

Appendix C YLD worksheet example: Stroke

YLD worksheet: Stroke

REGION: Australia

Code: L3

1. Case definition and sequelae

Disease category	Sequelae	Definition
Stroke	First-ever stroke with full recovery	First-ever stroke, no long-term disability after 6 months
	Mild permanent impairments	No mobility or self-care problems, some problems usual activities, pain, anxiety/depression.
	Moderate permanent impairments	Some mobility and self-care problems, some problems usual activities, pain, anxiety/depression.
	Severe permanent impairments	Some problems walking about, severe problems self-care, usual activities, pain, anxiety/depression.

2. Disease weights

Sequelae	Weight	Comment
First-ever stroke with full recovery	0.000	
Mild permanent impairments	0.360	Dutch weight
Moderate permanent impairments	0.630	Dutch weight
Severe permanent impairments	0.920	Dutch weight

3. Incidence of first-ever stroke is derived from public and private hospital data for Australia 1996 on hospitalised cases of stroke (ICD-9 codes 430–434, 436–437 in principal diagnosis field). The admissions data excludes people who died during the hospital episode. Admission data are based on counting people rather than admission episodes – we assume readmissions of the same person with a stroke diagnosis within the year refer to the same stroke.

About one-quarter – 22% (Perth); 28% (Auckland) – of non fatal strokes are managed outside the hospital system. (Bonita et al. 1994). It is likely that more strokes in those aged 75 years and over are cared for outside hospitals (particularly in nursing homes). Assuming that an arbitrary 44% of strokes in the 75+ age group did not come to hospital, the 75+ rate has been increased by a factor of 44%. Stroke incidence in other age groups has been increased by 17% in males and 9% in females to maintain an aggregate of 22% of strokes in all ages cared for outside hospitals.

Nearly three-quarters – 69% (Perth); 73% (Auckland) – of recorded strokes are first ever strokes. (Bonita et al. 1994). Estimated first-ever non-fatal strokes in 1996 are calculated by applying the inflation factors for strokes managed outside hospitals, then taking 69% of these (proportion first-ever). Rates are shown in the fifth and sixth columns in the next table. These are first-ever strokes not resulting in death prior to or during hospitalisation.

Estimated incidence of non-fatal first-ever stroke in Australia 1996 based on admissions data

	Admissions		Admissions/100,000		Incidence stroke/100,000	
	1996-97	1996-97	1996-97	1996-97	First-ever non-fatal	
	Male	Female	Male	Female	Male	Female
0-4	32	23	5	4	4	3
5-14	28	24	2	2	2	1
15-24	74	59	5	4	4	3
25-34	155	150	11	10	9	8
35-44	336	340	24	24	19	18
45-54	971	655	83	58	67	43
55-64	2,177	1,249	281	163	227	123
65-74	4,859	2,954	792	433	639	326
75+	5,069	6,101	1,466	1,086	1,457	1,079
Total	13,701	11,555				

Of incident stroke cases, 4.24% die within 28 days (Anderson et al. 1994, Bonita et al. 1994). Higher case fatality rates were reported at 29% in cases >75years compared to 18% in cases <75 years. (Bonita et al. 1994). Stroke mortality rates during the 1990s in Australia have been declining at around 5% per annum below age 75 and around 2-3% per annum for ages 75 and over (Mathur & Gajanayake 1998). It is estimated that around 50% of this decline is attributable to declining incidence and around 50% to decreasing case fatality. Assuming fatality rates in Australia in 1990 were similar to those in Perth, we reduce the Perth case fatality rates to reflect half the declines in Australian stroke mortality between 1990 and 1996. Case fatality rates were reported at 22% in males and 26% females. (Bonita et al. 1994).

The relative gender differences have been retained in both age groups:

Case fatality rates	Under 75	Over 75	Total
Perth 1989-90	18%	29%	24%
% decline between 1990 and 1996	14%	9%	
Extrapolated 1996	15%	27%	

Perth 1989-90	All ages	Extrapolated 1996	Under 75	Over 75
Male	22%	Male	14%	24%
Female	26%	Female	17%	29%
Total	24%	Total	15%	27%

5. The hospital inpatient figures exclude those dying during admission. The Perth figures relate to all strokes. Assuming that most deaths in the first 28 days occur while hospitalised, the number of deaths in the first 28 days can be extrapolated from the recorded survivors of first stroke, for instance, in the <75 age group, where the case fatality rate = 15%, we equate hospital episodes to 85% of incident strokes. Thus the adjusted number of early deaths = 100/85*15% of recorded survivors of first strokes. The proportional factors for each age and sex group have been determined as follows:

Proportional factor	Under 75	Over 75
Male	17%	32%
Female	20%	40%

Method 1: Total incidence/100,000 of first-ever stroke 1996

Age group	Factor	Males	Factor	Females
0-4	17%	5	20%	3
5-14	17%	2	20%	2
15-24	17%	5	20%	4
25-34	17%	10	20%	9
35-44	17%	23	20%	22
45-54	17%	78	20%	52
55-64	17%	265	20%	148
65-74	17%	745	20%	392
75+	32%	1,924	40%	1,513
Total		162		146

6. As a check on these estimates, a second approach has also been used. This starts with estimates of incidence from the only comprehensive population-based Australian study of stroke incidence (Anderson et al 1993) for a part of North and East Perth in 1989-90. A recent paper (Simons et al. 1998) gives estimates of stroke incidence in the Dubbo population. However, the initial study population excluded institutionalised older people, so the rates are not representative of the entire population. Incidence rates in the Table below are for the Perth study population. These have been adjusted downwards by half the average annual decline in mortality rates to estimate incidence rates for 1996.

Annual incidence first-ever stroke, Perth WA, 1989-90 (Anderson et al. 1993)

	Incidence/100,000		Annual decline		Total decline 1990-1996		Incidence/100,000	
	Male	Female	Male	Female	Male	Female	Male	Female
0-14	0	6	-0.075	-0.041	0.20	0.12	0	5
15-24	11	10	-0.075	-0.041	0.20	0.12	9	9
25-34	5	17	-0.044	-0.069	0.12	0.19	4	14
35-44	45	22	-0.032	-0.060	0.09	0.17	41	18
45-54	110	77	-0.057	-0.056	0.16	0.16	92	65
55-64	351	98	-0.055	-0.070	0.15	0.19	297	79
65-74	807	447	-0.050	-0.055	0.14	0.15	693	378
75-84	1,905	1,244	-0.027	-0.034	0.08	0.10	1,756	1,122
85+	3,010	2,161	-0.017	-0.023	0.05	0.07	2,860	2,016

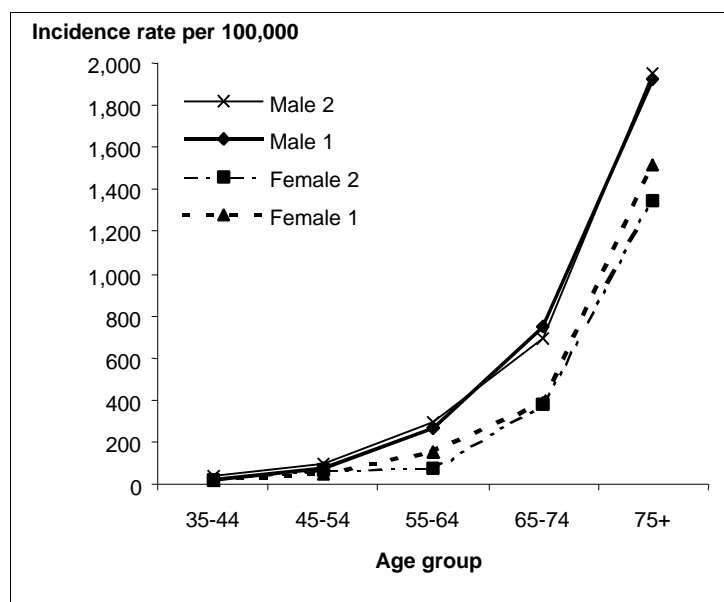
The following table and figure compare the incidence estimates based on hospital data for 1996 with the estimates based directly on the Perth incidence data.

Annual incidence rate, first ever stroke Australia, 1996

Age Group	Method 1		Method 2	
	Male	Female	Male	Female
0-4	5	3	0	5
5-14	2	2	0	5
15-24	5	4	9	9
25-34	10	9	4	14
35-44	23	22	41	18
45-54	78	52	92	65
55-64	265	148	297	79
65-74	745	392	693	378
75+	1,924	1,513	1,948	1,348

7. The graph below compares incidence rates for first-ever stroke calculated from the 1996 hospitalisation data (series 1) with the incidence rates calculated by direct extrapolation of those observed in Perth in 1990 (series 2). The two sets of rates are almost identical for males (the inflation factor of 44% at step 3 above was chosen to give a good match for all ages). Use of the same factor for females gives a slightly higher incidence rate in age group 75+ based on the hospitalisation data (but it was decided to keep the same factor for both sexes).

The resulting incidence rates for stroke 28-day survivors is shown on the right-hand side:



Age group	Incidence survivors/100,000	
	Final estimate	
	Male	Female
0-4	4	3
5-14	2	1
15-24	4	3
25-34	9	8
35-44	19	18
45-54	67	43
55-64	227	123
65-74	639	326
75+	1,457	1,079

8. For modelling of stroke survivors past the first 28 days we need to know the number of deaths. As only 58% of deaths in stroke cases are attributed to stroke (Anderson et al. 1994), we have multiplied recorded stroke deaths by 100/58. Next we deducted the modelled 28-day deaths (Note 5) from the extrapolated ABS deaths to obtain number of deaths in the stroke survivors. DISMOD was then used to model duration of survival for stroke survivors who did not die in the first 28 days (from estimated incidence rate and death rate). DISMOD only models up to age 90 and therefore we have included only deaths between 75 and 89 in the 75+ age group.

	Recorded deaths stroke		Total deaths—in people with stroke		Deaths from stroke in 28 days		Deaths in 28-day survivors		Probability of dying—general population		Expected deaths stroke survivors ^(a)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
0-4	1	0	2	0	4	3	0	0	0.0013	0.0010	0	0
5-14	2	3	3	5	4	4	0	2	0.0002	0.0001	0	0
15-24	8	5	14	9	10	9	4	0	0.0009	0.0003	0	0
25-34	20	14	34	25	21	23	13	2	0.0011	0.0004	0	0
35-44	64	42	110	73	45	52	65	21	0.0016	0.0008	0	0
45-54	158	119	272	206	130	99	142	106	0.0030	0.0020	2	1
55-64	323	215	557	371	291	189	266	182	0.0097	0.0054	17	5
65-74	1,113	863	1,919	1,487	649	448	1,270	1,039	0.0280	0.0148	110	33
75-89	3,022	4,627	5,210	7,978	1,616	2,442	3,594	5,536	0.0940	0.0729	474	442
Total	5,216	7,623	8,993	13,144	2,770	3,269	5,354	6,888			603	481

(a) Excluding stroke attributable deaths

DISMOD estimates of prevalence and duration for 28-day stroke survivors

Age group	Incidence/100,000		Stroke attributable deaths/100,000		Prevalence/100,000		Duration (years)		Prevalent cases	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
0–4	4	3	0.0	0.0	10	7	53.2	60.8	67	44
5–14	2	1	0.0	0.1	30	20	46.1	53.8	402	255
15–24	4	3	0.3	0.0	58	40	37.5	43.9	791	525
25–34	9	8	0.9	0.1	117	94	30.3	34.4	1,674	1,345
35–44	19	18	4.6	1.5	231	216	24.4	25.9	3,240	3,042
45–54	67	43	11.9	9.3	587	472	19.3	19.0	6,878	5,367
55–64	227	123	32.1	23.1	1,831	1,156	13.5	12.7	14,166	8,834
65–74	639	326	189.0	147.6	5,079	2,625	8.3	6.8	31,162	17,896
75+	1,457	1,100	902.5	906.4	11,128	4,712	4.4	3.2	38,475	26,481
Total									96,856	63,790

These durations are reasonably consistent with observed 1-year case fatality rates—38% for Perth in 1990 (Anderson et al. 1993). As 23% died within one month, the average case fatality rate for the next 11 months was 16%. Assuming that the instantaneous case fatality rates decline further in following years, this average is reasonably consistent with the average case fatality rates derived using DISMOD (around 10% for 65–74 years and 20% for 75 years and over).

9. The 1995 ABS National Health Survey provides self-report data on the prevalence (chronic or recent) of stroke including stroke after-effects (condition code 119). The reported prevalence per 1,000 is shown at the top of the next page (left). There were 110,507 persons with prevalent stroke or stroke-after effects in 1995 according to this survey. The prevalence of 28-day stroke survivors estimated at Step 8 corresponds to a total of 121,000 persons in 1996, quite consistent with the self-report data.

The 1993 Disability Survey gives an estimate of 39,200 people where stroke was the main cause of their disability (see table at the top of the next page to right). This is reasonably consistent with the NHS estimate, since many old people with mild disability resulting from stroke and with comorbidities will not report stroke as their main cause of disability. Of these, 21,000 have profound handicap (always requiring assistance for mobility, self-care or communication tasks), and 9,300 have severe or moderate handicap (sometimes requiring assistance or problems with self-care but not requiring assistance). There are three disease weights corresponding to different levels of permanent impairment (mild, moderate, severe) developed in the Netherlands study (Stouthard et al. 1997). Assuming that profound handicap corresponds to severe permanent impairments, and severe or moderate handicap corresponds to moderate permanent impairments, mild impairment prevalence can be calculated by subtracting the severe and moderate estimates from the total prevalence of survivors with permanent impairments.

Men are more likely to make a complete recovery from stroke (50%) than women (37%) (Bonita et al. Stroke 1997). Among stroke survivors, more women are dependent (27%) than men (16%) on others for self-care. We assumed that half the male incident cases and 37% of women experience mild disability for 6 months and the other half experience permanent impairments. The prevalence of survivors with permanent impairments was calculated from the total DISMOD prevalence of survivors by multiplying it by 50% for men and 63% for women.

An average disability weight for the permanently impaired survivors is calculated as the prevalence-weighted sum of the three disability weights for mild, moderate and severe impairments.

1995 National Health Survey

	Prevalence per 1,000	
	Male	Female
0-4	0	0
5-14	0	0
15-24	0	0
25-34	0	0
35-44	0	0
45-54	1	2
55-64	17	7
65-74	35	12
75+	52	50
Total	4.5	4.6

1993 Disability Survey: prevalence per 1,000

	Profound h'cap		Sev/mod h'cap		Total disabled	
	Male	Female	Male	Female	Male	Female
0-54	0.0	0.0	0.0	0.1	0.2	0.2
55-64	1.4	1.2	2.0	0.0	3.7	1.2
65-74	2.8	5.2	5.8	1.5	13.4	8.8
75+	15.1	18.9	3.6	3.7	22.5	23.9
Total	0.9	1.6	0.7	0.4	2.1	2.3

Age group	DISMOD estimates of total stroke survivor prevalence per 1,000		Mild balance (DISMOD prev- prof/sev/mod)		Average disability weights	
	Male	Female	Male	Female	Male	Female
0-4	0.1	0.1	0.0	0.0	0.360	0.360
5-14	0.3	0.2	0.1	0.0	0.360	0.360
15-24	0.5	0.3	0.2	0.1	0.360	0.360
25-34	1.0	0.8	0.5	0.4	0.360	0.360
35-44	1.9	1.8	0.9	1.0	0.360	0.360
45-54	4.9	3.7	2.4	2.2	0.366	0.373
55-64	15.4	9.1	7.7	5.6	0.481	0.455
65-74	41.7	17.1	20.8	10.7	0.467	0.551
75+	53.6	48.1	26.8	30.2	0.567	0.579
Total number	67,021	54,243				

10. YLD for those who die within 28 days

Use average length of stay for those who die in hospital as estimate of duration. Use disability weight for severe permanent impairments.

	Population ('00,000)	Incidence	Incidence per 100,000	Age at onset	Duration	Disability weight	YLDs	YLD per 100,000	Undiscounted YLDs (r=0)
Males									
0-4	6.66	28	4	2.5	0.00	0.920	0.0	0.0	0.0
5-14	13.39	50	4	10.0	0.00	0.920	0.0	0.0	0.0
15-24	13.64	135	10	20.0	0.00	0.920	0.4	0.0	0.4
25-34	14.31	296	21	30.0	0.01	0.920	1.5	0.1	1.5
35-44	14.03	630	45	40.0	0.01	0.920	5.3	0.4	5.3
45-54	11.72	1,520	130	50.0	0.01	0.920	14.8	1.3	14.8
55-64	7.74	2,251	291	59.9	0.02	0.920	31.6	4.1	31.7
65-74	6.14	3,984	649	69.8	0.02	0.920	62.4	10.2	62.5
75+	3.46	5,588	1616	80.7	0.02	0.920	110.1	31.8	110.2
All ages	91.08	14,483	159	67.5	0.02	0.920	226.3	2.5	226.3

10. YLD for those who die within 28 days (continued)

	Population (‘00,000)	Incidence Incidence	Incidence per 100,000	Age at onset	Duration	Disability weight	YLDs	YLD per 100,000	Undiscounted YLDs (r=0)
Females									
0–4	6.31	22	3	2.5	0.00	0.920	0.0	0.0	0.0
5–14	12.75	46	4	10.0	0.00	0.920	0.1	0.0	0.1
15–24	13.12	117	9	20.0	0.00	0.920	0.0	0.0	0.0
25–34	14.31	326	23	30.0	0.00	0.920	0.8	0.1	0.8
35–44	14.08	726	52	40.0	0.01	0.920	5.2	0.4	5.2
45–54	11.37	1,130	99	50.0	0.01	0.920	14.4	1.3	14.4
55–64	7.64	1,448	189	60.0	0.02	0.920	20.7	2.7	20.7
65–74	6.82	3,055	448	69.9	0.01	0.920	40.7	6.0	40.7
75+	5.62	13,722	2442	81.3	0.02	0.920	234.1	41.7	234.1
All ages	92.03	20,592	224	73.5	0.02	0.920	316.1	3.4	316.2

11. YLD for survivors who recover completely

Men are more likely to make a complete recovery from stroke (50%) than women(37%). (Bonita in Stroke 1997). Among stroke survivors, more women are dependent (27%) than men (16%), on others for self care. We assumed that half the male incident cases and 37% of women, experience mild disability for 6 months.

	Population (‘00,000)	Incidence Incidence	Incidence per 100,000	Age at onset	Duration	Disability weight	YLDs	YLD per 100,000	Undiscounted YLDs (r=0)
Males									
0–4	6.66	13	2	2.5	0.50	0.360	2.3	0.3	2.3
5–14	13.39	11	1	10.0	0.50	0.360	2.0	0.2	2.0
15–24	13.64	30	2	20.0	0.50	0.360	5.3	0.4	5.4
25–34	14.31	63	4	30.0	0.50	0.360	11.2	0.8	11.3
35–44	14.03	136	10	40.0	0.50	0.360	24.2	1.7	24.4
45–54	11.72	392	33	50.0	0.50	0.360	70.0	6.0	70.5
55–64	7.74	879	114	59.9	0.50	0.360	157.0	20.3	158.2
65–74	6.14	1,961	320	69.8	0.50	0.360	350.4	57.1	353.0
75+	3.46	2,518	728	80.7	0.50	0.360	449.9	130.1	453.3
All ages	91.08	6,003	66	70.0	0.5	0.360	1072	11.8	1,080.5
Females									
0–4	6.31	9	1	2.5	0.50	0.360	1.5	0.2	1.6
5–14	12.75	9	1	10.0	0.50	0.360	1.6	0.1	1.6
15–24	13.12	22	2	20.0	0.50	0.360	4.0	0.3	4.0
25–34	14.31	56	4	30.0	0.50	0.360	10.1	0.7	10.2
35–44	14.08	128	9	40.0	0.50	0.360	22.8	1.6	23.0
45–54	11.37	246	22	50.0	0.50	0.360	44.0	3.9	44.3
55–64	7.64	470	61	60.0	0.50	0.360	83.9	11.0	84.5
65–74	6.82	1,111	163	69.9	0.50	0.360	198.5	29.1	200.0
75+	5.62	3,031	539	81.3	0.50	0.360	541.5	96.4	545.6
All ages	92.03	5,082	55	73.2	0.5	0.360	907.9	9.9	914.8

12. YLD for those who survive 28 days and have permanent disability

Use duration modelled with DISMOD at step 8 above (assuming average duration same for those who remit and those who have permanent disability).

	Population (‘00,000)	Incidence	Incidence per 100,000	Age at onset	Duration	Disability weight	YLDs	YLD per 100,000	Undiscounted YLDs (r=0)
Males									
0–4	6.66	13	2	2.5	53.2	0.360	123	18.6	247
5–14	13.39	11	1	10.0	46.1	0.360	101	7.6	188
15–24	13.64	30	2	20.0	37.5	0.360	242	17.7	403
25–34	14.31	63	4	30.0	30.3	0.360	448	31.3	682
35–44	14.03	136	10	40.0	24.4	0.360	844	60.2	1,191
45–54	11.72	392	33	50.0	19.3	0.366	2,104	179.6	2,772
55–64	7.74	879	114	59.9	13.5	0.481	4,689	606.1	5,703
65–74	6.14	1,961	320	69.8	8.3	0.467	6,726	1,096.2	7,598
75+	3.46	2,518	728	80.7	4.4	0.567	5,888	1,703.1	6,286
All ages	91.08	6,003	66	70.0	9.0	0.500	21,169	232.4	25,071
Females									
0–4	6.31	9	1	2.5	60.8	0.360	87	13.8	189
5–14	12.75	9	1	10.0	53.8	0.360	86	6.8	175
15–24	13.12	22	2	20.0	43.9	0.360	194	14.9	351
25–34	14.31	56	4	30.0	34.4	0.360	435	30.4	699
35–44	14.08	128	9	40.0	25.9	0.360	829	58.9	1,192
45–54	11.37	246	22	50.0	19.0	0.373	1,329	116.9	1,743
55–64	7.64	470	61	60.0	12.7	0.455	2,257	295.3	2,714
65–74	6.82	1,111	163	69.9	6.8	0.551	3,788	555.7	4,190
75+	5.62	3,031	539	81.3	3.2	0.579	5,357	953.2	5,618
All ages	92.03	5,082	55	73.2	6.9	0.540	14,364	156.1	16,871

14. Total YLD for Stroke

	Population (‘00,000)	Incidence	Incidence per 100,000	Age at onset	Duration	Disability weight	YLDs	YLD per 100,000	Undiscounted YLDs (r=0)
Males									
0–4	6.66	54	8	2.5	—	0.171	126	0.3	250
5–14	13.39	73	5	10.0	—	0.112	104	0.2	190
15–24	13.64	195	14	20.0	—	0.110	248	0.6	409
25–34	14.31	422	29	30.0	—	0.107	461	0.8	695
35–44	14.03	901	64	40.0	—	0.108	874	63.6	1,221
45–54	11.72	2,304	197	50.0	—	0.124	2,189	207.8	2,858
55–64	7.74	4,008	518	59.9	—	0.184	4,878	689.8	5,893
65–74	6.14	7,906	1,289	69.8	—	0.205	7,139	1328.8	8,014
75+	3.46	10,625	3,073	80.7	—	0.220	6,449	2100.9	6,849
All ages	91.08	26,488	291	68.6	—	0.190	22,467	271.3	26,378

	Population (‘00,000)	Incidence per 100,000	Age at onset	Duration	Disability weight	YLDs	YLD per 100,000	Undiscounted YLDs (r=0)	
Females									
0–4	6.31	39	6	2.5	—	0.158	89	0.0	191
5–14	12.75	64	5	10.0	—	0.101	88	0.1	177
15–24	13.12	162	12	20.0	—	0.099	199	0.2	355
25–34	14.31	438	31	30.0	—	0.093	447	43.8	710
35–44	14.08	982	70	40.0	—	0.094	857	90.9	1,220
45–54	11.37	1,622	143	50.0	—	0.111	1,387	180.4	1,802
55–64	7.64	2,387	312	60.0	—	0.160	2,362	430.5	2,819
65–74	6.82	5,277	774	69.9	—	0.192	4,027	970.1	4,431
75+	5.62	19,784	3,520	81.3	—	0.144	6,132	2,120.0	6,398
All ages	92.03	30,756	334	73.4	—	0.150	15588	288.9	18,102

Comparison with the Global Burden of Disease estimates for EME: stroke

	Incidence per 100,000		Average duration	
	GBD	Australia	GBD	Australia
Males				
0–4	1.1	8	0	26.9
5–14	0.3	5	0.0	23.3
15–44	20	36	27.5	15.7
45–59	119	276	14.5	9.3
60+	767	859	5.6	4.9
All ages	149	291	8.2	5.7
Females				
0–4	0.8	6	0	30.7
5–14	0.2	5	0	27.2
15–44	16	38	31.5	17.6
45–59	102	185	17.3	9.1
60+	712	530	5.1	4.4
All ages	172	334	7.4	4.2

Comparison with EME and Mauritius

YLD* per 100,000	Males	Females	Persons	YLD/DALY (%)	DALY/100,000
Australia	174.7	118.1	Australia	34%	435
Mauritius	134.4	98.4	Mauritius	14%	857
EME	199.5	190.7	EME	31%	624

*Age-weighted and discounted YLD and DALYs.

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