Arthritis - the bottom line

The economic impact of arthritis in Australia

Arthritis AUSTRALIA

ACCESS ECONOMICS

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EXECUTIVE SUMMARY

In 2004, there were **3.4 million Australians with arthritis, 16.7% of the population.**

- 18.4% of women had arthritis, and 15.1% of men.
- 54% of Australians aged 75 or over had arthritis.
- 60% of all people with arthritis were of working age (15-64 years).

Demographic ageing will increase the number and proportion of Australians with arthritis **by 35% to around 4.6 million (20% - or one in every five people) by 2020.**

- Prevalence of osteoarthritis will increase from 7.8% (1.6m) to 9.8% (2.3m).
- Prevalence of rheumatoid arthritis will increase from 2.5% (0.5m) to 3.0% (0.7m).
- This suggests a major planning impact.

Direct allocated health system costs of arthritis were $3.0 billion in 2004, **5.3% of total national health expenditure.**

- Osteoarthritis accounted for $1.4 billion (48%) and rheumatoid arthritis for $300 million (10%).
- Inpatient costs were around one third of the total, and outpatients a further 10%.
- Aged care costs and pharmaceuticals are each 14%.
- **Research spending on arthritis (1.2% of total health costs) would need to double in order to reach the national average (2.4%).**

Another $486m in arthritis health costs are unallocated but include expenditure on capital, community health, public health programs, health administration and aids and appliances.

- This brings **total health costs to $3.5 billion in 2004.**
- This represents $1,030 for every person with arthritis.
- If current trends continue, health system costs will reach $4.7 billion by 2010.

Indirect costs of arthritis, at $7.7 billion in 2004, were even more substantial.

- They are dominated by $6.8 billion in lost earnings.
- There was also an estimated $567m in deadweight losses from raising additional taxation, $225 million in costs of paid carers, $88 million in travel costs and $48m in the cost of equipment and modifications related to the illness.

Total financial costs are thus $11.2 billion - 1.4% of GDP.

- $560 per Australian and $3,300 per person with arthritis in 2004.

In addition, there is the cost of **suffering and premature death - at over $8.0 billion.**

- This net cost is calculated on the basis of disability adjusted life years (DALYs) from premature death (YLL) as well as disability from morbidity (YLD).
- The value of a statistical life year used in the estimates is $162,561.
- Osteoarthritis accounted for nearly 79% of the burden of disease, and rheumatoid arthritis 16%.

Including pain and suffering, total costs amounted to $19.25 billion in 2004.

Compared to other national health priority areas (NHPAs):

- Prevalence of arthritis is rapidly approaching that of cardiovascular disease.
- The cost to the Australian health care system of treating arthritis is greater than other NHPAs such as diabetes and asthma.
- The **disability burden of arthritis in Australia is equal to that of dementia and second only to depression.**

EXECUTIVE SUMMARY

Arthritis is not a natural part of ageing. Scientific understanding of arthritis has advanced and, with ongoing research and development, prevention may be possible in terms of delays in the onset of the disease. Such delays would produce substantial reductions in the future number of cases (prevalence) and hence in real costs of arthritis.

- If an intervention in 2005 enabled arthritis onset to be delayed by ten years, age-specific incidence rates would be reduced such that, by 2020, prevalence would be 11.1% less than otherwise forecast. There would be 517,000 fewer cases.
- There would be 503,000 fewer cases of osteoarthritis and prevalence would in fact fall overall from 7.8% in 2004 to 7.6% in 2020.
- There would be 20,000 fewer cases of rheumatoid arthritis, with its prevalence rate rising only to 2.8% rather than 2.9% by 2020.

Numerous cost-effective treatments are available for arthritis, measured in terms of cost per Quality Adjusted Life Year (QALY) gained, including surgical and pharmaceutical interventions as well as psychosocial and public health interventions such as weight loss and education programs. Harvard University's Cost-Effectiveness Analysis Registry reports that:

- Cost saving interventions can include total hip arthroplasty for people with osteoarthritis and combined step-down prednisone, methotrexate and sulphasalazine in people with early rheumatoid arthritis.
- Other interventions are very cost effective eg, endoscopic carpal tunnel release versus open carpal tunnel release in middle-aged people with carpal tunnel syndrome, at US$340/QALY.
- Other interventions are less cost-effective eg, aquatic exercise classes at least twice a week in patients with osteoarthritis aged 55-75, at US$180,000/QALY.
- World Health Organisation advice suggests that interventions are cost-effective if they cost less than three times GDP per capita (A$124,000) to avert one lost DALY and very cost-effective if they cost less than GDP per capita (A$41,000, US$30,000) per DALY gained.

Arthritis is a highly prevalent and costly disease, necessarily a national health priority area due to the extent of its prevalence and socio-economic impacts. Cost-effective interventions and continued research and development to delay the onset of osteoarthritis in particular offer potential for substantial reductions in the future projected costs and burden of disease.

1. PREVALENCE OF ARTHRITIS

Access Economics estimates that in 2004 there were 3.4 million Australians living with arthritis. This represents approximately 16.7% of the population. Overall prevalence is expected to increase further over time due to Australia's ageing population. By 2020, one in five Australians (20%) will have arthritis in some form, while one in every ten Australians will have osteoarthritis, the most common type. With osteoarthritis, four other forms of arthritis accounted for 90% of cases - rheumatoid arthritis, fibromyalgia, systemic lupus erythematosus and gout. Of over 100 known forms of arthritis, others notable in Australia include Ross River virus, juvenile arthritis, ankylosing spondylitis, spondyloarthritis, psoriatic arthritis, scleroderma, bursitis, tendonitis, carpal tunnel syndrome, polymyalgia rheumatica, dermatomyositis, and Reiters Syndrome (Access Economics, 2001).

The number of people with arthritis in Australia is estimated from the *National Health Survey* (ABS 2002). The National Health Survey (NHS) is a survey of Australian households, most recently undertaken in 2001, where respondents are interviewed about their health status[1] (see Appendix A).

- Based on NHS results, in 2001 there were 6.06 million Australians with a long-term[2] musculoskeletal disorder. This equates to 32% of the population, significantly higher than the 26.5% who reported such conditions during the last survey in 1995 (largely due to demographic ageing). Musculoskeletal disorders comprise arthritis, osteoporosis, back pain, slipped disc and numerous other disorders relating to or involving the muscles and/or bones.
- People reporting arthritis accounted for 3.02 million of these (16.0% of the population).
  - > 1.39 million (46% of those with arthritis) reported osteoarthritis and 438,000 (14.5%) reported rheumatoid arthritis.

Accounting for demographic change from 2001 to 2004 and assuming that prevalence rates remain the same for each age-gender group, Access Economics estimates that 3.37 million Australians were affected by arthritis at end-June 2004. The increasing prevalence of arthritis over time is summarised in Table 1.1 below.

- The table highlights the projected increase (26%) in the osteoarthritis prevalence rate from 7.8% in 2004 to an estimated 9.8% in 2020.
- A 26% increase in overall population prevalence suggests a significant planning impact for any disease.

[1] Past surveys were conducted in 1989–90 and 1995.

[2] A long-term condition is defined in the NHS as one that in the respondent's opinion has lasted, or is expected to last for six months or more. Osteoarthritis is assumed to always be a long-term condition.

Table 1.1: Prevalence of arthritis 1995-2004

Prevalence Rates	1995[a]	2000[b]	2001[c]	2004[d]	2020[d]
All musculoskeletal disorders	26.5%	-	32.0%	32.8%	36.2%
All arthritic conditions	14.7%	15.4%	16.0%	16.7%	20.0%
Osteoarthritis	6.4%	6.8%	7.3%	7.8%	9.8%
Rheumatoid arthritis	2.6%	2.8%	2.3%	2.5%	3.0%

Source: (a) ABS (2001), (b) Access Economics (2001), (c) ABS (2003), (d) Access Economics calculations. Note that due to survey differences these figures are indicative only and should be used with caution.

Arthritis is more prevalent in women than in men, and in older people. In 2004:

- 18.4% of women had arthritis, compared to 15.1% of men:
  - 58.5% of people with rheumatoid arthritis and 64.2% of people with osteoarthritis were women; and
  - the gender bias towards women was more pronounced in the older age cohorts as shown in Figure 1-1 below.

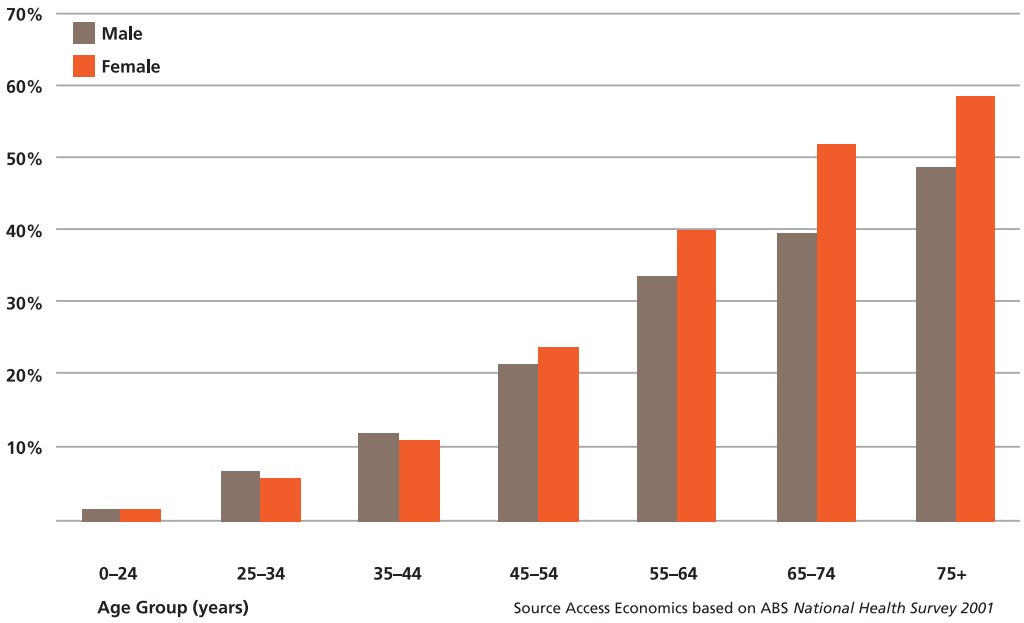


Figure 1-1: Prevalence of arthritis by age and gender, Australia, 2004

- Over 54% of Australians in the 75+ age group had arthritis. The age distribution of arthritis is shown in Figure 1-2.
- Despite the higher prevalence of arthritis in older age groups, 60% (2.03 million people) of all people with arthritis were of working age (15-64 years of age).

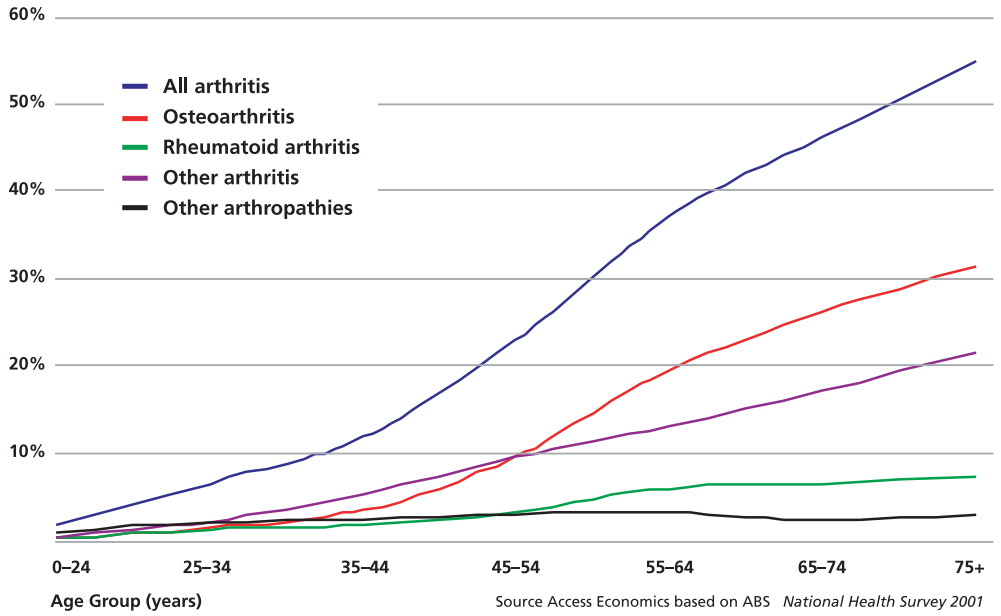


Figure 1-2: Prevalence of arthritis by age group, Australia, 2004

Figure 1-2 illustrates the prevalence of the main categories of arthritis reported by the NHS. Other arthritis includes gout, other forms of arthritis and arthritis where the respondent did not know or disclose the type of arthritis present. The final category, other arthropathies, represents joint complaints not identified by the survey respondent as arthritis, including perhaps long-term conditions relating to sports injuries. However, rheumatology experts advised that, from a clinical perspective, such conditions would be considered a form of arthritis. The slightly different nature of these conditions explains why, unlike other forms of arthritis, the prevalence of other arthropathies remains relatively constant among the age groups. Chapter 2 and Appendix A discuss reconciliation of the NHS categories with other arthritis classifications.

More detail on the estimated prevalence rates for the various forms of arthritis is set out in Table 1.2.

Table 1.2: Prevalence of arthritis, 2004, by age, gender & condition

Prevalence 2004	Male		Female		Total	
	No. (000)	%	No. (000)	%	No. (000)	%
Osteoarthritis						
0-24	5.3	0.15	5.0	0.15	10.3	0.15
25-34	15.8	1.10	22.5	1.56	38.3	1.33
35-44	38.1	2.55	61.6	4.07	99.6	3.32
45-54	101.2	7.40	161.4	11.64	262.6	9.53
55-64	159.3	14.97	251.7	24.06	411.0	19.48
65-74	124.0	18.57	233.2	33.16	357.2	26.05
75+	117.1	23.60	275.8	37.43	392.9	31.96
Total	**560.8**	**5.62**	**1,011.1**	**9.98**	**1,573.1**	**7.82**
Rheumatoid arthritis						
0-24	3.9	0.11	6.4	0.19	10.3	0.15
25-34	17.5	1.22	16.4	1.13	33.9	1.18
35-44	22.5	1.51	25.2	1.67	47.7	1.59
45-54	31.1	2.27	55.5	4.00	86.6	3.14
55-64	52.1	4.90	72.8	6.96	124.9	5.92
65-74	39.7	5.95	49.1	6.98	88.8	6.48
75+	34.0	6.85	63.1	8.56	97.1	8.18
Total	**200.8**	**2.01**	**288.5**	**2.85**	**493.0**	**2.45**
Other arthritis						
0-24	10.5	0.30	12.4	0.38	22.9	0.34
25-34	25.2	1.76	33.7	2.33	58.9	2.04
35-44	97.4	6.52	59.1	3.91	156.5	5.21
45-54	155.0	11.33	105.4	7.60	260.4	9.45
55-64	158.3	14.88	115.9	11.09	274.2	13.00
65-74	124.6	18.65	109.0	15.51	233.7	17.04
75+	125.9	25.38	131.5	17.85	257.5	20.67
Total	**696.8**	**6.98**	**567.2**	**5.60**	**1,261.4**	**6.27**
All arthritis						
0-24	59.6	1.72	54.0	1.64	113.6	1.68
25-34	100.1	6.98	86.7	5.99	186.8	6.48
35-44	184.5	12.36	167.0	11.05	351.5	11.70
45-54	294.1	21.50	335.5	24.19	629.6	22.85
55-64	361.6	33.98	419.5	40.12	781.1	37.02
65-74	265.5	39.74	366.4	52.11	631.9	46.08
75+	242.3	48.85	431.7	58.58	674.0	54.51
Total	**1,507.7**	**15.11**	**1,860.8**	**18.36**	**3,366.5**	**16.74**

Source: Access Economics based on ABS (2002) special data request

Note: Other arthritis excludes other arthropathies. All arthritis includes other arthropathies.

Numbers may not sum due to rounding.

If current trends continue, further ageing of the Australian population between 2004 and 2020 will mean that the prevalence of arthritis will increase to 20% of all Australians by 2020. Access Economics forecast of age-specific prevalence of various forms of arthritis is set out in Table 1.3. These forecast values account for projected demographic change between 2004 and 2020, but do not allow for other factors such as a new intervention that might delay or prevent arthritis.

Table 1.3: Projected prevalence of arthritis, 2020, by age, gender & condition

Prevalence 2020	Male No. (000)	Female No. (000)	Total No. (000)
Osteoarthritis			
0-24	5.2	4.8	10.0
25-34	17.2	24.1	41.3
35-44	39.5	63.0	102.5
45-54	114.6	182.4	297.0
55-64	219.6	361.7	581.4
65-74	219.2	411.3	630.5
75+	196.3	395.8	592.11
Total	**811.6**	**1,443.3**	**2,269.3**
Prevalence	7.0%	12.4%	9.8%
Rheumatoid arthritis			
0-24	3.8	6.2	10.0
25-34	19.1	17.5	36.6
35-44	23.4	25.8	49.1
45-54	35.2	62.7	97.9
55-64	71.8	104.7	176.5
65-74	70.2	86.6	156.8
75+	56.9	90.5	147.50
Total	**280.5**	**394.1**	**685.7**
Prevalence	2.4%	3.4%	3.0%
Other arthritis			
0-24	10.2	12.1	22.3
25-34	27.5	36.0	63.5
35-44	100.9	60.5	161.4
45-54	175.5	119.2	294.7
55-64	218.2	166.7	384.9
65-74	220.2	192.4	412.6
75+	211.1	188.8	399.9
Total	**963.7**	**775.6**	**1,726.6**
Prevalence	8.4%	6.6%	7.4%
All arthritis			
0-24	58.2	52.5	110.7
25-34	109.3	92.7	202.0
35-44	191.3	170.9	362.2
45-54	333.1	379.2	712.2
55-64	498.5	603.0	1,101.6
65-74	469.1	646.4	1,115.5
75+	406.3	619.6	1,025.8
Total	**2,065.7**	**2,564.3**	**4,633.0**
Prevalence	17.9%	22.0%	20.0%

Note: Other arthritis excludes other arthropathies. All arthritis includes other arthropathies.

Numbers may not sum due to rounding.

2. HEALTH COSTS OF ARTHRITIS

Health system costs related to arthritis were calculated using data specially requested from the Australian Institute of Health and Welfare (AIHW). Data on health expenditure for the 2000-2001 financial year were used as a base to project costs forward to 2004, taking into account health cost inflation and demographic changes (see Appendix A).

Under the AIHW classification system, musculoskeletal diseases are grouped into seven categories: rheumatoid arthritis, osteoarthritis, chronic back pain, slipped disc, occupational overuse syndrome, osteoporosis and other musculoskeletal disorders. This final category also includes some forms of arthritis, such as gout and systemic lupus erythematosus. Including only those costs allocated to the rheumatoid arthritis and osteoarthritis categories gives a minimum estimate for arthritis. Access Economics estimates that the cost attributable to arthritis is all (100%) of the rheumatoid arthritis and osteoarthritis categories plus 51 per cent of the other musculoskeletal disorders. This is based on the proportion of reported musculoskeletal conditions that were arthritis, from the National Health Survey 2001, and checked through triangulation against expert advice (see Appendix A).

Rheumatoid arthritis and osteoarthritis alone account for $1,723.8 million of health system costs in 2004 or 31% of health costs attributed to musculoskeletal disorders (see Figure 2-1). This forms a minimum estimate for the health costs of arthritis.

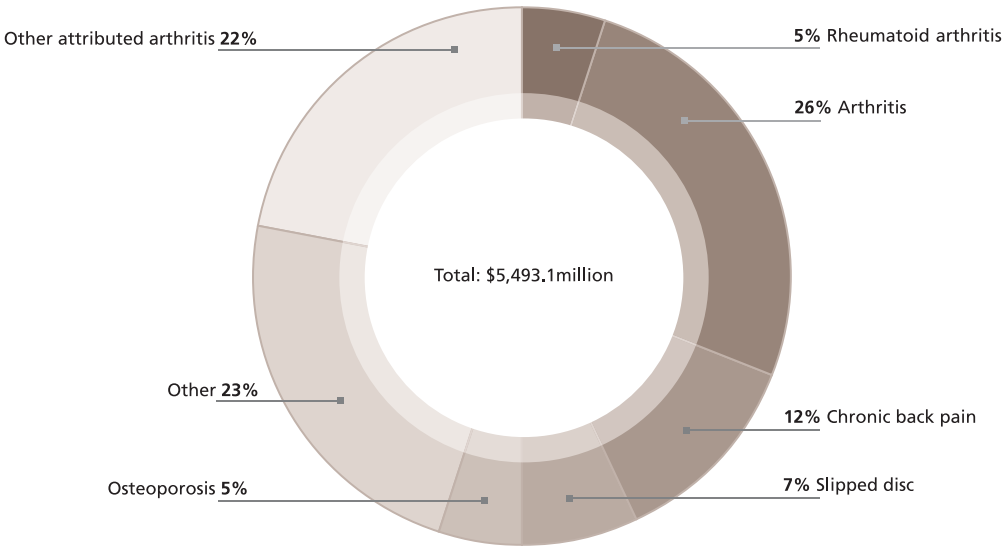


Figure 2-1: Allocated health costs of musculoskeletal conditions, 2004, $m, by condition

Adding the assumed attributable proportion of other musculoskeletal disorders, Access Economics estimates that arthritis-related health costs in 2004 represented 54% of musculoskeletal related health costs, and are in the order of $2,986.1 million, as shown in Table 2.1. On this estimate, arthritis accounts for 5.3% of the total health expenditure allocated to disease (AIHW, 2004).

Table 2.1: Allocated health costs of arthritis, 2004, $m, by type of cost

	In-patients	Out-patients	Aged Care	GPs	Spec-ialists	Imaging & Path	Pharma-ceuticals	OHPs (& dental)	Research	Total
Rheumatoid arthritis	32.5	48.5	72.0	12.8	9.0	20.6	56.1	42.0	3.5	297.1
Osteoarthritis	590.0	88.5	324.0	55.1	22.9	70.7	176.9	81.8	16.8	1,426.7
Total arthritis (minimum)	622.6	137.0	396.0	67.9	32.0	91.3	232.9	123.8	20.3	1,723.8
Other arthritis*	309.8	161.1	33.7	119.2	52.6	181.0	179.4	210.6	14.9	1,262.3
Total arthritis (AE estimate)	**932.4**	**298.1**	**429.7**	**187.1**	**84.6**	**272.3**	**412.4**	**334.4**	**35.2**	**2,986.1**

* Access Economics calculation based on NHS prevalence

Of these allocated health costs, treatment of osteoarthritis accounts for 48%, rheumatoid arthritis 10% and other attributed arthritis 42%.

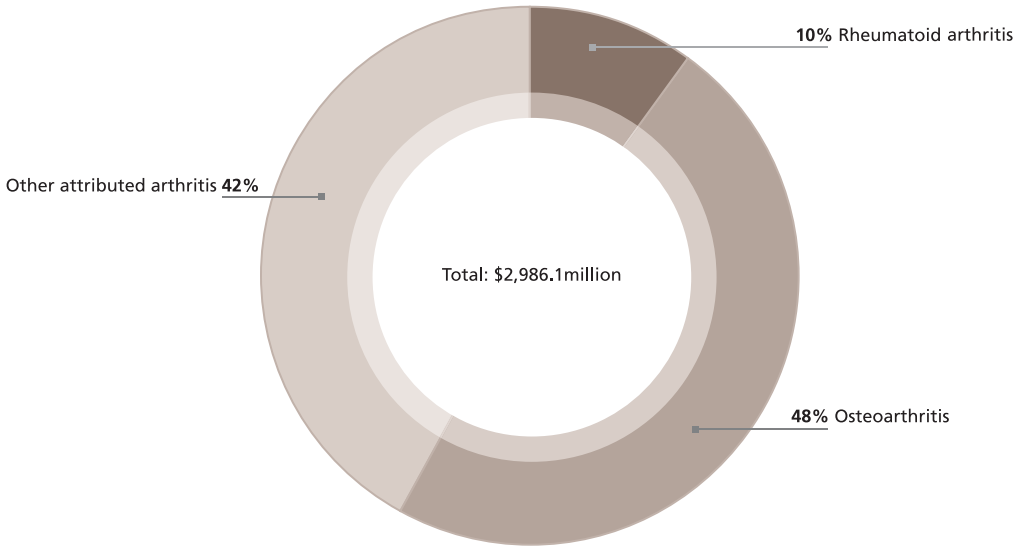


Figure 2-2: Allocated health costs of arthritis, 2004, $m, by condition

The contribution of the various health cost components to this estimate is shown in Figure 2-3 below. These shares have not changed significantly since 2000 (Access Economics, 2001).

- Inpatient hospital costs represented around one third of the total.
- Aged care costs and pharmaceutical costs were each 14%.
- Other health practitioner costs (11%), outpatient hospital costs (10%) and imaging and pathology costs (9%) were relatively substantial.
- Medical costs were relatively low (6% for GPs and 3% for specialists).
- Research remained only 1.2% of allocated health system costs.
- In contrast, across all diseases the national average spending on research is 2.4% (AIHW, 2004).

This suggests that research spending on arthritis would need to double in order to reach the national average.

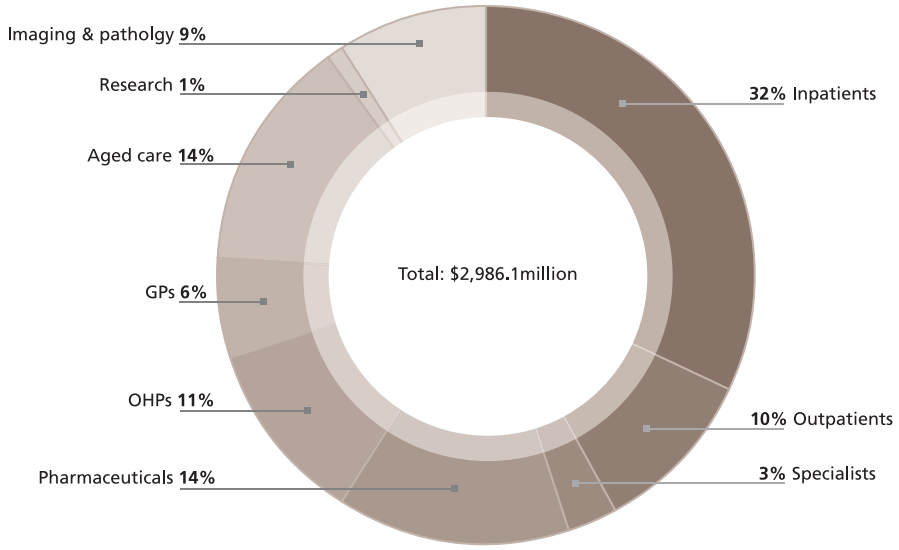


Figure 2-3: Health costs of arthritis, 2004, $m, by cost type

The distribution of costs by age and by sex is shown in Figure 2-4. The distribution of health costs mirrored the relative prevalence of arthritis between age groups and genders. Overall women received a greater share of health expenditure than men (59.9% of total allocated health costs), although more was spent on men than women under 34 years of age. This corresponds to the higher prevalence of arthritis in younger men shown previously in Table 1.2. Health care costs were also greater for older age groups, with the largest cost group being 75-84 year olds. More than 50% of total arthritis related health costs were spent on people over the age of 65.

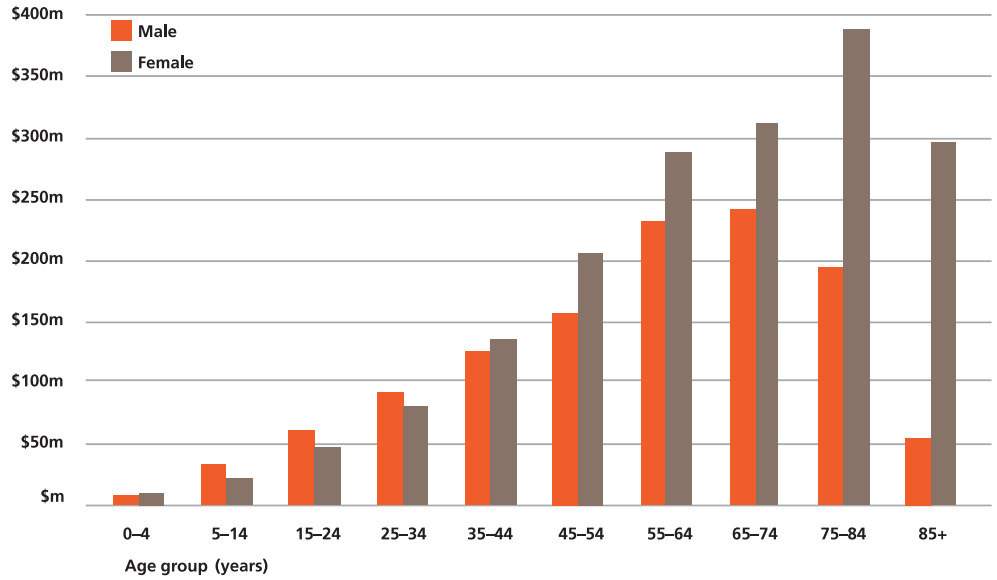


Figure 2-4: Health costs of arthritis, 2004, $m, by age & gender

In contrast to previously, the AIHW only now includes 86% of total recurrent health expenditure in their data, which we call the allocated health cost the excluded categories are capital expenditures, expenditure on community health, public health programs, health administration and health aids and appliances. We make allowance for the excluded elements by applying a loading of 100/86% to the estimates above, so that the total health system cost of arthritis in 2004 is $3.47 billion.

Table 2.2: Total health costs, 2004, $m

	Allocated costs	Unallocated costs	Total health costs
Rheumatoid arthritis	297.1	48.4	345.4
Osteoarthritis	1,426.7	232.3	1,659.0
Total arthritis (minimum)	**1,723.8**	**280.6**	**2,004.4**
Other arthritis*	1,262.3	205.5	1,467.8
Total arthritis (AE estimate)	**2,986.1**	**486.1**	**3,472.2**

Source: Access Economics based on AIHW (2004)

A rough estimate of the health cost per person with arthritis can be obtained by dividing the total health cost by the number of people with arthritis in 2004. The average health cost per person with arthritis, 2004, was $1,030.

Table 2.3: Health costs per person with arthritis, 2004, $ per annum

	Allocated costs	Total health costs
Rheumatoid arthritis	603	701
Osteoarthritis	907	1,055
Total arthritis (minimum)	**834**	**970**
Total arthritis (AE estimate)	**886**	**1,030**

Access Economics (2001) reported data from Mathers and Penn (1999) who used hospitalisation rates from the 1995 National Health Survey to estimate that the average annual health system cost per treated case of osteoarthritis or rheumatoid arthritis in 1994 was $973, or $1,242 in 2004 dollars, based on average 2.5% health inflation between 1994 and 2004 (AIHW, 2004). This is somewhat higher than the average cost per person with rheumatoid arthritis or osteoarthritis (minimum arthritis estimate) of $970 estimated using the current data. The reason for the difference is that the 2004 data captures more people with less severe disease; in particular, not all people with arthritis will seek medical assistance and most people will not need hospitalisation.

Access Economics projects that, if current trends continue, the total health system costs related to treatment of patients with arthritis will be $4.68 billion by 2010. This projection is based on expected demographic changes (from ABS 2003) and expected health inflation (AIHW, 2004). It does not make any allowance for possible changes in either the cost of treating arthritis (eg, due to new technologies) or in age-gender prevalence rates of arthritis.

Table 2.4: Forecast arthritis health costs, 2010, $m

	Allocated costs	Unallocated costs	Total health costs
Rheumatoid arthritis	408	66	475
Osteoarthritis	1,980	322	2,302
Total arthritis (minimum)	**2388**	**389**	**2,777**
Other arthritis*	1,638	267	1,905
Total arthritis (AE estimate)	**4,026**	**655**	**4,681**

Note: Numbers may not sum due to rounding.

3. INDIRECT COSTS OF ARTHRITIS

3.1 Financial costs

3.1.1 Loss of productivity

Based on data from the 2001 National Health Survey, Access Economics estimates that the employment rate for people with arthritis is 5.1% lower than the age-standardised rate for all Australians. It should be noted that, due to data limitations, we cannot categorically rule out that some portion of the lower employment rate of people with arthritis may be due to the influence of other socioeconomic factors or the impact of other comorbidities (see Appendix A).

Bearing this in mind, if people with arthritis were employed at the same rate as average Australians of the same age, then in 2004 an estimated additional 170,900 people would be employed. Assuming that on average each would receive the current average weekly wage of $751.90 (ABS 2004b) then the annual cost of lost earnings from workplace separation due to arthritis is $6.69 billion.

As well as those who do not work at all, some people with arthritis will still be employed but may reduce the number of hours worked or take a greater number of days off due to their illness. The National Health Survey also asked respondents whether they had taken days off from work either for their own illness or to care for another. In the 1995 survey, 8,201 people with arthritis reported that they had taken time off from work or school in the fortnight prior to the survey due to illness, for an average of 2.9 days. This is equivalent to 0.31% of all people with arthritis at the time. Assuming a similar proportion of arthritis sufferers were absent from work in 2004, there would have been the equivalent of 155,085 weeks of work lost through arthritis-connected absenteeism. At average weekly earnings, the lost earnings from absenteeism among people with arthritis in 2004 was $116.6 million.

3.1.2 Loss of tax revenue

Potential tax revenue foregone associated with these sources of lost production was $1,971m. There are two sources of lost tax revenue that result from the lower earnings above the potential income tax foregone and the potential indirect (consumption) tax foregone. The latter was lost because, as income falls, so does consumption of goods and services.

The lost tax revenue is summarised in Table 3.1. Of the total $1,971m in tax foregone, $1,434m (73%) relates to personal income tax and $537m (27%) to indirect taxation. Lost taxation revenue is estimated as a transfer payment, not a real economic cost.

Table 3.1: Potential earnings & tax revenue lost, Australians with arthritis, 2004

Potential earnings lost	$6,695million
Average personal income tax rate*	21.05%
Potential personal income tax lost	$1,434million
Average indirect tax rate*	15.48%
Potential indirect tax lost	$537million
Total potential tax revenue lost	**$1,971million**
Deadweight loss from additional taxation	**$567million**

*AEM Model, Access Economics Pty Limited

3.1.3 Deadweight loss

Administration of the taxation system costs around 1.25% (derived from total amounts spent and revenue raised in 2000-01, relative to the Commonwealth department running costs). However, larger deadweight losses (DWLs) from taxation also arise from the distortionary impacts that taxes have on workers' work and consumption choices. It is estimated that this amounts to 27.5% of each extra tax dollar that is required to be collected (Lattimore, 1997 and used in Productivity Commission, 2003, p6.15-6.16, with rationale). Table 3.1 thus also shows the estimated real losses arising from these sources, noting:

- conservatively, the assumption is not made that welfare payments must be funded by further taxation that imposes additional 27.5% DWLs, since deficit funding or other alternatives might also possibly be exercised (and since this argument might be used in relation to the direct health funding also);
- total real deadweight losses from taxation revenue raising was estimated as **$567m** in 2004.

3.1.4 Cost of carers, travel, aids & modifications

Walsh & Chappell (1999) conducted a survey on behalf of the Department of Family and Community Services of 409 recipients of disability support pension who had a musculoskeletal impairment. The study estimated the additional expenditure of these people on personal care, home help, and other aids and appliances. Based on these data, Access Economics estimates that, for Australian arthritis sufferers in 2004:

- the cost of paid carers was $225.2 million;
- the cost of aids and modifications was at least $47.5 million; and
- the cost of travel associated with their condition was $88.1 million.

Table 3.2: Cost of carers, aids & other financial costs, 2004

	Cost Item	2004 $ pa	Total cost $m
1	Care, inc. personal care, bathing, travel assistance	1067.8	126.0
2	Home tasks, inc. house cleaning, gardening, house maintenance	841.3	99.2
3	Travel, inc. MV modifications, taxis, community transport, personal travel expenses	747.2	88.1
4	Uncapped prescriptions	303.0	35.7
5	Housing modifications - amortised	300.0	35.4
6	Consumables, inc. dressings, ointments, batteries, incontinence sheets, pads	338.3	39.9
7	Health practitioners	347.1	40.9
8	Aids and appliances inc. wheelchairs, special clothing, communication aids	197.1	23.2
9	Furniture - amortised	103.0	12.1
	Total	**4,244.8**	**500.7**
	Sum 1, 2 (carers)	**1,909.1**	**225.5**
	Sum 5, 9 (aids & modifications) net	**600.1**	**47.5**
	Sum 5, 6, 8, 9 (aids & modifications) gross	**938.4**	**110.7**

Source: Access Economics based on Frisch (2001), Walsh & Chappell (1999)

Note: Numbers may not sum due to rounding.

The gross cost of aids and modifications, $110.7 million, includes out-of-pocket expenditure on consumables, aids and appliances. This is similar to the cost of equipment and devices previously estimated (Access Economics, 2001) based on US studies. In Table 3.2 we exclude cost items 4, 6 and 7 in the net cost of aids and modifications to avoid double counting of health costs (see Appendix A).

The cost of carers is likely to be a conservative estimate as it does not include informal care, which is provided free to patients by family members and friends. The value of this informal care is also not captured in the estimates of health costs outlined in the previous chapter. The imputed value of unpaid care for other adult family members, friends or neighbours was $19.3 billion in 2000-01, greater than the total welfare expenditure incurred by governments and non-government community service organisations combined (AIHW 2003, p76).

To date, there has not been a comprehensive study into the informal care needs of Australians with arthritis upon which a robust estimate of the cost of this informal care, including the lost income of carers (who could otherwise have been involved in paid work). This cost could potentially be quite significant. A Dutch study (Brouwer et al, 2004) of rheumatoid arthritis patients found that approximately 50% of all patients reported that they received informal care from their partner. These informal caregivers spent, on average, 27.4 hours per week providing care, comprising around 15 hours per week on household tasks such as shopping, cleaning and other household chores and 12.4 hours per week assisting the patient with the activities of daily living (ADL). Informal care was supplemented with formal assistance with household tasks in 24% of cases (average 4.5 hours a week) and for ADL in 3.9% of cases (average 2.5 hours a week). In addition, 6.1% of patients receiving informal care were on a waiting list for formal care.

Since robust data is still emerging in relation to the value of informal carers of people with arthritis in Australia, this cost element is conservatively excluded from this analysis, with only the cost of paid carers included.

3.2 Burden of disease of arthritis

The pain, suffering and premature death from arthritis can be measured using the internationally recognised Burden of Disease methodology, which estimates the years of healthy life lost due to a condition. This is measured in terms of disability-adjusted life years (DALYs). DALYs have two components:

- the years of life lost due to premature death (YLL) the mortality burden; and
- the years of healthy life lost due to disability (YLD) the morbidity burden.

More detail on the burden of disease methodology is provided in Appendix A of this report.

The calculations of the burden of disease from arthritis are based on the AIHW 1996 study of the burden of disease for a variety of disease and injury categories. Access Economics has extrapolated the AIHW estimates of the burden of disease for arthritis to 2004, based on the growth in the number of people with arthritis over this period and applying the same attribution as used to calculate the proportion of direct health costs attributable to arthritis.

Table 3.3: Burden of disease arthritis, 2004

	YLL	YLD	DALYs
Rheumatoid arthritis	2,470	11,253	13,722
Osteoarthritis	731	66,729	67,460
Minimum arthritis	3,200	77,981	81,182
Other arthritis	2,515	2,039	4,554
TOTAL ARTHRITIS	**5,715**	**80,021**	**85,736**

The mortality burden of arthritis is relatively low, but the morbidity burden related to years of pain and suffering is high (see Figure 3-1).

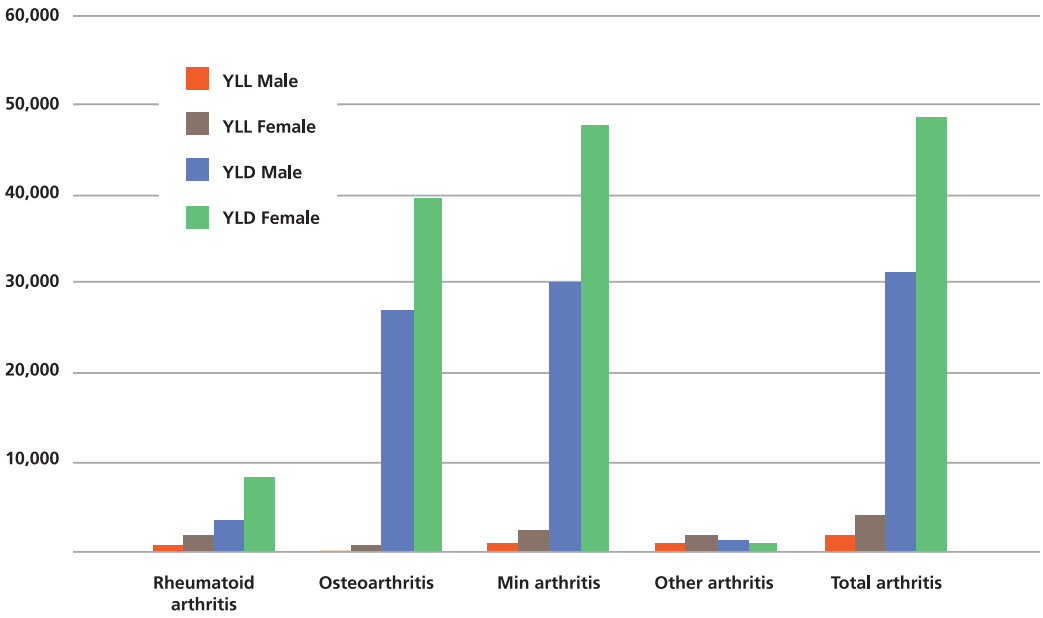


Figure 3-1: Burden of disease of arthritis, 2004, YLL & YLD, by condition & gender

As Figure 3-2 shows, the burden of disease from osteoarthritis is a large proportion (79%) of the total arthritis burden of disease. While the mortality burden (YLL) from osteoarthritis is lower than for rheumatoid arthritis or other arthritis, the morbidity burden (YLD) is much greater.

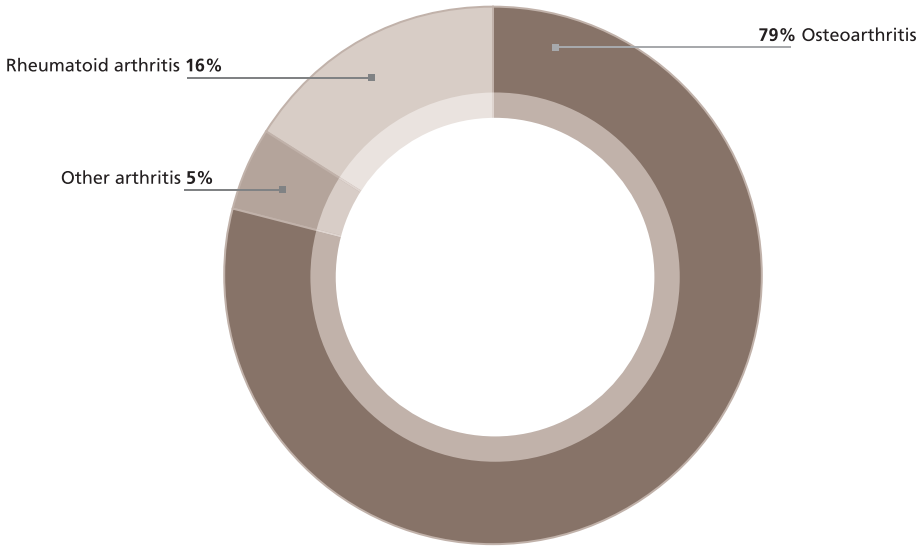


Figure 3-2: Burden of disease of arthritis, 2004, DALYs, by condition

As would be expected due to the greater prevalence of arthritis in older age groups, the burden of disease is also borne largely by people over the age of 45 (see Figure 3-3).

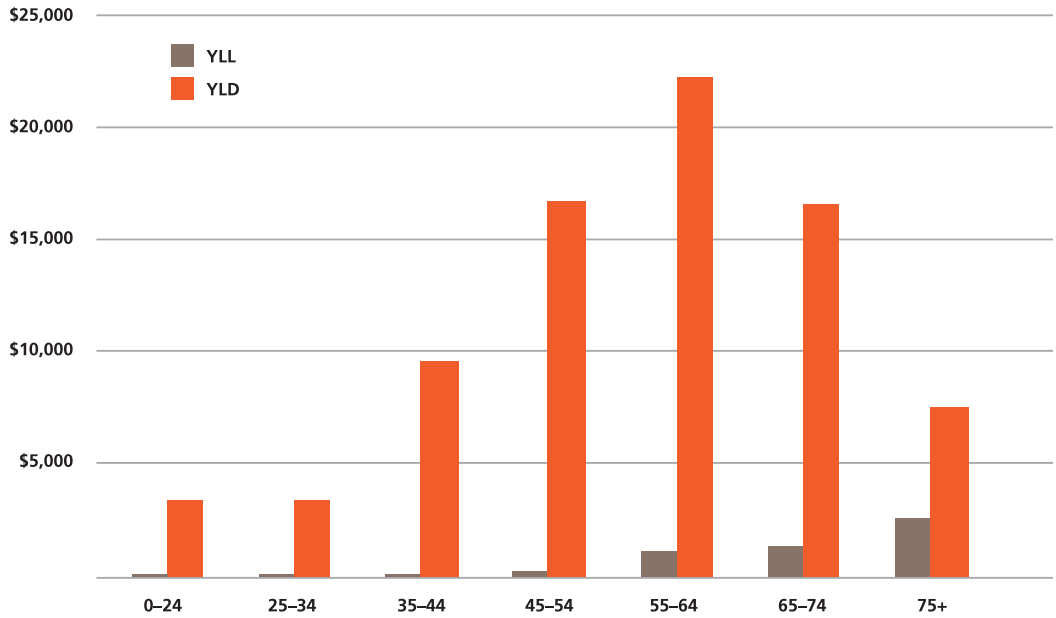


Figure 3-3: Burden of disease of arthritis, 2004, YLL & YLD by age

3.2.1 Cost of suffering and premature death from arthritis

Ascribing a value to a statistical life (VSL) allows the expression of the burden of disease in dollar terms. Access Economics assumes a VSL of $3.7 million and applies a discount rate of 3.3% over a timeframe of 40 years to derive the discounted value of a life year (VLY) of $162,561. For discussion of the rationale underpinning this approach see Appendix A.

Applying the VLY to the DALYs associated with arthritis, Access Economics estimates the gross cost of suffering and premature death associated with arthritis was $13.9 billion in 2004.

Table 3.4: Gross cost of suffering and premature death from arthritis, 2004, $m

	Male	Female	Total
Minimum arthritis			
Gross YLL cost	144	376	520
Gross YLD cost	4,943	7,734	12,677
Gross DALY Cost	**5,087**	**8,110**	**13,197**
All arthritis			
Gross YLL cost	281	648	929
Gross YLD cost	5,136	7,872	13,008
Gross DALY Cost	**5,417**	**8,520**	**13,937**

The wage-risk studies that underlie the calculation of the VSL take into account all known personal impacts - suffering and premature death, lost wages/income, out-of-pocket personal health costs and so on - implying that the value calculated is a gross figure. The net cost of pain and suffering, after lost earnings and the cost of carers and other aids are removed, is $8.1 billion, as shown in Table 3.5. Out-of-pocket personal health costs are assumed to be 20% of total health costs, based on the most recently available data (AIHW, 2003).

Table 3.5: Net cost of suffering from arthritis, $m, 2004

Gross cost of suffering	$13,937 million
less lost earnings after tax	$4,808 million
less paid carers costs	$225 million
less aid & modification costs	$48 million
less travel costs	$88 million
less health costs borne personally	$694 million
Net cost of suffering	**$8,041 million**

Note: Numbers may not sum due to rounding.

4. COMPARISONS AND OPPORTUNITIES

4.1 Summary of costs

Chapters 2 and 3 highlighted the economic impacts of arthritis in Australia. In total these impacts reached almost $19.3 billion in 2004. Table 4.1 shows the components of this cost.

Table 4.1: Summary of the costs of arthritis, $m, 2004

Cost category	$million
Health costs	
Hospitals	1,231
Aged care	430
Other health costs	1,326
Allocated health	**2,986**
Unallocated health	**486**
Sub-total health	**3,472**
Financial costs	
Lost earnings	6,812
Deadweight loss from raising additional taxation	567
Paid carers costs	225
Aids & modifications	48
Travel	88
Sub-total other financial costs	**7,739**
Total financial costs	**11,211**
Net cost of suffering	**8,041**
Total cost of arthritis	**19,252**

Note: Numbers may not sum due to rounding.

Of the $19.25 billion total cost:

- The largest component (43%) was the cost attributed to suffering and premature death, $8.0 billion.
- Second largest is the lost earnings of arthritis sufferers who were unable to work at the same rate as the general population, equal to $6.8 billion (35%).
- Health costs of $3.5 billion represented 18% of the total cost.

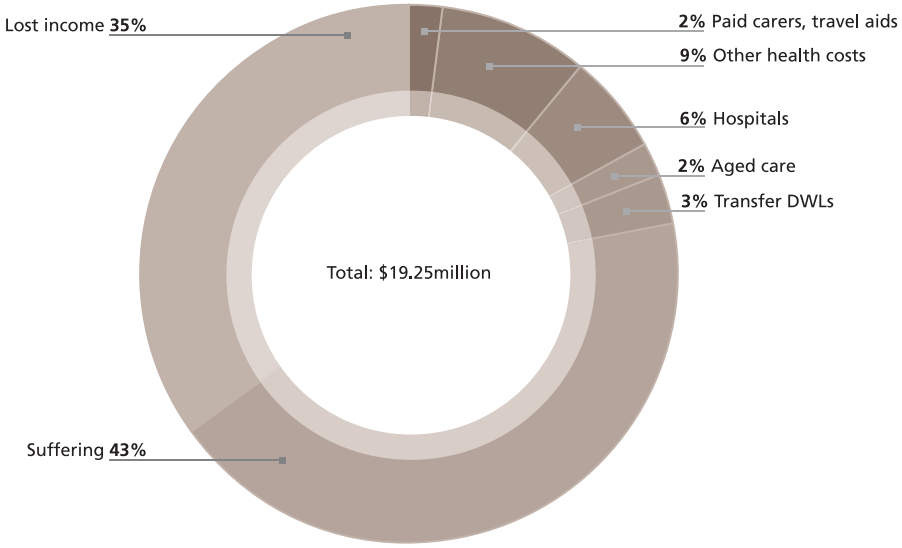


Figure 4-1: Composition of the costs of arthritis, $billion, 2004

Financial costs other than health system expenditure (sometimes called indirect costs) are more than twice health expenditure. In a previous report (Access Economics, 2001) the other financial costs of arthritis were estimated to be three times health system expenditure. The multiplier is lower in this study, partly because total health costs include some allowance for personal health costs, such as out-of-pocket expenses for aids and other health-related consumables and partly because data limitations prevented us from imputing the cost of informal care for people with arthritis.

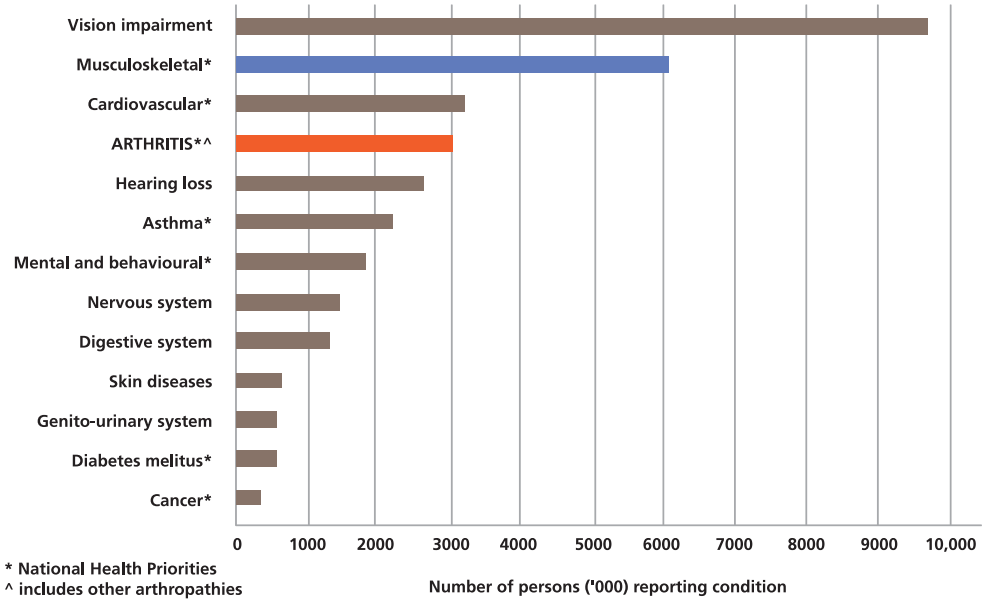
The total financial cost of arthritis, $11.2 billion, represents:

- 1.4% of Australia's 2004 Gross Domestic Product (GDP);
- $560 per Australian; and
- $3,330 per person with arthritis in 2004.

4.2 Comparison with other national health priorities

Since Access Economics previous study, arthritis and musculoskeletal conditions have been recognised as a national health priority area (NHPA). The other NHPAs are asthma, cancer, cardiovascular disease, diabetes, injury prevention and control and mental health.

Figure 4-2 compares the reported prevalence, from the 2001 NHS, of the national health priorities and other disease chapters. By 2001 arthritis was rapidly approaching the prevalence of cardiovascular disease.

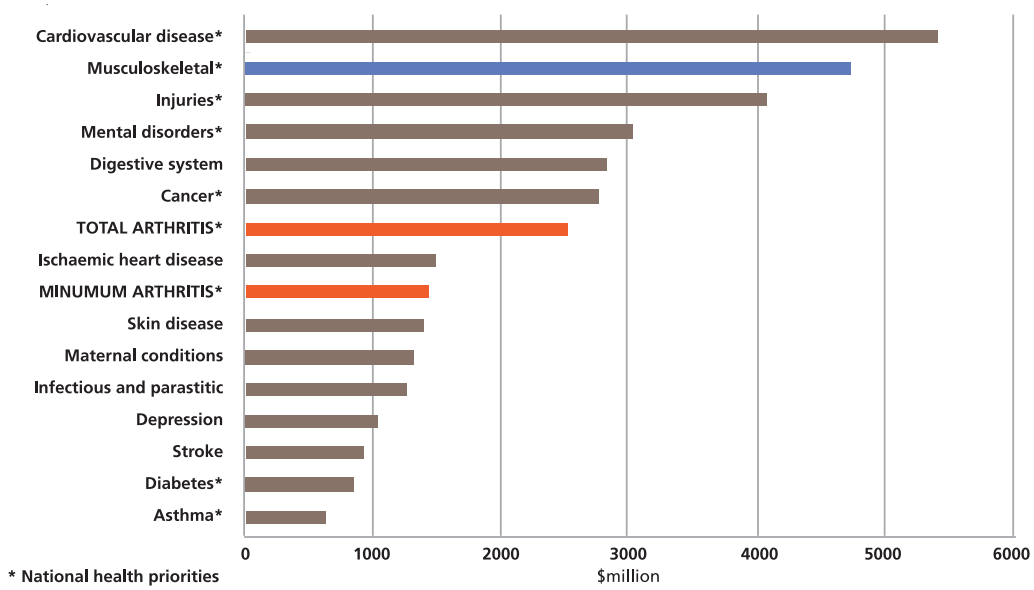


Source: ABS 2002

Note: Vision impairment includes refractive error that can be corrected with spectacles/lenses.

Figure 4-2: Comparison of reported prevalence, selected conditions

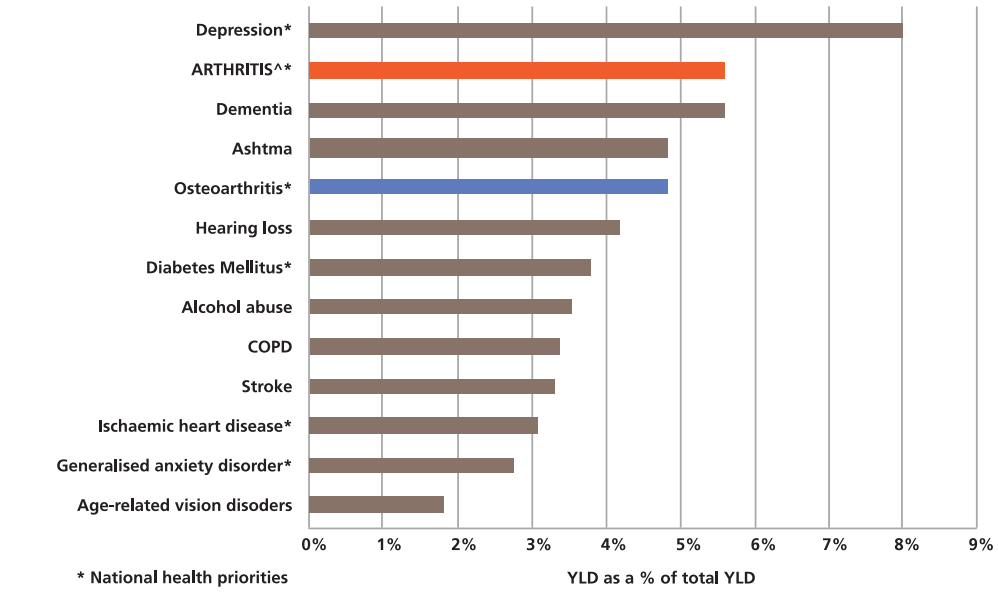
Based on 2000-01 data from AIHW (2004) regarding direct health system expenditure, musculoskeletal disease is the second most costly of the seven NHPAs, after cardiovascular disease. The cost to the Australian health care system of treating arthritis is greater than other NHPAs such as diabetes and asthma, as shown in Figure 4-3.



Source: Access Economics based on AIHW (2004)

Figure 4-3: Health cost comparison, NHPAs & other, 2000-01, $m

Arthritis is also one of the largest contributors to the disability burden in Australia, as shown in Figure 4-4 below. Including the YLDs from osteoarthritis, rheumatoid arthritis and the attributable proportion of other musculoskeletal disorders, arthritis has the same share of total YLDs as dementia, with depression being the only illness with a greater disability burden.



^ Access Economics estimate

Source: Access Economics based on Mathers et al (1999), Annex Table G, for the year 1996

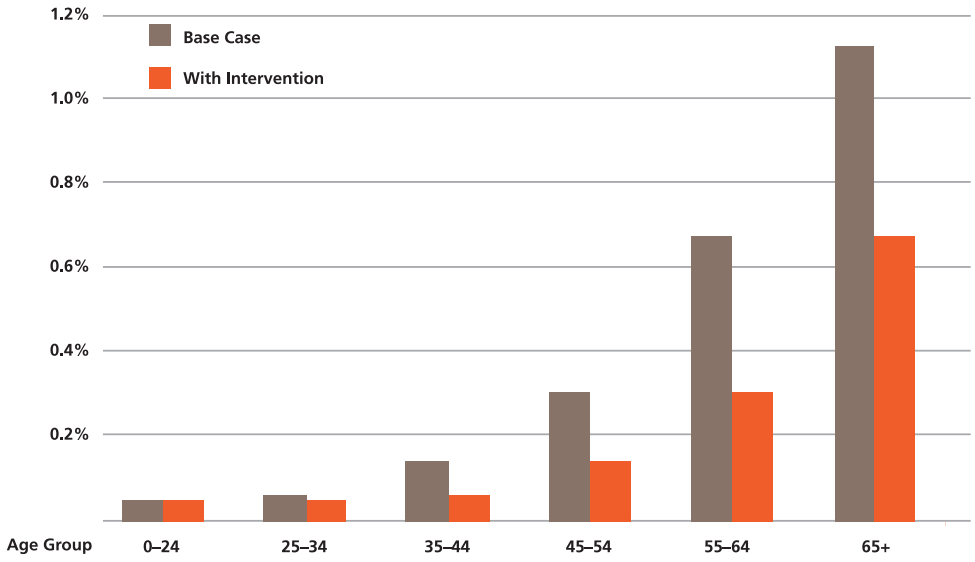
Figure 4-4: Comparison of YLD Burden - arthritis and selected others

4.3 Scenario analysis

Arthritis is not a natural part of ageing. Scientific understanding of arthritis has advanced and, with ongoing research and development, prevention may be possible in terms of delays in the onset of the disease. Such delays would produce substantial reductions in the future number of cases (prevalence) and hence in real costs of arthritis.

This section looks at how a hypothetical intervention occurring in 2005 that delayed the onset of arthritis for ten years, would affect the prevalence of arthritis between 2005 and 2020, and thus reduce the health, financial and pain and suffering costs associated with arthritis.

The number of new cases of arthritis each year is known as the incidence of arthritis. An intervention that delayed the onset of arthritis for ten years would reduce the age-specific incidence rates (ASIR) for arthritis as shown in Figure 4-5.



Source: Access Economics based on Mathers et al (1999), Annex Table D, for the year 1996

Figure 4-5: Age-specific incidence rates, 2005, scenario analysis

Delaying the onset of arthritis for ten years would significantly reduce the projected prevalence of arthritis. If current trends continue, we expect that 20% of Australians will have arthritis in 2020 (4.6 million people). A fall in the ASIR of arthritis would reduce this to 17.8%, an 11.1% reduction (see Figure 4-6) or 517,000 fewer Australians with arthritis (4.1 million overall).

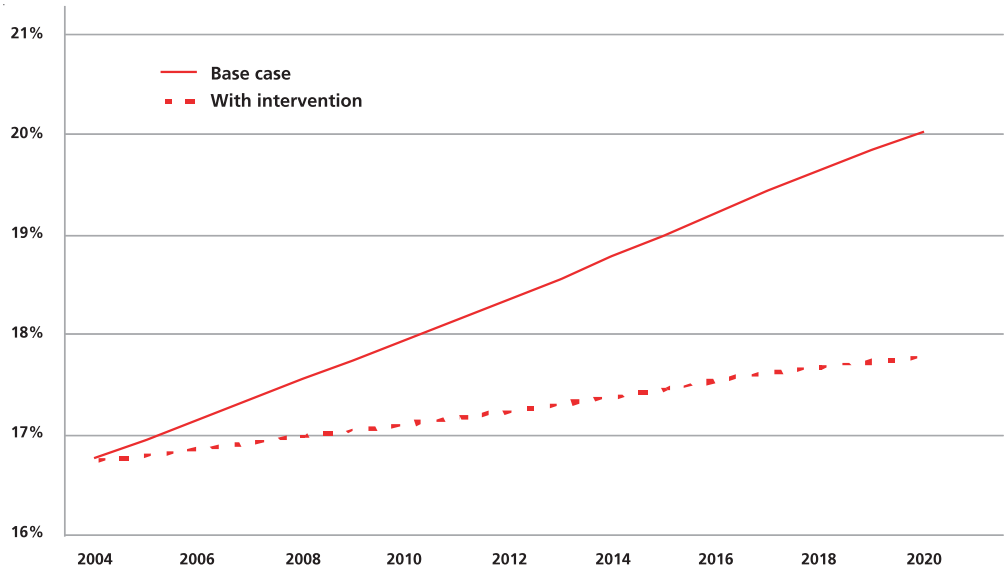


Figure 4-6: Impact of onset delay on the prevalence of total arthritis, Aust, 2004-2020

The fall in the prevalence of total arthritis is driven by falls in the most common forms of arthritis.

- The intervention would reduce the prevalence of osteoarthritis from 9.8% to 7.6% in 2020. This is a 22.2% reduction in prevalence - 503,000 fewer cases - and would mean that osteoarthritis would be less prevalent in 2020 than it was in 2004 (Figure 4-7).

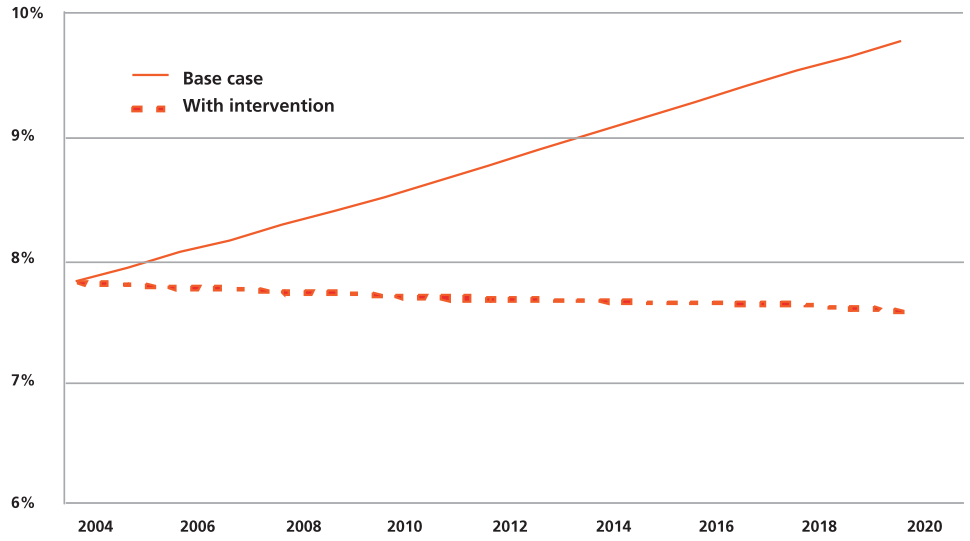


Figure 4-7: Impact of onset delay on prevalence of osteoarthritis, Aust, 2004-2020

- There would also be a 3.0% reduction in the prevalence of rheumatoid arthritis in 2020, from 2.9% to 2.8% (Figure 4-8) 20,000 fewer cases.

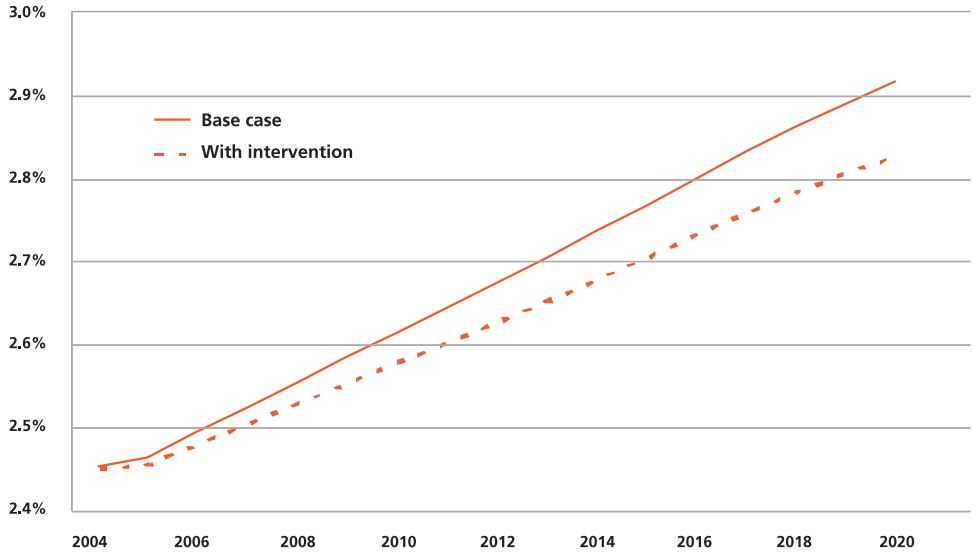


Figure 4-8: Impact of onset delay on the prevalence of rheumatoid arthritis, Aust, 2004-2020

Other forms of arthritis have varying ages of onset and duration, and so reducing the onset by ten years does not give meaningful results. However, as osteoarthritis and rheumatoid arthritis form a large proportion of all cases of arthritis, reducing the onset of these diseases also reduces the prevalence of total arthritis. The expected impacts of the intervention are set out in more detail in Table 4.2.

Table 4.2: Modelling results impacts of onset delay, by condition, 2005-2020

Prevalence	Base Case		Intervention		Change		
	% Pop'n	No. (000)	% Pop'n	No. (000)	%	% Pop'n	No. (000)
Rheumatoid arthritis							
2005	2.5	500	2.5	499	-0.2%	-0.0	-1
2010	2.6	557	2.6	550	-1.3%	-0.0	-7
2015	2.8	616	2.7	603	-2.1%	-0.1	-13
2020	2.9	677	2.8	656	-3.0%	-0.1	-20
Osteoarthritis							
2005	7.9	1,610	7.8	1,584	-1.6%	-0.1	-26
2010	8.5	1,812	7.8	1,644	-9.3%	-0.8	-168
2015	9.1	2,034	7.7	1,706	-16.1%	-1.5	-327
2020	9.8	2,261	7.6	1,758	-22.2%	-2.2	-503
All arthritis							
2005	16.9	3,442	16.8	3,415	-0.8%	-0.2	-27
2010	17.9	3,824	17.1	3,651	-4.5%	-0.8	-173
2015	19.0	4,227	17.5	3,891	-7.9%	-1.5	-335
2020	20.0	4,640	17.8	4,123	-11.1%	-2.2	-517

4.4 Cost-effectiveness of interventions

Table 4.3 below summarises the results of a number of studies into the cost-effectiveness of possible interventions for arthritis, based on Harvard University's Cost-Effectiveness Analysis Registry.3 This registry reports on the cost-effectiveness of different interventions using a standardised ratio - the cost per Quality Adjusted Life Year (QALY) gained. As discussed in Appendix A, QALYs measure both improvements in life expectancy and in quality of life. Cost saving interventions in fact reduce overall financial costs - for example, they may enhance activities of daily living to such an extent that entry to nursing home care is delayed or averted.

Table 4.3: Cost-effectiveness of selected interventions

Year of Study	Intervention	$/QALY in 2002 US$
1996	Total hip arthroplasty (THA) vs no THA in white 60 yo women with hip osteoarthritis in ACR functional Class III (significant functional limitation, but not dependent)	cost-saving
1998	Combined step-down prednisone, methotrexate, and sulphasalazine vs. sulphasalzine alone in early rheumatoid arthritis patients	cost-saving
1998	Endoscopic carpal tunnel release vs open carpal tunnel release in carpal tunnel syndrome (age group 45)	340
1997	Chiropody services vs no chiropody services in 60-75 yo clinic patients needing routine chiropody	1,700
1999	Misoprostol/diclofenac combination vs nonsteroidal anti-inflammatory drug treatment in female patients with rheumatoid arthritis and a history of gastro-intestinal bleeding	4,700
2001	Aquatic exercise class at least twice a week vs no exercise/usual care (less than 1 hour of exercise per week) in patients with osteoarthritis aged 55-75	180,000

There is a variety of opinion on where boundaries for cost-effective interventions lie. The World Health Organisation (2002) defines cost-effective and very cost-effective as:

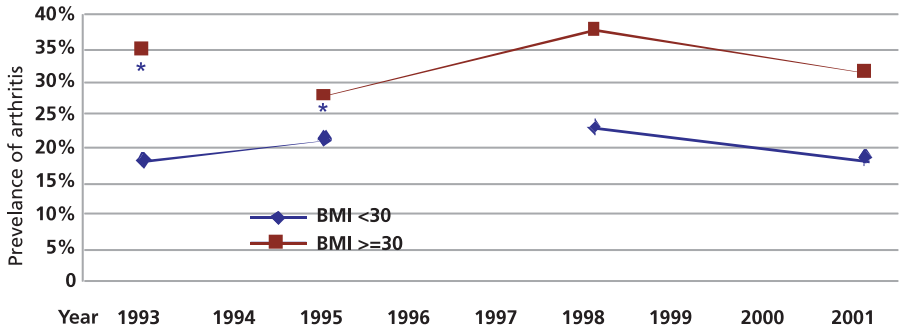
- Cost-effective: one to three times GDP per capita to avert one lost DALY; for Australia in 2004, A$41,000 (US$30,000) to A$124,000 (US$90,000).
- Very cost-effective: less that GDP per capita to avert one lost DALY; for Australia in 2004, less than A$41,000 (US$30,000).

Brown et al (2004) suggest that interventions costing less than US$50,000/QALY gained are cost-effective whereas those costing more that US$100,000/QALY gained are not cost effective.

Table 4.3 also shows that the cheapest treatments are not necessarily the most cost-effective. For example, aquatic exercise classes for people with osteoarthritis is presumably a relative low cost intervention, but it is not very cost-effective at $180,000/QALY. The most cost-effective interventions are surgical or pharmaceutical interventions.

In addition to the interventions shown in the table, there are many other interventions that have been evaluated using different types of cost benefit analysis. Some of these are outlined below.

Weight loss: Any interventions that reduce obesity are likely to be cost-effective in reducing arthritis prevalence and costs, because obesity is a risk factor for arthritis. An Oregon study found that 27% of adults with arthritis are obese whereas among adults without arthritis, only 18% are obese (Oregon Department of Human Services, 2004). The relative risk of osteoarthritis associated with obesity is in the range of 2 to 4 depending on the site of arthritis. The population-attributable risk suggests that up to 24% of knee arthritis could be attributed to obesity (Vermont Department of Health, 1999), for example. A South Australian study (Gill et al, 2003) also found significant differences between arthritis prevalence in obese and non-obese populations, utilising annual data from the Health Omnibus Study (HOS), 1991-1998, 2001 (Figure 4-9).



Source: Gill et al (2003).

Figure 4-9: Obesity and arthritis prevalence, South Australia

The US National Centre for Chronic Disease Prevention and Health Promotion (Centre for Disease Control, 2004) cites studies showing the effectiveness of weight loss and other effective psychosocial interventions in reducing arthritis symptoms.

- A randomised controlled study among women showed that the amount of weight lost was strongly correlated with improvements in signs and symptoms of knee osteoarthritis (Felson et al, 1992).
- Regular exercise reduces pain and improves physical performance among older people with disabling osteoarthritis of the knee (Ettinger et al, 1999; Minor and Allegrante, 1997).
- The Arthritis Self-Help Course (ASHC) is a 6-week course of weekly 2-hour sessions guided by two trained instructors who follow a detailed protocol for educating in relation to arthritis self-management. Developed in the early 1980s at Stanford University and sponsored by the US Arthritis Foundation, the ASHC reduces arthritis-related pain by 20%, physician visits by 40%, and overall health care costs, and is considered a highly cost-effective public health intervention (Kruger et al, 1998; Lorig et al, 1993).
- Arthritis phone service interventions consist of initial telephone contact and follow-up by trained, nonmedical personnel who provide information, referral, and problem-solving strategies. People with osteoarthritis, rheumatoid arthritis, and lupus have shown improvements in physical and psychological health and pain as a result of these interventions (Maisiak et al, 1996; Weinberger et al, 1993).

The Centre concludes that:

Early and aggressive management of inflammatory arthritis can reduce complications and delay costly procedures like joint replacements. More prevention research is needed to evaluate the effectiveness and cost-effectiveness of existing programs and community strategies, to develop new strategies to encourage people with arthritis to participate in self-management programs, and to develop new cost-effective self-management strategies. To be broadly effective, these strategies need to be adaptable to the needs of different age and racial/ethnic groups.

APPENDIX A - METHODOLOGY

Prevalence

Data on the prevalence in 2001 of various musculoskeletal conditions, including arthritis, in the Australian population was obtained by special data request from the Australian Bureau of Statistics (ABS) National Health Survey 2001 (ABS 2002). Population projections by age and gender from the ABS (2003a) were applied to the NHS data to generate age and sex specific prevalence rates for 2004.

The National Health Survey is a survey of households, which collects information on the prevalence of long-term conditions based on self-reporting from the household members interviewed.
The questions asked relevant to arthritis are set out in the box below.

National Health Survey Questions

Qn 545: Do you currently have -

- osteoarthritis?
- rheumatoid arthritis?
- gout?
- rheumatism?
- other type of arthritis?
- unknown type of arthritis?

Qn 552: Do you have any other conditions that have lasted, or are expected to last, for 6 months or more?[4]

For the 2001 NHS, long-term conditions were categorised according to the ICD-10 classification system, developed by the World Health Organisation. Based on the advice of Australian medical experts, Access Economics included all reported cases of osteoarthritis, rheumatoid arthritis, gout, other and unknown arthritis and other arthropathies to estimate the prevalence rate for arthritis. Other musculoskeletal disorders reported in the NHS such as back pain or rheumatism may in fact be undiagnosed or unreported cases of arthritis, but to maintain a conservative estimate we have not sought to attribute any share of these disorders to arthritis.

[4] At this point respondents were shown a prompt card listing the following examples; amputation or loss of limb, back - slipped disc or other disc problems, back pain or back problems, behavioural or emotional disorders, deformity or disfigurement from birth, other deformity or disfigurement, dependence on drugs or alcohol, difficulties in learning or understanding, feeling anxious or nervous, feeling depressed, gallstones, incontinence, paraplegia or paralysis, speech impediment.

The AIHW derives their expenditure estimates from an extensive top-down process developed in collaboration with the National Centre for Health Program Evaluation (NCHPE) for the Disease Costs and Impact Study (DCIS). The approach measures health services utilisation and expenditure for specific diseases and disease groups in Australia. The DCIS methodology (Mathers et al, 1998) has been gradually refined over the 1990s to now estimate a range of direct health costs from hospital morbidity data, case mix data, Bettering the Evaluation and Care of Health (BEACH) data, the National Health Survey (NHS) and other sources.

Our AIHW data request related to new DCIS data released on 12 May 2004 (AIHW, 2004) for the year 2000-01, disaggregated by age, gender and type of cost. These data use burden of disease categories based on the Tenth Revision of the International Classification of Disease (ICD-10) published by the World Health Organisation (WHO) and the International Classification of Primary Care Version 2 (ICPC2).

In this report, the 2000-01 data provided by the AIHW were used as a base for our estimates for 2004. Two factors contribute to the extrapolation:

- health cost inflation, which measured 3.2% from 2000-01 to 2001-02 and is assumed to measure 2.8% (the average rate for the 5-year period to 200102) till 2004 - 10.6% overall for the whole period - as detailed in Table A.1; and
- projected growth of the prevalence of arthritis, based on AusStats data for population growth for each age group.

Table A.1: Health cost inflation, % per annum, Australia, 1991-92 to 2001-02

Period	Health inflation	General inflation
2000-01 to 2001-02	3.2	2.5
Average annual rates of inflation		
1992-93 to 1997-98	2.5	1.5
1997-98 to 2001-02	2.8	2.3
1991-92 to 2001-02	2.5	1.8

Source: AIHW (2003).

The AIHW only includes 86% of total recurrent health expenditure, which we call the allocated health cost - the excluded categories are capital expenditures, expenditure on community health, public health programs, health administration, and health aids and appliances. We make allowance for the excluded elements by applying a loading of 100/86% to calculate the total health cost.

While both are based on the ICD-10 classification system, the AIHW burden of disease categories are slightly different to those used in the National Health Survey. While the health costs associated with rheumatoid arthritis and osteoarthritis are separately categorised, other forms of arthritis form part of the wider category other musculoskeletal disorders. While no known study has been undertaken to ascertain the proportion of arthritis-related costs in this category, we sought the expert view of a renowned Australian rheumatologist who advised that a share of 60-70% would be reasonable. In calculating the total health costs attributable to arthritis Access Economics has adopted a conservative approach relative to this advice, including 51% of the costs allocated to other musculoskeletal disorders, based on the share of arthritis as a proportion of all musculoskeletal conditions as reported in the NHS 2001.

Lost earnings and production

This focuses on the loss of production or earnings associated with illness and premature death. From the 2001 NHS (ABS 2002) data, only 39.2% of those people over the age of 15 reporting arthritis are employed, compared to 59.9% of the general population (ABS 2004a). However, arthritis is known to be more prevalent in females and in older people, both groups who tend to have lower levels of workforce participation and employment. Correcting for this effect, the age-standardised employment rate of 44.3% is still 5.1% higher than the employment rate of people with arthritis. It is assumed that, in the absence of arthritis, these people would obtain employment at the same rate as the average Australian, and earn the same average weekly earnings (ABS 2004b, June, for all employees). The implicit assumption is that there is no other factor, such as lower education levels or another comorbid condition, that is over-represented in people with arthritis, or that could cause both propensity to arthritis and propensity to lower employment. While there is no *a priori* reason to expect this and indeed the substantial prevalence of arthritis would reduce the likelihood, robust Australian econometric data based on prospective longitudinal studies do not exist to categorically rule out this possibility. Another implicit assumption is that the number of such people would not be of sufficient magnitude to substantially influence the overall clearing of the labour market.

Data on absenteeism was taken from the 1995 National Health Survey (ABS, 1997), which reported the number of people with arthritis who took time off work or study in the fortnight prior to the survey. This was updated to account for changes in population and the prevalence of arthritis among Australians aged over 15 between 1995 and 2004, and multiplied by the average number of days off to estimate a total number of days off work or study. We also assume that a similar number of people take time off every two weeks, so that the annual number of days off would be 26 times the reported fortnightly amount.

The total number of days was divided by five, the number of days in an average working week, to give the number of working weeks lost. We assume that, had people with arthritis been well enough to work, they would have received the average weekly wage (ABS 2004b, June, for all employees), and hence the total cost of absenteeism is the number of weeks of work lost multiplied by average weekly earnings.

Potential tax revenue foregone

People with arthritis who work less or retire early will not only forego income, but will also pay less personal income tax, and to the extent that their lower income leads to lower consumption of goods and services, they also pay less indirect tax. While the exact extent of the latter effect should best be calculated in the context of a general equilibrium model of the economy, we calculate this estimate on the following basis.

- The income tax foregone is a product of the average personal income tax rate (21.05%) and the foregone income (the lost earnings estimate described above).
- With arthritis and lower income, there will be less consumption of goods and services, estimated up to the level of the disability pension. Without arthritis, it is conservatively assumed that consumption would comprise 90% of income (the savings rate may well be lower than this). The indirect tax foregone is a product of the foregone consumption and the average indirect tax rate (15.48%).

Average tax rates for 2004 were derived from the AE macroeconomic model, incorporating changes from 1 July to the upper marginal tax rates. Tax revenue sacrificed is included as a transfer payment (not a real economic cost).

Cost of carers, travel, aids & modifications

The estimated cost of carers, travel, aids and modifications is based on the Walsh & Chappell (1999) survey of the expenses incurred by disability support pensioners with a musculoskeletal impairment, as reported in Frisch (2001).

On average, each person spent $936 per year on these goods and services. However there was a large variation in the amount spent in each category, so a more accurate estimate is obtained using the average cost per person per annum for each category of expenditure. Moreover, the average cost incurred by recipients of the disability support pension (DSP) may overstate the average cost across all people with arthritis as to qualify for the DSP a person must have a physical impairment of 20 points or more as determined by Centrelink, or be unable to work 30 hours or more per week due to their disability.

To estimate the arthritis related cost of carers, travel, aids and modifications Access Economics has:

- adjusted for inflation between 1999, when the survey was conducted, and 2004 to get the median per person cost of assistance in 2004 dollars (see Table A.2).
  - > an assumed inflation rate of 2.5% per annum was applied, consistent with the average annual rate of health inflation between 1991-92 and 2001-02 (AIHW, 2003, see also Table A.1)
- estimated the number of people with arthritis needing assistance based on the proportion of Australians with musculoskeletal impairment who claim the Disability Support Pension.
  - > an assumed percentage of 3.5% was used, based on information from the Department of Family and Community Services (2003) that, as at June 2003, there were just under 227,000 recipients of the DSP whose main disability was musculoskeletal impairment. This is approximately 3.5% of all Australians expected to have a musculoskeletal condition in 2003, based on the 2001 NHS prevalence rates and the demographic profile of Australia in 2003.

Table A.2 Cost of carers, aids, travel & other modifications, per person, 1999 & 2004

	Cost Item	1999 $ pa	2004 $ pa
1	Care, inc. personal care, bathing, travel assistance	943.8	1067.8
2	Home tasks, inc. house cleaning, gardening, house maintenance	743.6	841.3
3	Travel, inc. MV modifications, taxis, community transport, personal travel expenses	660.4	747.2
4	Uncapped prescriptions	267.8	303.0
5	Housing modifications amortised	265.2	300.0
6	Consumables, inc. dressings, ointments, batteries, incontinence sheets, pads	299.0	338.3
7	Health practitioners	306.8	347.1
8	Aids and appliances inc. wheelchairs, special clothing, communication aids	174.2	197.1
9	Furniture amortised	91.0	103.0
	Total	**3751.8**	**4,244.8**

Hence the annual cost for each cost item in 2004 is calculated according to the formula below:

2004 annual cost of care for people with arthritis

= assumed percentage of people with arthritis receiving DSP (3.5%)

x number of people with arthritis in 2004 (3.4 million)

x cost per person in 2004 dollars

Carers costs include both personal care and assistance with household tasks. We include both a gross and net estimate for expenditure on aids and modifications as there may be some overlap between the products and services included in the Walsh & Chappell survey, and those already counted as health costs. In particular, the net estimate includes only housing modifications and furniture, not other aids and appliances to avoid the possibility of double counting expenditure on other consumables which may have been covered in the health costs. Travel, such as to medical appointments associated with arthritis, or increased use of taxis and alternative transport due to limited mobility is also included.

SUFFERING AND PREMATURE DEATH METHODOLOGY

Valuing life and health

Since Schelling's (1968) discussion of the economics of life saving, the economic literature has properly focused on **willingness to pay** (willingness to accept) measures of mortality and morbidity risk. Using evidence of market trade-offs between risk and money, including numerous labour market and other studies (such as installing smoke detectors, wearing seatbelts or bike helmets etc), economists have developed estimates of the **value of a statistical life (VSL).**

> The willingness to pay approach estimates the value of life in terms of the amounts that individuals are prepared to pay to reduce risks to their lives. It uses stated or revealed preferences to ascertain the value people place on reducing risk to life and reflects the value of intangible elements such as quality of life, health and leisure. While it overcomes the theoretical difficulties of the human capital approach, it involves more empirical difficulties in measurement (BTE, 2000, pp20-21).

Viscusi and Aldy (2002) summarise the extensive literature in this field, most of which has used econometric analysis to value mortality risk and the hedonic wage by estimating compensating differentials for on-the-job risk exposure in labour markets, in other words, determining what dollar amount would be accepted by an individual to induce him/her to increase the possibility of death or morbidity by x%. They find the VSL ranges between US$4 million and US$9 million with a median of US$7 million (in year 2000 US dollars), similar but marginally higher than the VSL derived from US product and housing markets, and also marginally higher than non-US studies, although all in the same order of magnitude. They also review a parallel literature on the implicit value of the risk of non-fatal injuries.

> A particular life may be regarded as priceless, yet relatively low implicit values may be assigned to life because of the distinction between identified and anonymous (or statistical) lives. When a value of life estimate is derived, it is not any particular persons life that is valued, but that of an unknown or statistical individual (Bureau of Transport and Regional Economics, 2002, p19).

Weaknesses in this approach, as with human capital, are that there can be substantial variation between individuals. Extraneous influences in labour markets such as imperfect information, income/wealth or power asymmetries can cause difficulty in correctly perceiving the risk or in negotiating an acceptably higher wage.

Viscusi and Aldy (2002) include some Australian studies in their meta-analysis, notably Kniesner and Leeth (1991) of the Australian Bureau of Statistics (ABS) with VSL of US2000 $4.2 million and Miller et al (1997) of the National Occupational Health and Safety Commission (NOHSC) with quite a high VSL of US2000$11.3m-19.1 million (Viscusi and Aldy, 2002, Table 4, pp92-93). Since there are relatively few Australian studies, there is also the issue of converting foreign (US) data to Australian dollars using either exchange rates or purchasing power parity and choosing a period.

Access Economics (2003) presents outcomes of studies from Yale University (Nordhaus, 1999) - where VSL is estimated as $US2.66m; University of Chicago (Murphy and Topel, 1999) - US$5m; Cutler and Richardson (1998) - who model a common range from US$3 million to US$7m, noting a literature range of $US0.6 million to $US13.5 million per fatality prevented (1998 US dollars). These eminent researchers apply discount rates of 0% and 3% (favouring 3%) to the common range to derive an equivalent of $US75,000 to $US150,000 for a year of life gained.

DALYs and QALYs

In an attempt to overcome some of the issues in relation to placing a dollar value on a human life, in the last decade an alternative approach to valuing human life has been derived. The approach is non-financial, where pain, suffering and premature mortality are measured in terms of Disability Adjusted Life Years (DALYs), with 0 representing a year of perfect health and 1 representing death (the converse of a QALY or quality-adjusted life year where 1 represents perfect health). This approach was developed by the World Health Organisation (WHO), the World Bank and Harvard University and provides a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990, projected to 2020 (Murray and Lopez, 1996). Methods and data sources are detailed further in Murray et al (2001).

The DALY approach has been adopted and applied in Australia by the Australian Institute for Health and Welfare (AIHW) with a separate comprehensive application in Victoria. Mathers et al (1999) from the AIHW estimate the burden of disease and injury in 1996, including separate identification of premature mortality (YLL) and morbidity (YLD) components. In any year, the disability weight of a disease (for example, 0.18 for a broken wrist) reflects a relative health state. In this example, 0.18 would represent losing 18% of a year of healthy life because of the inflicted injury.

The DALY approach has been successful in avoiding the subjectivity of individual valuation and is capable of overcoming the problem of comparability between individuals and between nations, although nations have subsequently adopted variations in weighting systems. For example, in some countries DALYs are age-weighted for older people although in Australia the minority approach is adopted - valuing a DALY equally for people of all ages.

The main problem with the DALY approach is that it is not financial and is thus not directly comparable with most other cost measures. In public policy making, therefore, there is always the temptation to re-apply a financial measure conversion to ascertain the cost of an injury or fatality or the value of a preventive health intervention. Such financial conversions tend to utilise willingness to pay or risk-based labour market studies described above.

The Department of Health and Ageing (based on work by Applied Economics) adopted a very conservative approach to this issue, placing the value of a human life year at around A$60,000 per annum, which is lower than most international lower bounds on the estimate.

In order to convert DALYs into economic benefits, a dollar value per DALY is required. In this study, we follow the standard approach in the economics literature and derive the value of a healthy year from the value of life. For example, if the estimated value of life is A$2 million, the average loss of healthy life is 40 years, and the discount rate is 5 per cent per annum, the value of a healthy year would be $118,000.[5] Tolley, Kenkel and Fabian (1994) review the literature on valuing life and life years and conclude that a range of US$70,000 to US$175,000 per life year is reasonable. In a major study of the value of health of the US population, Cutler and Richardson (1997) adopt an average value of US$100,000 in 1990 dollars for a healthy year.

[5] In round numbers, $2,000,000 = $118,000/1.05 + $118,000/$(1.05)^2$ ... + $118,000/$(1.05)^{40}$ [AE comment: The actual value should be $116,556, not $118,000 even in round numbers.]

Although there is an extensive international literature on the value of life (Viscusi, 1993), there is little Australian research on this subject. As the Bureau of Transport Economics (BTE) (in BTE, 2000) notes, international research using willingness to pay values usually places the value of life at somewhere between A$1.8 and A$4.3 million. On the other hand, values of life that reflect the present value of output lost (the human capital approach) are usually under $1 million.

The BTE (2000) adopts estimates of $1 million to $1.4 million per fatality, reflecting a 7 per cent and 4 per cent discount rate respectively. The higher figure of $1.4 million is made up of loss of workforce productivity of $540,000, loss of household productivity of $500,000 and loss of quality of life of $319,000. This is an unusual approach that combines human capital and willingness to pay concepts and adds household output to workforce output.

For this study, a value of $1 million and an equivalent value of $60,000 for a healthy year are assumed.[6] In other words, the cost of a DALY is $60,000. This represents a conservative valuation of the estimated willingness to pay values for human life that are used most often in similar studies.[7] (DHA, 2003, pp11-12).

As the citation concludes, the estimate of $60,000 per DALY is very low. The Viscusi (1993) meta-analysis referred to reviewed 24 studies with values of a human life ranging between $US0.5 million and $US16m, all in pre-1993 US dollars. Even the lowest of these converted to 2003 Australian dollars at current exchange rates, exceeds the estimate adopted ($1m) by nearly 25%. The BTE study tends to disregard the literature at the higher end and also adopts a range (A$1-$1.4m) below the lower bound of the international range that it identifies (A$1.8-$4.3m).

The rationale for adopting these very low estimates is not provided explicitly. Certainly it is in the interests of fiscal restraint to present as low an estimate as possible.

In contrast, the majority of the literature as detailed above appears to support a higher estimate for VSL, as presented in Table A, which Access Economics believes is important to consider in disease costing applications and decisions. The US dollar values of the lower bound, mid-range and upper bound are shown at left. The average estimate is the average of the range excluding the high NOHSC outlier. Equal weightings are used for each study as the:

- Viscusi and Aldy meta-analysis summarises 60 recent studies;
- ABS study is Australian; and
- Yale and Harvard studies are based on the conclusions of eminent researchers in the field after conducting literature analysis.

[6] The equivalent value of $60,000 assumes, in broad terms, 40 years of lost life and a discount rate of 5 per cent. [AE comment: More accurately the figure should be $58,278]

[7] In addition to the cited references in the text, see for example Murphy and Topel's study (1999) on the economic value of medical research. [AE comment: Identical reference to our Murphy and Topel (1999).]

Where there is no low or high US dollar estimate for a study, the mid-range estimate is used to calculate the average. The mid-range estimates are converted to Australian dollars at purchasing power parity (as this is less volatile than exchange rates) of USD=0.7281AUD for 2003 as estimated by the OECD.

Access Economics concludes the VSL range in Australia lies between $3.7 million and $9.6m[8], with a mid-range estimate of $6.5m. These estimates have conservatively not been inflated to 2004 prices, given the uncertainty levels.

Table A.3 International estimates of VSL, various years

	US$m Lower	US$m Mid-range	US$m Upper	A$m 0.7281
Viscusi & Aldy meta-analysis 2002	4	7	9	9.6
Australian: ABS 1991		4.2		5.8
NOHSC 1997	11.3		19.1	
Yale (Nordhaus) 1999		2.66		3.7
Harvard (Cutler & Richardson) 1998	0.6	5	13.7	6.9
Average*	2.9	4.7	7.4	6.5

* Average of range excluding high NOHSC outlier, using mid-range if no data; conservatively not inflated.

A$m conversions are at the OECD 2003 PPP rate.

Discount rate

Choosing an appropriate discount rate for present valuations in cost analysis is a subject of some debate, and can vary depending on which future income or cost stream is being considered. There is a substantial body of literature, which often provides conflicting advice, on the appropriate mechanism by which costs should be discounted over time, properly taking into account risks, inflation, positive time preference and expected productivity gains.

The absolute minimum option that one can adopt in discounting future income and costs is to set future values in current day dollar terms on the basis of a risk free assessment about the future (that is, assume the future flows are similar to the certain flows attaching to a long term Government bond).

Wages should be assumed to grow in dollar terms according to best estimates for inflation and productivity growth. In selecting discount rates for this project, we have thus settled upon the following as the preferred approach.

- Positive time preference: We use the long term nominal bond rate of 5.8% pa (from recent history) as the parameter for this aspect of the discount rate. (If there were no positive time preference, people would be indifferent between having something now or a long way off in the future, so this applies to all flows of goods and services.)

[8] Calculated from the non-indexed studies themselves. Converting the AE average estimates from USD to AUD at PPP would provide slightly higher estimates - 3.9 million and 10.2m, with the same mid-range estimate.

- **Inflation:** The Reserve Bank has a clear mandate to pursue a monetary policy that delivers 2 to 3% inflation over the course of the economic cycle. This is a realistic longer run goal and we therefore endorse the assumption of 2.5% pa for this variable. (It is important to allow for inflation in order to derive a real (rather than nominal) rate.)
- **Productivity growth:** The Commonwealth Government's Intergenerational Report assumed productivity growth of 1.7% in the decade to 2010 and 1.75% thereafter. We suggest 1.75% for the purposes of this analysis.

There are then two different discount rates that should be applied:

- To discount income streams of future earnings, the discount rate is:
  - 5.8 - 2.5 - 1.75 = 1.55%.
- To discount other future streams (healthy life, health services, legal costs, accommodation services and so on) the discount rate is:
  - 5.8 2.5 = 3.3%

While there may be sensible debate about whether health services (or other costs with a high labour component in their costs) should also deduct productivity growth from their discount rate, we argue that these costs grow in real terms over time significantly as a result of other factors such as new technologies and improved quality, and we could reasonably expect this to continue in the future.

Scenario Analysis

The scenario analysis compares the projected prevalence of arthritis if current trends continue (the base case) to a second scenario where an intervention in 2005, such as a new technology or treatment, reduces the onset of arthritis by around ten years.

The incidence and prevalence of arthritis are related to each other based on the following formula:

$$P_t + I_{t+1} + D_{t+1} = P_{t+1}$$

P_t is the set of age-specific prevalence rates of arthritis in year t,
I_{t+1} is the set of age-specific incidence rates in year t+1,
D_{t+1} is the set of age-specific mortality rates in year t+1, and
P_{t+1} is the set of age-specific prevalence rates of arthritis in year t+1

Access Economics calculated the relationship between arthritis prevalence and incidence using:

- prevalence data based on the National Health Survey (ABS 2002); and
- incidence data based on Mathers et al (1999) burden of disease calculations, for the year 1996.

As noted previously, these two data sources group musculoskeletal disorders into slightly different categories. Osteoarthritis and rheumatoid arthritis are separately categorised in both data sets, so we assume that new cases of other forms of arthritis reported in the NHS (gout, other arthritis and other arthropathies) are equal to 51% of the incidence of other musculoskeletal disorder category reported by Mathers. Any discrepancy between the two data sources is picked up in the adjustment of expected mortality.

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To model the effect of an intervention which delays the onset of arthritis by ten years, we assume the intervention will change the incidence rate for each ten-year age cohort to that of the preceding age group prior to the shock (see Table A.).

Table A.4: Modelling parameters - ASIR for total arthritis, 2005, %

Age Group	Base case	Intervention
0-24	0.05	0.05
25-34	0.06	0.05
35-44	0.14	0.06
45-54	0.30	0.14
55-64	0.68	0.30
65+	1.13	0.68

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LIST OF ABBREVIATIONS

ABS	Australian Bureau of Statistics
ADL	activities of daily living
AE	Access Economics
AIHW	Australian Institute for Health and Welfare
ASIR	age specific incidence rate
AUD	Australian dollars
AWE	average weekly earnings
BEACH	Bettering the Evaluation and Care of Health
BT(R)E	Bureau of Transport (and Regional) Economics
CEA	cost effectiveness analysis
DALY	disability adjusted life year
DHA	Department of Health and Ageing
DCIS	Disease Costs and Impact Study
DSP	disability support pension
DWL	deadweight loss
GDP	gross domestic product
GP	general practitioner
ICD	International Classification of Disease
ICPC	International Classification of Primary Care
NHPA	national health priority area
NHS	National Health Survey
OA	osteoarthritis
OECD	Organisation for Economic Cooperation and Development
OHP	other health practitioner
PPP	purchasing power parity
QALY	quality adjusted life year
RA	rheumatoid arthritis
SLE	systemic lupus erythematosus
US	United States of America
USD	United States dollars
VLY	value of a life year
VSL	value of a statistical life
WHO	World Health Organisation
YLD	years of healthy life lost due to premature mortality
YLL	years of life lost due to premature mortality

ARTHRITIS AUSTRALIA

Arthritis Australia is the peak arthritis organisation in Australia and is supported by affiliate offices in every state and territory.

Services primarily involve:

- Lobbying all levels of government about issues affecting people with arthritis and other musculoskeletal conditions
- Conducting education and information sessions for the general public and health professionals
- Training leaders to run self-management courses
- Providing access to information to help people make informed choices about the management of their condition
- Facilitating and resourcing support networks for those living with arthritis
- Raising finds to support its medical research program

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