adults aged 70 years and older it is estimated that 43% of women and 13% of men had osteoporosis in 2012 (approximately 183,000 women and 43,000 men).

Of the NSW & ACT population with osteoporosis and osteopenia aged 50 years and over, 3% (n=49,174) had fractures in 2012. Of these older adults 16.5% had a hip fracture (n=5,847) with the remainder sustaining non-hip fractures (14% wrist, 18% vertebral and 51% with 'other' fracture types). Due to the higher prevalence of osteopenia compared to osteoporosis, fracture numbers were highest among those with osteopenia in each age and gender subgroup except for women aged 70+ years, where 58% more fractures occurred in women with osteoporosis compared to osteopenia (Table 3).

Fractures in Men vs Women

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

Across the two age groups and both bone density categories, absolute fracture numbers were consistently higher in women than men (percentages of fractures in men were: 'All' fractures 29%; Hip 29%; Wrist 11%; Vertebral 22%; 'Other' sites grouped: 36%). There were twice as many fractures in men with osteopenia than osteoporosis (osteopenia: n=9,523 vs osteoporosis n=4,629). In women the fracture numbers were more balanced due to the combination of a higher population in the older age group and the very high fracture rate among these older women with osteoporosis (aged 70+ years: 6.8%; n=12,475/183,056).

Table 2: 2012 NSW & ACT population by gender, age group and BMD category

	Osteoporosis		Osteopenia		Normal BMD		Total Population		
Age Group	Female	Male	Female	Male	Female	Male	Female	Male	Both
50-69 years	112,231	27,314	421,436	464,059	328,421	358,105	862,088	849,479	1,711,567
70+ years	183,056	43,129	195,219	197,328	45,018	93,665	423,293	334,122	757,415
Totals	**295,287**	**70,443**	**616,655**	**661,388**	**373,439**	**451,770**	**1,285,381**	**1,183,601**	**2,468,982**

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

	Female					Male					All
	50-69 years		70+ years		Total	50-69 years		70+ years		Total	
Population	Osteoporosis	Osteopenia	Osteoporosis	Osteopenia	All Women	Osteoporosis	Osteopenia	Osteoporosis	Osteopenia	All Men	Total
Total Population	**112,231**	**421,436**	**183,056**	**195,219**	**911,942**	**27,314**	**464,059**	**43,129**	**197,328**	**731,831**	**1,643,772**
Population with fracture (Total)	**6,192**	**8,473**	**12,475**	**7,880**	**35,021**	**2,341**	**4,994**	**2,288**	**4,529**	**14,153**	**49,174**
Hip											
Starting population	230	315	3,212	2,029	5,787	138	295	641	1,269	2,343	8,130
Hospitalised	230	315	3,212	2,029	5,787	138	295	641	1,269	2,343	8,130
Wrist											
Starting population	1,217	1,665	2,067	1,306	6,254	122	261	128	253	764	7,018
Hospitalised	548	749	1,323	836	3,455	54	115	64	126	359	3,814
Vertebral											
Starting population	931	1,274	2,922	1,846	6,973	245	523	405	802	1,976	8,949
Hospitalised	438	599	1,841	1,163	4,040	123	261	272	538	1,193	5,233
Other											
Starting population	3,814	5,219	4,274	2,700	16,007	1,836	3,916	1,114	2,205	9,071	25,077
Hospitalised	2,326	3,184	2,906	1,836	10,252	844	1,801	824	1,631	5,102	15,354
Low BMD population without fracture	**106,039**	**412,962**	**170,581**	**187,339**	**876,921**	**24,973**	**459,065**	**40,840**	**192,799**	**717,678**	**1,594,599**

Total Cost of Osteoporosis and Osteopenia in NSW & ACT 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)	**$585,539,778**	58.6
- Hip fractures	$259,291,970	
- Wrist fractures	$42,002,142	
- Vertebral fractures	$62,148,711	
- Other fractures	$222,096,954	
Total Cost Informal Care	**$49,868,359**	5.0
- Hip fractures	$13,355,088	
- Wrist fractures	$2,563,221	
- Vertebral fractures	$10,302,028	
- Other fractures	$23,648,022	
Total Direct Fracture Cost (including informal care)	**$635,408,137**	63.6
- Hip fractures	$272,647,059	
- Wrist fractures	$44,565,363	
- Vertebral fractures	$72,450,740	
- Other fractures	$245,744,976	
Total Direct Non-Fracture Cost	**$302,499,615**	30.3
- Routine medical and pathology (includes Vitamin D tests)	$217,204,830	
- DXA	$9,589,001	
- Pharmaceuticals – bone health	$75,705,784	
TOTAL DIRECT COSTS (fracture treatment + management of osteoporosis)	**$937,907,752**	93.8
TOTAL DIRECT COSTS (excluding informal care)*	**$888,039,393**	
Total Indirect cost (Productivity Loss due to Fractures)	**$61,862,267**	6.2
- Hip fractures	$28,509,272	
- Wrist fractures	$3,078,509	
- Vertebral fractures	$7,016,982	
- Other fractures	$23,257,504	
TOTAL DIRECT and INDIRECT COST	**$999,770,019**	
TOTAL DIRECT and INDIRECT COST (DUE TO FRACTURES)	$697,270,404	69.7

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

The treatment of fractures accounted for 68% of the total direct costs (including formal care) of osteoporosis ($635mil/$938mil: Table 4). Of this, hip fractures accounted for the highest proportion (43%) although the direct treatment cost of fractures at 'other' sites was 39% of the cost of all fractures. Treatment costs of vertebral fracture accounted for 11% of the cost of all fractures. Informal care includes the cost of non-health community services such as 'meals on wheels' and home help. This cost was 5% 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 32% 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 NSW & ACT the total cost of acute hospital care for fractures associated with osteoporosis or osteopenia in 2012 was $426.8 million, of which the total for acute inpatient hospitalisation was $406 million (95% of total hospital costs) (Table 5). The remainder of $20.4 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 32,531 acute admissions to hospital in 2012, representing 241,835 bed-days, with an average length of stay of 4.4 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 37% of bed-days, vertebral fractures 9% of hospital costs and 12% of bed-days, wrist fractures 7% of hospital costs and 3% of bed-days and 'other' fractures 41% of total acute hospital costs and 48% of acute bed-days. People aged 70 years and over accounted for 70% of total acute hospital inpatient costs of fractures, and costs for women were 71% 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 $118 million representing 29% of total hospital costs. 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	**$81,862,398**	**20**	**$208,074,865**	**51**	**$38,149,274**	**9**	**$78,368,422**	**19**	**$406,454,959**	**100**	**43.3**
- Hip	9,341,156	2	118,105,768	29	7,400,859	2	43,206,569	11	$178,054,351	44	
- Wrist	9,479,223	2	14,859,078	4	1,233,084	0	1,311,327	0	$26,882,711	7	
- Vertebral	6,928,178	2	20,075,543	5	2,559,974	1	5,400,591	1	$34,964,285	9	
- Other	56,113,841	14	55,034,477	14	26,955,358	7	28,449,936	7	$166,553,612	41	
Hospital (Non-admitted services) – Total Cost	**$7,584,870**	**37**	**$6,705,218**	**33**	**$4,123,054**	**20**	**$1,967,861**	**10**	**$20,381,003**	**100**	**2.2**
- Hip	107,251	1	312,286	2	71,977	0	174,409	1	$665,923	3	
- Wrist	1,706,777	8	1,670,653	8	243,112	1	202,477	1	$3,823,020	19	
- Vertebral	931,234	5	1,544,501	8	398,485	2	377,597	2	$3,251,817	16	
- Other	4,839,608	24	3,177,777	16	3,409,481	17	1,213,378	6	$12,640,244	62	
All Hospital – Total Cost	**$89,447,268**	**21**	**$214,780,082**	**50**	**$42,272,328**	**10**	**$80,336,284**	**19**	**$426,835,962**	**100**	**45.5**
- Hip	9,448,407	2	118,418,054	28	7,472,835	2	43,380,979	10	$178,720,274	42	
- Wrist	11,186,000	3	16,529,731	4	1,476,196	0	1,513,803	0	$30,705,730	7	
- Vertebral	7,859,412	2	21,620,044	5	2,958,458	1	5,778,188	1	$38,216,102	9	
- Other	60,953,449	14	58,212,254	14	30,364,839	7	29,663,314	7	$179,193,856	42	

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

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

All Fractures	Female Ages 50-69 years Total Cost	Female Ages 50-69 years % Direct Total Cost	Female Age 70+ years Total Cost	Female Age 70+ years % Direct Total Cost	Male Ages 50-69 years Total Cost	Male Ages 50-69 years % Direct Total Cost	Male Age 70+ years Total Cost	Male Age 70+ years % Direct Total Cost	All Total Cost	All % Direct Total Cost
Hospital Total	$89,447,268	9.5	$214,780,082	22.9	$42,272,328	4.5	$80,336,284	8.6	$426,835,962	45.5
Ambulance	$3,832,060	0.4	$9,029,037	1.0	$2,155,647	0.2	$3,621,413	0.4	$18,638,156	2.0
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	$1,988,041	0.2	$2,650,499	0.3	$976,547	0.1	$1,289,327	0.1	$6,904,414	0.7
Rehabilitation	$7,646,396	0.8	$64,008,940	6.8	$2,535,293	0.3	$16,418,219	1.8	$90,608,847	9.7
Nursing Home	$-	0.0	$16,847,191	1.8	$-	0.0	$5,310,629	0.6	$22,157,820	2.4
Community Services (home help and MOW)	$2,624,572	0.3	$11,295,904	1.2	$59,297	0.0	$2,761,293	0.3	$16,741,066	1.8
Pharmaceuticals – Fracture Management	$30,088	0.0	$39,931	0.0	$8,482	0.0	$6,586	0.0	$85,088	0.0
Supplements – Vitamin D and Calcium	$1,088,619	0.1	$1,454,642	0.2	$543,217	0.1	$481,946	0.1	$3,568,424	0.4
Total Direct Health Care Cost (excludes informal care)	**$106,657,044**	**11.4**	**$320,106,226**	**34.1**	**$48,550,811**	**5.2**	**$110,225,697**	**11.8**	**$585,539,778**	**62.4**
Informal care	$10,778,500		$27,002,519		$5,889,194		$6,198,146		$49,868,359	
Total Direct Cost (includes informal care)	$117,435,544		$347,108,745		$54,440,005		$116,423,843		$635,408,137	
Productivity Loss due to Fracture (Indirect)	$7,496,509		$38,212,098		$3,284,625		$12,869,035		$61,862,267	
Total Cost (Direct and Indirect)	**$124,932,053**		**$385,320,844**		**$57,724,630**		**$129,292,878**		**$697,270,404**	

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

Hip Fractures	Female Ages 50-69 years Total Cost	Female Ages 50-69 years % Direct Total Cost	Female Age 70+ years Total Cost	Female Age 70+ years % Direct Total Cost	Male Ages 50-69 years Total Cost	Male Ages 50-69 years % Direct Total Cost	Male Age 70+ years Total Cost	Male Age 70+ years % Direct Total Cost	All Total Cost	All % Direct Total Cost
Hospital Total	$9,448,407	1.0	$118,418,054	12.6	$7,472,835	0.8	$43,380,979	4.6	$178,720,274	19.1
Ambulance	$326,771	0.0	$3,392,370	0.4	$267,824	0.0	$1,320,243	0.1	$5,307,208	0.6
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	$192,232	0.0	$842,883	0.1	$145,759	0.0	$661,893	0.1	$1,842,767	0.2
Rehabilitation	$1,822,761	0.2	$38,270,892	4.1	$2,139,476	0.2	$10,441,140	1.1	$52,674,269	5.6
Nursing Home	$-	0.0	$10,940,812	1.2	$-	0.0	$5,146,035	0.5	$16,086,847	1.7
Community Services (home help and MOW)	$26,262	0.0	$3,148,034	0.3	$-	0.0	$907,195	0.1	$4,081,491	0.4
Pharmaceuticals – Fracture Management	$1,588	0.0	$14,173	0.0	$362	0.0	$1,587	0.0	$17,710	0.0
Supplements – Vitamin D and Calcium	$40,282	0.0	$359,567	0.0	$30,016	0.0	$131,540	0.0	$561,404	0.1
Total Direct Health Care Cost (excludes informal care)	**$11,858,302**	**1.3**	**$175,386,784**	**18.7**	**$10,056,272**	**1.1**	**$61,990,612**	**6.6**	**$259,291,970**	**27.6**
Informal care	$66,444		$12,560,734		$19,804		$708,106		$13,355,088	
Total Direct Cost (includes informal care)	$11,924,746		$187,947,518		$10,076,076		$62,698,718		$272,647,059	
Productivity Loss due to Fracture (Indirect)	$1,029,229		$20,037,738		$1,032,908		$6,409,397		$28,509,272	
Total Cost (Direct and Indirect)	**$12,953,975**		**$207,985,257**		**$11,108,984**		**$69,108,116**		**$301,156,331**	

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

	Female				Male				All	
	Ages 50-69 years		Age 70+ years		Ages 50-69 years		Age 70+ years			
Wrist Fractures	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	$11,186,000	1.2	$16,529,731	1.8	$1,476,196	0.2	$1,513,803	0.2	$30,705,730	3.3
Ambulance	$337,284	0.0	$650,085	0.1	$50,151	0.0	$104,906	0.0	$1,142,426	0.1
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	$309,718	0.0	$412,429	0.0	$30,950	0.0	$31,988	0.0	$785,086	0.1
Rehabilitation	$962,835	0.1	$5,608,573	0.6	$20,875	0.0	$329,974	0.0	$6,922,257	0.7
Nursing Home	$-	0.0	$1,287,058	0.1	$-	0.0	$9,087	0.0	$1,296,145	0.1
Community Services (home help and MOW)	$36,925	0.0	$574,727	0.1	$-	0.0	$9,768	0.0	$621,419	0.1
Pharmaceuticals – Fracture Management	$6,305	0.0	$7,195	0.0	$245	0.0	$239	0.0	$13,984	0.0
Supplements – Vitamin D and Calcium	$214,261	0.0	$244,516	0.0	$28,509	0.0	$27,809	0.0	$515,095	0.1
Total Direct Health Care Cost (excludes informal care)	**$13,053,328**	**1.4**	**$25,314,315**	**2.7**	**$1,606,925**	**0.2**	**$2,027,574**	**0.2**	**$42,002,142**	**4.5**
Informal care	$917,809		$1,636,518		$8,894		$0		$2,563,221	
Total Direct Cost (includes informal care)	$13,971,137		$26,950,833		$1,615,819		$2,027,574		$44,565,363	
Productivity Loss due to Fracture (Indirect)	$571,281		$2,302,819		$45,977		$158,433		$3,078,509	
Total Cost (Direct and Indirect)	**$14,542,417**		**$29,253,652**		**$1,661,796**		**$2,186,007**		**$47,643,872**	

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

	Female				Male				All	
	Ages 50-69 years		Age 70+ years		Ages 50-69 years		Age 70+ years			
Vertebral Fractures	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	$7,859,412	0.8	$21,620,044	2.3	$2,958,458	0.3	$5,778,188	0.6	$38,216,102	4.1
Ambulance	$804,757	0.1	$2,297,695	0.2	$332,257	0.0	$348,725	0.0	$3,783,433	0.4
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	$328,513	0.0	$443,055	0.0	$100,256	0.0	$105,402	0.0	$977,226	0.1
Rehabilitation	$769,625	0.1	$7,805,403	0.8	$47,396	0.0	$1,399,839	0.1	$10,022,263	1.1
Nursing Home	$-	0.0	$1,791,187	0.2	$-	0.0	$38,548	0.0	$1,829,736	0.2
Community Services (home help and MOW)	$900,083	0.1	$5,687,437	0.6	$-	0.0	$73,064	0.0	$6,660,583	0.7
Pharmaceuticals – Fracture Management	$1,361	0.0	$2,871	0.0	$436	0.0	$669	0.0	$5,337	0.0
Supplements – Vitamin D and Calcium	$163,936	0.0	$345,861	0.0	$56,919	0.0	$87,316	0.0	$654,032	0.1
Total Direct Health Care Cost (excludes informal care)	**$10,827,687**	**1.2**	**$39,993,553**	**4.3**	**$3,495,721**	**0.4**	**$7,831,750**	**0.8**	**$62,148,711**	**6.6**
Informal care	$2,622,146		$5,803,144		$1,274,699		$602,039		$10,302,028	
Total Direct Cost (includes informal care)	$13,449,833		$45,796,697		$4,770,420		$8,433,790		$72,450,740	
Productivity Loss due to Fracture (Indirect)	$1,060,200		$4,585,768		$327,406		$1,043,608		$7,016,982	
Total Cost (Direct and Indirect)	**$14,510,033**		**$50,382,464**		**$5,097,827**		**$9,477,398**		**$79,467,722**	

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

Other Fractures	Female Ages 50-69 years Total Cost	Female Ages 50-69 years % Direct Total Cost	Female Age 70+ years Total Cost	Female Age 70+ years % Direct Total Cost	Male Ages 50-69 years Total Cost	Male Ages 50-69 years % Direct Total Cost	Male Age 70+ years Total Cost	Male Age 70+ years % Direct Total Cost	All Total Cost	All % Direct Total Cost
Hospital Total	$60,953,449	6.5	$58,212,254	6.2	$30,364,839	3.2	$29,663,314	3.2	$179,193,856	19.1
Ambulance	$2,363,248	0.3	$2,688,888	0.3	$1,505,416	0.2	$1,847,538	0.2	$8,405,090	0.9
Community Fracture Mgt (incl GP, Physio, Med Spec, X-ray)	$1,157,578	0.1	$952,132	0.1	$699,582	0.1	$490,044	0.1	$3,299,336	0.4
Rehabilitation	$4,091,175	0.4	$12,324,071	1.3	$327,546	0.0	$4,247,265	0.5	$20,990,057	2.2
Nursing Home	$-	0.0	$2,828,133	0.3	$-	0.0	$116,960	0.0	$2,945,093	0.3
Community Services (home help and MOW)	$1,661,302	0.2	$1,885,707	0.2	$59,297	0.0	$1,771,267	0.2	$5,377,572	0.6
Pharmaceuticals – Fracture Management	$20,834	0.0	$15,691	0.0	$7,440	0.0	$4,092	0.0	$48,057	0.0
Supplements – Vitamin D and Calcium	$670,141	0.1	$504,699	0.1	$427,774	0.0	$235,280	0.0	$1,837,893	0.2
Total Direct Health Care Cost (excludes informal care)	**$70,917,727**	**7.6**	**$79,411,575**	**8.5**	**$33,391,892**	**3.6**	**$38,375,761**	**4.1**	**$222,096,954**	**23.7**
Informal care	$7,172,101		$7,002,123		$4,585,797		$4,888,001		$23,648,022	
Total Direct Cost (includes informal care)	$78,089,828		$86,413,698		$37,977,690		$43,263,761		$245,744,976	
Productivity Loss due to Fracture (Indirect)	$4,835,800		$11,285,773		$1,878,334		$5,257,597		$23,257,504	
Total Cost (Direct and Indirect)	**$82,925,628**		**$97,699,471**		**$39,856,024**		**$48,521,358**		**$269,002,480**	

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

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

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

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

	Change in Total Cost ($)				
	2012 Results	Hip Fractures Increase by 25%		Hip Fractures Decrease by 25%	
	2012$	2012$	%	2012$	%
Total Direct Fracture Cost (including informal care)	635,408,137	703,569,902	10.73	567,246,372	-10.73
TOTAL DIRECT COSTS	937,907,752	1,006,069,517	7.27	869,745,987	-7.27
TOTAL DIRECT and INDIRECT COST	999,770,019	1,075,059,102	7.53	924,480,936	-7.53

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 ±2,032 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 $704 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 $567 million, a saving of over $68 million.

Burden of Osteoporosis and Osteopenia in NSW & ACT from 2013-2022

Fracture Numbers and Costs in NSW & ACT 2013-2022

As described in the Method (Appendix A), the change in fracture numbers is based on the ABS projection for the NSW & ACT 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: 132% vs 112%; men: 140% vs 110%).

The highest proportional increase is projected in men aged 70+ year age group where fracture numbers will increase by 40% over the next ten year period. In older women fracture numbers are projected to increase by 32% however as the population of women in this age group is higher and women have higher fracture rates than men, 55% of the total direct costs of all fractures are attributable to women aged 70 years and older. By comparison, almost 20% of the total costs are attributable to men aged 70+ years and fractures in adults aged 50 to 69 years account for 17% and 8% of the costs in women and men, respectively.

Over the same ten year period the total direct cost of all fractures is expected to increase slightly more than the number of fractures (128% compared with a 124% overall increase in fracture numbers). The increase in cost is proportionally more because the cost per hip fracture is substantially higher than fracture at other sites and hip fractures are much more common in the older age group where the highest increase in the population is expected.

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

		Annual Total Number of Fractures and Total Direct Cost (2012$)				
		Female		Male		Total
Year	All Fractures	50-69 years	70+ years	50-69 years	70+ years	All Fractures
2013	Annual total number of fractures	15,380	21,200	7,644	7,230	51,454
	Total Direct Costs $	*123,157,149*	*362,166,039*	*56,734,166*	*122,757,192*	*664,814,546*
2014	Annual total number of fractures	15,668	21,762	7,761	7,492	52,684
	Total Direct Costs $	*125,463,937*	*371,744,597*	*57,604,307*	*127,199,750*	*682,012,590*
2015	Annual total number of fractures	15,905	22,367	7,854	7,768	53,894
	Total Direct Costs $	*127,360,286*	*382,054,507*	*58,297,549*	*131,870,011*	*699,582,353*
2016	Annual total number of fractures	16,111	23,005	7,934	8,058	50,803
	Total Direct Costs $	*129,013,888*	*392,916,547*	*58,890,419*	*136,784,912*	*717,605,766*
2017	Annual total number of fractures	16,226	23,893	7,967	8,447	56,534
	Total Direct Costs $	*129,934,750*	*408,049,658*	*59,136,092*	*143,375,529*	*740,496,029*
2018	Annual total number of fractures	16,385	24,693	8,021	8,798	57,897
	Total Direct Costs $	*131,202,298*	*421,670,928*	*59,532,386*	*149,327,992*	*761,733,604*
2019	Annual total number of fractures	16,594	25,453	8,099	9,119	59,265
	Total Direct Costs $	*132,875,788*	*434,617,307*	*60,115,706*	*154,772,445*	*782,381,246*
2020	Annual total number of fractures	16,795	26,254	8,181	9,448	60,677
	Total Direct Costs $	*134,486,752*	*448,250,192*	*60,719,921*	*160,341,786*	*803,798,651*
2021	Annual total number of fractures	17,055	27,067	8,290	9,775	62,187
	Total Direct Costs $	*136,567,819*	*462,113,926*	*61,531,865*	*165,895,124*	*826,108,734*
2022	Annual total number of fractures	17,298	27,896	8,400	10,090	63,685
	Total Direct Costs $	*138,518,657*	*476,228,301*	*62,349,962*	*171,235,891*	*848,332,812*
2013-2022	**Total number of fractures**	**163,416**	**243,591**	**80,152**	**86,226**	**569,080**
	Total Direct Costs $	***$1,308,581,323***	***$4,159,812,002***	***$594,912,373***	***$1,463,560,632***	***$7,526,866,331***

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 50-69 years	Female 70+ years	Male 50-69 years	Male 70+ years	Total Hip Fractures
2013	Annual number of hip fractures	572	5,459	451	2,026	8,508
	Total Direct Costs $	*12,505,734*	*195,723,808*	*10,507,904*	*65,691,121*	*284,428,567*
2014	Annual number of hip fractures	583	5,604	458	2,099	8,744
	Total Direct Costs $	*12,739,972*	*200,911,205*	*10,669,066*	*68,068,151*	*292,388,394*
2015	Annual number of hip fractures	592	5,760	463	2,176	8,991
	Total Direct Costs $	*12,932,533*	*206,495,929*	*10,797,463*	*70,566,957*	*300,792,882*
2016	Annual number of hip fractures	599	5,924	468	2,258	9,249
	Total Direct Costs $	*13,100,445*	*212,380,468*	*10,907,270*	*73,196,620*	*309,584,803*
2017	Annual number of hip fractures	604	6,153	470	2,367	9,593
	Total Direct Costs $	*13,193,952*	*220,581,826*	*10,952,772*	*76,722,708*	*321,451,258*
2018	Annual number of hip fractures	609	6,359	473	2,465	9,906
	Total Direct Costs $	*13,322,662*	*227,962,908*	*11,026,171*	*79,907,421*	*332,219,162*
2019	Annual number of hip fractures	617	6,554	478	2,555	10,204
	Total Direct Costs $	*13,492,593*	*234,977,279*	*11,134,209*	*82,820,395*	*342,424,477*
2020	Annual number of hip fractures	625	6,761	482	2,647	10,515
	Total Direct Costs $	*13,656,175*	*242,363,923*	*11,246,118*	*85,800,190*	*353,066,407*
2021	Annual number of hip fractures	634	6,970	489	2,739	10,832
	Total Direct Costs $	*13,867,493*	*249,874,702*	*11,396,500*	*88,771,480*	*363,910,175*
2022	Annual number of hip fractures	643	7,183	495	2,827	11,149
	Total Direct Costs $	*14,065,587*	*257,521,626*	*11,548,023*	*91,629,044*	*374,764,279*
2013-2022	**Total number of hip fractures**	**6,079**	**62,727**	**4,726**	**24,159**	**97,691**
	Total Direct Costs $	***$91,862,696***	***$1,521,596,286***	***$76,410,079***	***$525,789,136***	***$3,275,030,404***

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 1.3 times more than the number of men but the total annual number of people aged 50 to 69 years in NSW & ACT with hip fracture is just over 1,000. In NSW & ACT for people aged 70 years and older, the annual number of hip fractures increases dramatically. In women the number of hip fractures is almost ten times higher than those aged less than 70 years. In men the annual number of hip fractures in the older age group is 4.5 times higher than the younger age group. However, the population projections for the 10 years from 2013 to 2022 mean there is likely to be a greater proportional increase in older men with hip fracture. Numbers will increase by 40% in men compared to a 32% increase in older women with hip fracture. The projected increase in hip fractures in women and men aged 50 to 69 years is approximately 11% over the ten year period.

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

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

Year	Wrist Fractures	Annual Total Number of Wrist Fractures and Total Direct Cost (2012$) Female 50-69 years	Female 70+ years	Male 50-69 years	Male 70+ years	Total Wrist Fractures
2013	Annual number of wrist fractures	3,022	3,512	399	404	7,337
	Total Direct Costs $	*14,651,828*	*28,585,755*	*1,682,959*	*2,149,735*	*47,070,277*
2014	Annual number of wrist fractures	3,079	3,605	405	419	7,508
	Total Direct Costs $	*14,926,263*	*29,327,081*	*1,708,771*	*2,227,627*	*48,189,742*
2015	Annual number of wrist fractures	3,125	3,705	410	434	7,675
	Total Direct Costs $	*15,151,869*	*30,125,247*	*1,729,335*	*2,309,529*	*49,315,981*
2016	Annual number of wrist fractures	3,166	3,811	414	450	7,841
	Total Direct Costs $	*15,348,596*	*30,966,297*	*1,746,922*	*2,395,732*	*50,457,547*
2017	Annual number of wrist fractures	3,188	3,958	416	472	8,035
	Total Direct Costs $	*15,458,149*	*32,138,615*	*1,754,210*	*2,511,368*	*51,862,343*
2018	Annual number of wrist fractures	3,219	4,091	419	491	8,221
	Total Direct Costs $	*15,608,948*	*33,193,638*	*1,765,966*	*2,615,795*	*53,184,346*
2019	Annual number of wrist fractures	3,261	4,217	423	509	8,410
	Total Direct Costs $	*15,808,040*	*34,196,199*	*1,783,269*	*2,711,291*	*54,498,800*
2020	Annual number of wrist fractures	3,300	4,349	427	528	8,604
	Total Direct Costs $	*15,999,694*	*35,251,983*	*1,801,193*	*2,808,978*	*55,861,848*
2021	Annual number of wrist fractures	3,351	4,484	433	546	8,814
	Total Direct Costs $	*16,247,276*	*36,325,467*	*1,825,278*	*2,906,367*	*57,304,388*
2022	Annual number of wrist fractures	3,399	4,621	439	564	9,023
	Total Direct Costs $	*16,479,364*	*37,418,425*	*1,849,546*	*3,000,026*	*58,747,361*
2013-2022	**Total number of wrist fractures**	**32,110**	**40,354**	**4,187**	**4,816**	**81,468**
	Total Direct Costs $	***$155,680,028***	***$327,528,708***	***$17,647,450***	***$25,636,447***	***$526,492,633***

Unlike other fracture sites where the ratio of women to men is about three to one, the annual projected number of wrist fractures in women is eight times the projected number in men. There is less difference in fracture numbers between the older and younger age groups in wrist fractures compared with fractures at other sites. The cost of treating wrist fractures in older adults in NSW & ACT will increase by 25% over the ten years from 2013 to 2022 from $47 million to a projected $59 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 the impact of inflation.

In 2013, 61% of the total cost of treating wrist fractures is attributable to women aged 70 years and older (Table 15). From our source data (based on service use from 284 individuals with wrist fracture from eight study sites across Australia; Appendix table A1), the mean cost of treating a woman with wrist fracture aged 70 years and over is 65% higher than treating a woman aged 50 to 69 years. Utilisation rates of services (Appendix B) shows hospitalisation is almost 20% higher in older woman than younger woman (65% vs 45%: 70+ years vs 50 to 69 years old, respectively). The comparable hospitalisation rates in men are 5% higher in older men (50% vs 44%, 70+ years vs 50 to 69 years old, respectively).

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

Year	Vertebral Fractures	Annual Total Number of Vertebral Fractures and Total Direct Cost (2012$) Female 50-69 years	Female 70+ years	Male 50-69 years	Male 70+ years	Total Vertebral Fractures
2013	Annual number of vertebral fractures	2,313	4,965	800	1,281	9,359
	Total Direct Costs $	*14,105,126*	*47,877,464*	*4,983,196*	*8,949,846*	*75,915,632*
2014	Annual number of vertebral fractures	2,356	5,097	812	1,327	9,593
	Total Direct Costs $	*14,369,321*	*49,145,477*	*5,059,624*	*9,271,963*	*77,846,385*
2015	Annual number of vertebral fractures	2,392	5,239	822	1,376	9,829
	Total Direct Costs $	*14,586,509*	*50,510,052*	*5,120,514*	*9,610,258*	*79,827,333*
2016	Annual number of vertebral fractures	2,423	5,388	831	1,427	10,069
	Total Direct Costs $	*14,775,895*	*51,947,556*	*5,172,588*	*9,966,068*	*81,862,107*
2017	Annual number of vertebral fractures	2,440	5,596	834	1,496	10,367
	Total Direct Costs $	*14,881,361*	*53,949,701*	*5,194,167*	*10,442,365*	*84,467,594*
2018	Annual number of vertebral fractures	2,464	5,783	840	1,559	10,646
	Total Direct Costs $	*15,026,533*	*55,752,016*	*5,228,975*	*10,872,806*	*86,880,329*
2019	Annual number of vertebral fractures	2,495	5,961	848	1,616	10,920
	Total Direct Costs $	*15,218,197*	*57,465,236*	*5,280,210*	*11,266,842*	*89,230,485*
2020	Annual number of vertebral fractures	2,526	6,149	856	1,674	11,205
	Total Direct Costs $	*15,402,700*	*59,269,236*	*5,333,281*	*11,669,928*	*91,675,145*
2021	Annual number of vertebral fractures	2,565	6,340	868	1,732	11,504
	Total Direct Costs $	*15,641,043*	*61,103,977*	*5,404,597*	*12,072,171*	*94,221,788*
2022	Annual number of vertebral fractures	2,601	6,534	879	1,788	11,802
	Total Direct Costs $	*15,864,472*	*62,971,815*	*5,476,454*	*12,459,072*	*96,771,813*
2013-2022	**Total number of vertebral fractures**	**24,575**	**57,052**	**8,391**	**15,275**	**105,293**
	Total Direct Costs $	***149,871,156***	***549,992,529***	***52,253,606***	***106,581,319***	***858,698,610***

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

Approximately 22% of the total cost and 18% of the number of individuals with clinically diagnosed vertebral fracture are men. In 2013 the total cost of treating individuals with clinically diagnosed vertebral fracture(s) was 61% higher than the total cost of treating individuals with wrist fracture. Our source data, although based on small numbers of hospitalised individuals suggests the length of stay in acute hospital is longer for individuals with clinical vertebral fractures (5.4 vs 2.4 days, vertebral vs wrist fracture patients, respectively).[1]

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

Year	'Other' Fractures	Annual Total Number of 'Other' Fractures and Total Direct Cost (2012$) Female 50-69 years	Female 70+ years	Male 50-69 years	Male 70+ years	Total 'Other' Fractures
2013	Annual number of 'other' fractures	9,473	7,263	5,994	3,520	26,250
	Total Direct Costs $	*81,894,461*	*89,979,013*	*39,560,107*	*45,966,490*	*257,400,071*
2014	Annual number of 'other' fractures	9,650	7,456	6,085	3,647	26,839
	Total Direct Costs $	*83,428,380*	*92,360,834*	*40,166,847*	*47,632,008*	*263,588,069*
2015	Annual number of 'other' fractures	9,796	7,663	6,159	3,781	27,400
	Total Direct Costs $	*84,689,375*	*94,923,279*	*40,650,236*	*49,383,267*	*269,646,157*
2016	Annual number of 'other' fractures	9,923	7,882	6,221	3,923	27,949
	Total Direct Costs $	*85,788,952*	*97,622,226*	*41,063,638*	*51,226,492*	*275,701,309*
2017	Annual number of 'other' fractures	9,994	8,186	6,247	4,112	28,540
	Total Direct Costs $	*86,401,288*	*101,379,516*	*41,234,943*	*53,699,087*	*282,714,834*
2018	Annual number of 'other' fractures	10,092	8,460	6,289	4,283	29,124
	Total Direct Costs $	*87,244,155*	*104,762,366*	*41,511,274*	*55,931,971*	*289,449,766*
2019	Annual number of 'other' fractures	10,220	8,721	6,351	4,439	29,731
	Total Direct Costs $	*88,356,958*	*107,978,593*	*41,918,017*	*57,973,917*	*296,227,485*
2020	Annual number of 'other' fractures	10,344	8,995	6,415	4,599	30,353
	Total Direct Costs $	*89,428,183*	*111,365,049*	*42,339,330*	*60,062,690*	*303,195,251*
2021	Annual number of 'other' fractures	10,504	9,274	6,500	4,759	31,037
	Total Direct Costs $	*90,812,007*	*114,809,780*	*42,905,489*	*62,145,107*	*310,672,383*
2022	Annual number of 'other' fractures	10,654	9,557	6,587	4,912	31,711
	Total Direct Costs $	*92,109,235*	*118,316,435*	*43,475,939*	*64,147,750*	*318,049,359*
2013-2022	**Total number of 'other' fractures**	**100,650**	**83,457**	**62,848**	**41,975**	**288,934**
	Total Direct Costs $	***$870,152,994***	***$1,033,497,091***	***$414,825,820***	***$548,168,779***	***$2,866,644,684***

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

When grouped together as fractures at 'other' sites, the total number of individuals with 'other' fracture is 3 times higher than the number of individuals with hip fracture. However the total cost burden of fracture treatment for this group is almost the same (~90%) as that attributed to hip fractures (Tables 14 & 17).

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

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

Community Health Care Service	Annual Total Cost (2012$)									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Bisphosphonates	78,812,178	91,571,241	95,629,882	98,178,528	101,179,619	104,096,554	106,977,338	109,953,088	113,039,804	116,099,755
DXA	14,168,167	14,588,800	15,032,862	15,497,827	16,117,761	16,684,885	17,235,643	17,810,727	18,392,463	18,967,228
Vitamin D Test	33,556,666	34,297,905	34,996,414	35,677,404	36,391,068	37,103,956	37,850,777	38,615,381	39,462,450	40,295,756
Routine Pathology Test	46,919,180	47,955,585	48,932,246	49,884,411	50,882,262	51,879,027	52,923,238	53,992,313	55,176,691	56,341,826
Community GP Visits	146,893,173	150,138,138	153,196,221	156,177,712	159,302,775	162,424,230	165,694,086	169,041,855	172,750,519	176,398,993
All Total Cost $	**320,349,363**	**338,551,667**	**347,787,625**	**355,415,882**	**363,873,487**	**372,188,652**	**380,681,081**	**389,413,364**	**398,821,927**	**408,103,559**

The total cost of managing osteoporosis and osteopenia in NSW & ACT in 2017 is estimated to be $364 million (Table 18). This is 45% of the estimated cost of fracture management/treatment in 2017 (Table 13: $740 million). The costs related to the management of osteoporosis /osteopenia is detailed in Appendix A and is based on 2.4 visits to a general practitioner each year and twice yearly routine biochemistry to assess renal function and serum calcium. Cost assumptions include 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 2011/2012[2] with costs conservatively assigned at the lowest cost bisphosphonate (see Appendix A Methods). In 2017 the cost of management of low bone status is 33% 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$) Female 50-69 years	Female 70+ years	Male 50-69 years	Male 70+ years	Total All Fractures
2013	Total management cost of osteoporosis/osteopenia*$					320,349,363
	Total Direct Costs of Fractures $	*123,157,149*	*362,166,039*	*56,734,166*	*122,757,192*	*664,814,546*
	Combined costs $					*985,163,909*
2014	Total management cost of osteoporosis/osteopenia* $					338,551,667
	Total Direct Costs of Fractures $	*125,463,937*	*371,744,597*	*57,604,307*	*127,199,750*	*682,012,590*
	Combined costs $					*1,020,564,257*
2015	Total management cost of osteoporosis/osteopenia* $					347,787,625
	Total Direct Costs of Fractures $	*127,360,286*	*382,054,507*	*58,297,549*	*131,870,011*	*699,582,353*
	Combined costs $					*1,047,369,978*
2016	Total management cost of osteoporosis/osteopenia* $					355,415,882
	Total Direct Costs of Fractures $	*129,013,888*	*392,916,547*	*58,890,419*	*136,784,912*	*717,605,766*
	Combined costs $					*1,073,021,648*
2017	Total management cost of osteoporosis/osteopenia* $					363,873,487
	Total Direct Costs of Fractures $	*129,934,750*	*408,049,658*	*59,136,092*	*143,375,529*	*740,496,029*
	Combined costs $					*1,104,369,516*
2018	Total management cost of osteoporosis/osteopenia* $					372,188,652
	Total Direct Costs of Fractures $	*131,202,298*	*421,670,928*	*59,532,386*	*149,327,992*	*761,733,604*
	Combined costs $					*1,133,922,256*
2019	Total management cost of osteoporosis/osteopenia* $					380,681,081
	Total Direct Costs of Fractures $	*132,875,788*	*434,617,307*	*60,115,706*	*154,772,445*	*782,381,246*
	Combined costs $					*1,163,062,327*
2020	Total management cost of osteoporosis/osteopenia* $					389,413,364
	Total Direct Costs of Fractures $	*134,486,752*	*448,250,192*	*60,719,921*	*160,341,786*	*803,798,651*
	Combined costs $					*1,193,212,015*
2021	Total management cost of osteoporosis/osteopenia* $					408,103,559
	Total Direct Costs of Fractures $	*136,567,819*	*462,113,926*	*61,531,865*	*165,895,124*	*826,108,734*
	Combined costs $					*1,234,212,292*
2022	Total management cost of osteoporosis/osteopenia* $					270,210,036
	Total Direct Costs of Fractures $	*138,518,657*	*476,228,301*	*62,349,962*	*171,235,891*	*848,332,812*
	Combined costs $					*1,118,542,848*
2013 - 2022	**Total management cost of osteoporosis/osteopenia* $**					**3,546,574,716**
	Total Direct Costs of Fractures $	***1,308,581,323***	***4,159,812,002***	***594,912,373***	***1,463,560,632***	***7,526,866,331***
	Combined costs $					***11,073,441,047***

** 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.

A separate report has not been generated for ACT. The burden of osteoporosis for NSW & ACT has been reported together.

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 Study[4] were used. The 5-year rates were then applied to the 5-year population cohorts from the ABS[5] 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 cohort[6] 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 study[9] 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 Australia[2] 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 Men	50-69 years Women	70+ years Men	70+ years 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$ Cost (as needed)	Cost (routine)	Assumptions re Use	Data Source
- 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 Women	Men	Cost 12 months (2012$) Women	Men	Assumptions re Use	Data Source
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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