

The burden of mental disorders: a comparison of methods between the Australian burden of disease studies and the Global Burden of Disease study

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The national and Victorian burden of disease studies in Australia set out to examine critically the methods used in the Global Burden of Disease study to estimate the burden of mental disorders. The main differences include the use of a different set of disability weights allowing estimates in greater detail by level of severity, adjustments for comorbidity between mental disorders, a greater number of mental disorders measured, and modelling of substance use disorders, anxiety disorders and bipolar disorder as chronic conditions. Uniform age-weighting in the Australian studies produces considerably lower estimates of the burden due to mental disorders in comparison with age-weighted disability-adjusted life years. A lack of follow-up data on people with mental disorders who are identified in cross-sectional surveys poses the greatest challenge in determining the burden of mental disorders more accurately.

Keywords: Australia; mental disorders, epidemiology; cost of illness; disability evaluation, methods; comparative study.

Voir page 436 le résumé en français. En la página 436 figura un resumen en español.

The prominent position of mental disorders, particularly depression, as a cause of disease burden is a widely quoted result of the Global Burden of Disease (GBD) study (1–5). However, there has been little discussion of the methods used to estimate the mental health burden at either the global or national level. The general debate about the use of the disability-adjusted life year (DALY) as a summary measure of population health has largely concentrated on the underlying assumptions of age-weighting and discounting and the relevance of burden of disease measurements to policy-making (6–11).

One report has challenged the severity weights for mental disorders used in the GBD study. Findings from a small community sample in New South Wales, Australia, led to a cautious conclusion that the GBD study may have overestimated the disability weights (DWs) for depression and substance disorders, while underestimating the level of disability associated with anxiety disorders (12). However, the epidemiological assumptions that fed into the GBD study's calculation of the burden of mental disorders have not been scrutinized in the

literature. Only three of the intended ten volumes in the *Global Burden of Disease and Injury Series* have been published to date (13–15); and a description of methods used in calculating the burden of mental disorders has not yet appeared. The only epidemiological information is in vol. 2 of the series, detailing for each disease and world region the age-specific and sex-specific values of incidence, prevalence, average duration and mortality.

As part of the two recent burden of disease studies in Australia, an effort was made to examine critically the GBD estimates for mental disorders, to improve the methods and to apply them to the most appropriate information on the epidemiology of mental disorders in the country. The results of the national Australian study conducted by the Australian Institute of Health and Welfare and of an analysis of the burden of disease in Victoria carried out by the state's Department of Human Services are available as printed reports and on the internet (16–19). The two project teams worked closely together and shared methods and analyses.

The methods used to estimate the burden of mental disorder in Australia are discussed below, and departures from those of the GBD study are identified and justified. The consequences are described and discussed of the methodological changes on the estimates for the state of Victoria and the results are compared with those of the GBD estimates for the Established Market Economy (EME) region. Although burden was estimated for dementia and other neurological conditions in the

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Australian studies, these conditions were included in a separate category for nervous system disorders and they are not discussed here.

Methods

The disability-adjusted life year

Summary measures of population health combine information on mortality and non-fatal health outcomes to describe population health in a single number. The DALY was designed to provide a common measure for fatal and non-fatal health outcomes, to allow estimates of health impact to be mapped to causes, and to enable common values and health standards to be applied to all regions of the world (13).

DALYs for a disease are the sum of the years of life lost because of premature mortality in the population and the years lost because of disability for incident cases of the health condition in question. The DALY is a *health gap* measure that extends the concept of potential years of life lost because of premature death to include equivalent years of healthy life lost in states of less than full health, broadly termed disability (20).

The Australian burden of disease studies depart from the general methodology used in the GBD study in the following key areas.

- The GBD study used a standard life table (West level 26) with a life expectancy at birth of 82.5 years for women and 80 years for men, whereas the Australian studies used the Australian cohort life expectancy (taking declining mortality trends into account) for 1996. This resulted in a life expectancy at birth of 85.7 years for women and 81.5 years for men.
- In the GBD study, DALYs were discounted at 3% and age-weighted. In the Australian studies, DALYs were discounted but were not age-weighted. Age-weighting is intended to capture a greater social responsibility in young and mid-adult life for the very young and old. Age-weighting was not used in the Australian studies because it is perceived as inequitable by some people and because the GBD sensitivity analyses showed that it did not essentially change the overall estimates of burden (13).
- In addition to DWs developed for the GBD study, the Australian studies used those developed by Dutch researchers (21, 22) for many conditions because of their greater detail and their focus on the most common disabilities found in countries of low mortality.
- The GBD study did not account for the occurrence of comorbid health states, whereas the Australian studies made adjustments for the effects of comorbidity between highly prevalent physical conditions, between mental disorders, and between injuries.
- The Australian studies included a wider range of disease and injury categories than the GBD study

and provided a more detailed age breakdown of the burden of disease.

Data sources

Apart from deaths associated with drug overdoses and, to a lesser extent, alcohol dependence, the number of deaths in Australia attributed to mental disorders is small. We included as heroin deaths a substantial number of deaths coded under accidental poisoning due to opioids in the International Classification of Diseases, ninth revision (ICD-9).

The estimation of the disability associated with mental disorders requires information on the incidence, average duration, and severity of each disease and its sequelae. The incidence of mental disorders is rarely measured; surveys tend to report one-year prevalence (the number of people who experienced relevant symptoms at any time during the preceding 12 months). To derive the incidence, we made extensive use of the DisMod software package developed by Harvard University to examine the consistency between estimates of incidence, prevalence, duration and mortality (23).

The data sources are summarized in Table 1. The main source of prevalence data for adults was the National Mental Health and Wellbeing Survey (MHS) of 1997 (24), in which information was collected on symptoms experienced in the preceding 12 months, 1 month, and 2 weeks for a representative sample of 10 560 adults. A computerized version of the Composite International Diagnostic Interview was used in this work. Interviews were completed for 78% of the individuals approached. The unit record data of the survey contained information on the prevalence of mental disorders by ICD-10 and DSM-IV (Diagnostic and Statistical Manual of Mental Disorders) categories as well as a number of measures of disability, namely the abbreviated Short Form (SF-12), the General Health Questionnaire (GHQ), the Brief Disability Questionnaire (BDQ) and the Kessler psychological distress scale. We used the ICD-10 diagnoses for consistency with our other disease categories which were largely based on ICD-9 categories. The only exception was post-traumatic stress disorder (PTSD), for which we used the DSM-IV diagnosis, because the ICD-10 criteria were too broad and would have resulted in overestimation due to misclassification of other anxiety disorders (25). One of the modules of the Composite International Diagnostic Interview on mania was omitted from the survey, and this meant that estimates of bipolar disorder were inaccurate. Instead, we relied on estimates from international epidemiological studies (26).

Initially, we built our estimates of schizophrenia on overseas data as well (27). The results of the Low Prevalence Disorders substudy of the MHS showed a prevalence of psychotic disorders which was similar to our initial estimates (28). The exclusion of institutionalized patients from the MHS sample was only important for these low-prevalence conditions, for which we relied on other data sources.

Table 1. Data sources used in Australian burden of disease studies to estimate the incidence and/or prevalence of mental disorders

Data source	Mental disorder
National Mental Health and Wellbeing Survey, 1997 (24)	Anxiety disorders (panic disorder, agoraphobia, social phobia, generalized anxiety disorder, obsessive–compulsive disorder) Depression (major depressive episode and dysthymia) Schizophrenia (27) Most substance abuse (alcohol, cannabis, sedative and stimulant drug dependence or harmful use) Borderline personality disorder
National Drug Strategy Household Survey, 1998 (29)	Heroin and residual “other drugs” category
Reviews of international epidemiological studies	Schizophrenia (26) Bipolar disorder (25) Eating disorders (anorexia and bulimia) (30, 31) Childhood disorders (attention-deficit hyperactivity disorder, autism and Asperger syndrome) (32–35) Depression and separation anxiety disorder in childhood (29)

We based our estimates of heroin dependence and harmful use (5 per 1000 persons aged 15–44 years) on the numbers of heroin users enrolled in methadone programmes together with expert estimates of the proportion of dependent users reached by these programmes. We checked the resulting estimates for consistency with prevalence data from the National Drug Strategy Household Survey of 1998, making allowance for underreporting and for heroin users who would not be captured in a household sample (29).

Severity

The Dutch study (21, 22) provided weights for three levels of severity for most of the mental disorders. Because of the large size of the mental health burden we felt it desirable to use Australian information on severity distributions together with these weights to obtain more accurate estimates of burden. In using a single overall DW for the spectrum of severity of a disease, as in the GBD study, a severity distribution is assumed and judgement of that implicit distribution becomes part of the DW estimation task.

The use of the Dutch weights required the matching of Australian epidemiological data to the severity levels defined in the Dutch study. Where the level of severity was available, as with the three levels of severity of ICD-10 diagnoses of depression and panic disorder in the MHS, local mental health experts doubted whether the diagnostic categories were representative of the actual level of severity of disability.

We used information from the SF-12 for each respondent in order to classify the conditions in the MHS in the mild, moderate and severe categories

defined in the Dutch DW study, which derived DWs using EuroQol 5D+ (EQ5D+) descriptions for each of the health states valued. The EQ5D+ is an extended version of the EuroQol health measurement instrument with an additional domain of cognitive functioning. The EQ5D+ descriptions of the six anxiety disorders in adults distinguish mild/moderate from severe mostly in the third domain of usual activities and the fifth domain of anxiety/depression with a score of 2 for mild/moderate and 3 for severe. Similarly, harmful alcohol use (with a score of 2) differs from alcohol dependence (with a score of 3) in the usual activities domain. The difference between mild, moderate and severe depression involves further domains but it has the same split between mild/moderate and severe on the usual activities and anxiety/depression domains.

We thus mapped responses to three questions (B6, B7 and B12, relating to usual activities) in the SF-12 to the three levels of the EuroQol usual activities domain. Similarly, we mapped responses to three other questions (B9, B10 and B11, relating to anxiety, depression and energy level) in the SF-12 to the three levels of the EuroQol anxiety/depression domain. This enabled us to categorize MHS respondents in accordance with the EuroQol levels for usual activities and anxiety/depression and hence with the severity categories for the DWs.

In order to validate this method of determining severity we examined how it compared with the way the ICD-10 classified depression into mild, moderate and severe levels. This involved comparing the scores of all other instruments used in the MHS, each of which, in its limited way, describes the severity of disability, as follows: the mental and physical

component score of SF-12 (MCS and PCS, with the latter not expected to be much affected by mental disorders); the overall score and Likert scores of the GHQ; reported days out of role from the BDQ, the main BDQ score; the mental outcome study score of the BDQ; the WHO score of the BDQ; and the Kessler psychological distress scale. As these instruments refer to the preceding four weeks, we based our comparisons of scores on those reporting symptoms of depression in this period only. As shown in Table 2, the classification system based on the SF-12 resulted in larger differentials for the average disability score (in the expected direction) as measured by each of the other disability instruments. This suggested that our classification system was better at discerning different levels of severity in depression and supported our use of this classification system across the conditions for which we derived estimates from the MHS.

Comorbidity

We derived prevalence estimates from the MHS for six anxiety disorders, six substance use disorders, borderline personality disorder, major depressive episodes and dysthymia. Comorbidity between these mental disorders was very common; the prevalence in Australia of people with one of them being 17.8%, 35% of whom had two or more diagnoses. At the level of individual diagnoses, the proportion of persons with comorbid conditions was even higher. For example, of the people with a current diagnosis of major depression, 61% had at least one other concurrent diagnosis. Comorbidity with anxiety disorders was common, occurring in a third of people with depression. Comorbidity in people with borderline personality disorder was even more frequent (94%). Depression, anxiety disorder and substance use disorder occurred in 62%, 48% and 52%, respectively, of people with borderline personality disorder.

Counting each of these disorders as a separate episode could result in attributing disability in one person in excess of a DW of 1 — the equivalent of being dead! In order to avoid overestimation of

burden, we shared comorbidity between anxiety disorders, affective disorders, borderline personality disorder, and alcohol and drug dependence equally so that a person with two or more disorders was partially counted in each category. On the advice of mental health experts, 75% of comorbidity with harmful alcohol use was attributed to the relevant other mental disorder and 25% was attributed to harmful alcohol use, whereas 50% of comorbidity between anxiety and affective disorders was attributed to each category, whereas comorbidity between all other disorders was attributed equally between categories.

Because we captured the level of severity separately our estimates took into account that people with multiple diagnoses were likely to have greater severity than people with only a single diagnosis.

Duration

It is argued that dysthymia and major depressive disorder are part of the same disease entity, as people with dysthymia frequently develop superimposed major depressive episodes and the symptomatic course of major depression commonly changes between levels of severity (30–32). Modelling major depression and dysthymia as one disease proves very difficult because of the heterogeneity of the course of the disease: some people have only one episode, some are continuously depressed for a long time, and the majority have multiple episodes that vary in frequency. We therefore decided to model major depression as episodes and to model dysthymia separately. We added the years lost due to disability (YLD) of major depression and dysthymia to give total YLD for depression.

We derived estimates of the average duration of major depressive episodes from the one-year prevalence (symptomatic at some time during the preceding 12 months) and point prevalence (symptomatic in the preceding two weeks) as follows:

$$\text{One-year prevalence} = \text{point prevalence} \times \frac{52 \text{ weeks} + \text{average duration}}{\text{average duration}}$$

This gave average durations of 38.2 weeks and 24.9 weeks for males and females, respectively. The

Table 2. Comparison of ICD-10 classification of severity of depression and classification based on SF-12 with scores from multiple instruments

Instrument	ICD-10 classification			SF-12 based classification		
	Mild	Moderate	Severe	Mild	Moderate	Severe
SF-12 MCS	46.0	34.1	29.8	46.4	30.9	21.6
SF-12 PCS	47.9	46.5	44.2	50.3	44.7	42.1
GHQ score	3.0	5.2	5.5	2.9	5.2	7.0
GHQ Likert score	13.5	17.4	18.1	13.6	17.4	20.9
BDQ — days out of role	4.8	4.8	9.1	1.6	6.8	12.8
BDQ main score	1.7	1.8	2.2	1.4	2.0	2.4
BDQ MOS score	4.2	4.5	6.1	2.9	5.7	6.8
BDQ WHO score	5.9	6.3	9.1	4.0	8.3	10.2
Kessler psychological distress scale	40.1	35.3	30.4	39.0	33.9	27.3

literature suggests that the mean duration of both initial and recurrent episodes of major depression is consistent at 20 weeks (26, 33). Our higher estimate may be attributable to recall bias of those with symptoms of major depression in the preceding year who did not have current symptoms. Having no evidence to support or reject this hypothesis we used the estimates of duration calculated above.

The overall YLD estimates are not very sensitive to the assumed duration, as a shorter estimate of duration leads to a higher estimate of incidence derived from the same observed prevalence, and the total YLD values are proportional to incidence multiplied by average duration. In fact, a 20-week duration for depressive episodes resulted in almost identical estimates of YLD, although there was a moderate shift in the age distribution from younger adults to older age groups. We used a remission rate of 0.124 in our DisMod model for dysthymia based on a reported remission in 58% of subjects during seven years of follow-up (31). From young adults to older ages the modelled average duration ranged from 8.0 to 3.8 years.

The literature on anxiety disorders (34, 35), obsessive-compulsive disorder (OCD) (36) and PTSD (37, 38) suggests that these disorders generally run a chronic course with periods of remission and relapse. This contrasts with the relatively short durations estimated in the GBD study of 0.75, 1.6 and 2.5 years for panic disorder, OCD and PTSD, respectively. To account for asymptomatic periods during the course of these chronic conditions we adjusted our durations by the ratio of point prevalence and one-year prevalence.

In our DisMod models for substance use disorders we assumed age-specific remission rates and incidences that were consistent with the observed large age differences in prevalence. This led to duration estimates of 2–5 years for harmful alcohol use, 3–7 years for alcohol dependence, 5–17 years for heroin dependence, and 3–4 years for marijuana, sedative and stimulant dependence. The DisMod models for alcohol dependence and harmful use included a twofold increased risk of death, resulting in a number of deaths amounting to about 60% of all those attributed to alcohol in our risk factor calculations. We accepted this as plausible, since not all deaths attributed to alcohol occur in people who qualify for a diagnosis of substance use disorder. For harmful alcohol use and dependence on marijuana, sedatives and stimulants we used the same method of adjustment to account for asymptomatic periods as described above for anxiety disorders. This method cannot be applied to alcohol dependence, as the definition assumes a chronic unremitting state. However, local alcohol experts did not believe that the large numbers of people identified with alcohol dependence, particularly at younger ages, all experienced disability for the duration of the condition. We therefore adjusted our YLD calculations, assuming that the 47–60% in males and 16–53% in females, depending on age, who reported higher scores on the

SF-12 than the population average, represented an equivalent to the asymptomatic periods estimated for anxiety disorders.

We estimated durations of 4–6 years for borderline personality disorder. This may seem short for a personality disorder but there is no credible alternative set of incidence and remission estimates that can be matched to the observed MHS prevalence figures using DisMod.

Schizophrenia was modelled as a lifelong condition that generally starts in young adulthood and has an elevated risk of dying based on standardized mortality ratios (SMRs) of 154 in males and 162 in females in the United Kingdom (39).

Disability weights

For most mental disorders we used the Dutch DWs (Table 3). The DWs for drug dependence disorders, manic episodes in bipolar disorder and borderline personality disorder were extrapolated by panels of local experts in the same way as the GBD study's expert panel derived weights for most conditions after anchoring weights for 22 indicator conditions. The weight for schizophrenia is a compound of 30% for the untreated weight and 70% for the treated weight from the GBD study, reflecting the average time spent in psychosis reported from a number of industrialized countries in the International Pilot Study of Schizophrenia (40).

Comparisons with estimates from the GBD study

In order to make meaningful comparisons with the results of the GBD study for the EME region, we recalculated our results with age-weighting and applied the same standard model life table for years of life lost (YLL). All comparisons are presented as rates of DALYs per 1000 population age-standardized to the 1990 EME population.

Results

According to Australian reports based on non-age-weighted DALYs, mental illness contributed 13.2% of the total disease burden in Victoria and 13.3% of that in the country as a whole in 1996 (16, 19). Only 6% of the mental illness burden was attributable to mortality, mostly involving fatal outcomes associated with substance use disorders. Affective, anxiety and substance use disorders together accounted for four-fifths of the overall burden attributable to mental illness (Fig. 1). For men, depression was the eighth leading cause of overall burden, while alcohol and drug use disorders were the thirteenth and fifteenth, respectively. For women, depression was the fifth leading cause of overall burden, while generalized anxiety disorder and alcohol use disorder were the twelfth and seventeenth, respectively.

Adding the age-weighting of the GBD study to the results for Victoria gave considerably more

Table 3. Comparison of disability weights (DWs) for mental disorders used in the Australian burden of disease studies and the Global Burden of Disease study

Disease category	GBD DW ^a	Australian DW ^b	Comments on Australian DWs
Substance use disorders			
Alcohol dependence	0.18	0.07–0.18	Dutch weights (0.11–0.55)
Drug use	0.25		
Heroin dependence		0.27	Locally derived weights
Marijuana dependence		0.11	
Sedative dependence		0.18	
Stimulant dependence		0.11	
Anxiety disorders			Range of Dutch weights ^c
Panic disorder	0.15	0.21–0.27	0.11–0.69
Obsessive–compulsive disorder	0.12	0.20–0.28	0.17–0.60
Post-traumatic stress disorder	0.11	0.14–0.15	0.13–0.51
Agoraphobia		0.14–0.16	0.11–0.55
Social phobia		0.18–0.21	0.17–0.59
Generalized anxiety disorder		0.22–0.23	0.17–0.60
Affective disorders			Range of Dutch weights
Major depressive episodes	0.50	0.37–0.41	0.14–0.76
Dysthymia		0.33–0.38	
Bipolar disorder	0.51	0.18	Composite of locally derived weight for mania (0.50), Dutch moderate depression weight for depressive episodes (0.34) and Dutch mild depression weight for time between episodes (0.14)
Schizophrenia	0.41	0.43	Composite of 30% untreated and 70% treated GBD DWs
Borderline personality disorder		0.54	Locally derived weight
Eating disorders		0.28	Dutch weight
Attention deficit/hyperactivity disorder (ADHD)		0.02–0.15	Dutch weights for mild and moderate ADHD
Autism		0.55	Dutch weight

^a Calculated from treated and untreated DWs together with proportion assumed treated. For further details on GBD weights see ref. 13.

^b DW range indicates variations by age and sex in distribution by severity level.

^c For further details, refer to Dutch disability weights study (21, 22).

prominence to mental disorders. They thus became the largest group of conditions, contributing 20.7% to the burden of disease. This was very similar to the estimate of the GBD study for EMEs, in which mental disorders other than dementia accounted for 19.5% of the total burden of disease. With age-weighting, depression became the leading cause of DALYs for women and the second cause for men in Victoria. Alcohol dependence in men and women and drug dependence in men entered the top ten, while generalized anxiety disorder, social phobia and bipolar disorder ranked among the top twenty conditions for both men and women; eating disorders and drug dependence also entered the top twenty for women.

Notwithstanding the close agreement on the total size of the mental health burden, there were substantial differences between the estimates for Victoria and those of the GBD study for EME countries in respect of particular disorders (Table 4). These differences are the result of variations in estimates for one or more of the YLD parameters (i.e. incidence, duration and DWs) for most mental illnesses (Table 5).

Two main factors explain most of the differences. Firstly, the occurrence of the disease, i.e. its prevalence, may have differed between Australia and the EMEs. It should be noted that almost all estimates were derived from prevalence data. The prevalence estimates for Victoria (Table 5)

included the downward adjustment for comorbidity between mental disorders. Secondly, the disease models may have differed, particularly in respect of the assumptions on the distribution of severity, DWs and average duration.

Our estimates of the burden of alcohol dependence and harmful use in men were less than half those for the EMEs. To some extent this reflected a lower prevalence in Victoria (partly attributable to the adjustment for comorbidity) but the main influence was the downward adjustment of the average level of disability, on the assumption that the proportion of survey respondents not reporting disability on six key questions of the SF-12 reflected symptom-free periods during the course of illness.

Despite taking a similar prevalence of major depression as a starting point and including dysthymia, we estimated a lower burden from depression in Victoria. This was largely because of the use of lower DWs. Our YLD estimates for bipolar disorder were based on a prevalence more than double that estimated in the GBD study. Nevertheless, the estimate of the associated burden in Victoria was much lower because we use different DWs. The GBD study used a uniform weight of 0.51 for the EME region while in Victoria we modelled manic episodes at a weight of 0.50, depressive episodes at 0.34 and the time between episodes at 0.14, resulting in an average weight of 0.18 for the overall course of illness. The very different estimates of the duration of bipolar disorder between the two studies cannot explain the large differences in burden estimates because the incidence and duration are modelled on prevalence data. Combinations of high incidence and short duration or low incidence and long duration that are consistent with the same prevalence figures lead to marginal differences in burden estimates, as YLD values are determined by the product of incidence and duration.

Australian data indicated a higher prevalence of PTSD in both sexes and of panic disorder in women, but much lower prevalence of OCD. The latter was probably overestimated in the GBD study, which may have relied on survey results in which lay interviewers used too broad criteria to diagnose this disorder, as occurred in a Canadian study (41). In contrast to the short durations for anxiety disorders in the GBD study, we modelled them as chronic conditions with periods of remission and relapses. This led to very different YLD estimates, which were also affected by the higher DWs. Our estimate of the burden due to PTSD was higher, mostly because of the higher prevalence. Our much lower estimate of YLD for OCD was mostly influenced by the sixfold lower prevalence estimate, the higher DW estimates and the MHS-based estimates indicating that men and women with OCD had 11% and 41%, respectively, of the time symptom-free during the course of their illness. Higher average DWs, an estimate of 74% symptom-free periods during the course of illness, and a higher observed prevalence resulted in YLD estimates for panic disorder that

Fig. 1. The burden of mental illness (years of life lost (YLL), years lost due to disability (YLD), and disability-adjusted life years (DALYs)), by disorder and sex, Victoria, Australia, 1996

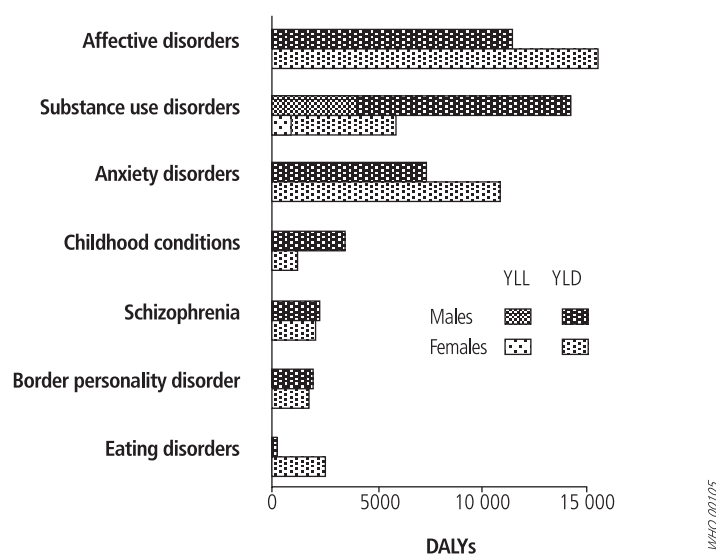


Table 4. DALY rates per 1000 population^a for mental disorders in Established Market Economies (EME) (1990) and Victoria, Australia (1996)

Disorder	Males		Females	
	EME	Victoria	EME	Victoria
All mental disorders	25.9	20.1	21.4	21.2
Affective disorders	8.2	6.7	12.7	9.0
Depression	6.0	5.3	10.7	7.7
Bipolar disorder	2.2	1.4	2.1	1.3
Anxiety disorders	2.4	4.3	3.6	6.0
Post-traumatic stress disorder	0.3	0.5	0.4	0.5
Obsessive-compulsive disorder	1.6	0.4	2.0	0.3
Panic disorder	0.6	0.2	1.1	0.6
Other anxiety disorders	0.0	3.2	0.0	4.6
Substance abuse	12.4	6.4	2.6	3.1
Alcohol dependence / harmful use	9.7	4.3	1.7	1.9
Drug dependence / harmful use	2.7	2.1	0.9	1.2
Schizophrenia	2.9	1.2	2.6	1.0
Other mental disorders	0.0	1.5	0.0	2.1

^a Age-weighted and discounted DALYs, age-standardized to EME population, 1990.

were considerably lower in men and women in comparison with the estimates in the GBD study. With the inclusion of three additional anxiety disorders in adults (social phobia, generalized anxiety disorder, and agoraphobia) and separation anxiety disorder in childhood, the estimates in the Victoria study for anxiety disorders were two-thirds higher than in the GBD study.

Table 5. Estimates of prevalence, incidence and duration of mental disorders in the Global Burden of Disease (GBD) study (1990) and Victoria (Vic) (1996)

	Disorder	Prevalence per 1000 ^a		Incidence per 1000 ^a		Duration in years ^b	
		GBD	Vic	GBD	Vic	GBD	Vic
Males	Major depression	0.9	1.0	16.3	10.9	0.56	0.73
	Bipolar disorder	0.3	0.7	2.7	0.3	1.4–1.5	21–24
	Panic disorder	0.3	0.3	3.8	0.2	0.75	10–16
	Obsessive–compulsive disorder	1	0.1	6.2	0.2	1.6	4–7
	Post-traumatic stress disorder	0.2	0.4	0.8	0.9	2.5	5
	Schizophrenia	0.9	0.3	0.2	0.1	52–54	21–57
	Alcohol dependence	3.9	2.7	24.0	12.9	1.5–1.7	4–5
	Drug use ^c	0.8	2.0	7.7	4.3	1	3–13
Females	Major depression	1.7	1.5	29.8	27.3	0.56	0.48
	Bipolar disorder	0.3	0.7	2.6	0.3	1.4–1.5	21–24
	Panic disorder	0.6	1.1	7.5	0.7	0.75	10–16
	Obsessive–compulsive disorder	1.3	0.2	8.2	0.3	1.6	4–7
	Post-traumatic stress disorder	0.3	0.6	1.3	1.1	2.5	5
	Schizophrenia	0.9	0.3	0.2	0.1	52–54	21–57
	Alcohol dependence	0.7	0.9	4.3	5.0	1.5–1.7	4–5
	Drug use ^d	0.2	0.8	2.5	1.7	1	3–13

^a Prevalences and incidences include an adjustment for comorbidity with other mental disorders.

^b Ranges indicate variations in duration by age and sex.

^c The GBD estimated prevalence of “dysfunctional and harmful drug use” as one category.

The YLD estimates for schizophrenia in Victoria were 60% lower than in the GBD study and reflected lower estimates of prevalence, as other assumptions of DWs and average duration were almost identical.

Discussion

The epidemiological assumptions underlying calculations of the disease burden caused by mental disorders have not previously been examined. The Australian burden of disease studies developed new models for each of the mental disorders included in the GBD study and made estimates for ten new disease categories. Major differences in the underlying assumptions are outlined below.

- The use of Dutch DWs in the Australian studies allowed the construction of disease models with details by level of severity. In principle it is a great improvement if estimates can be made explicitly by level of severity, as each of the mental disorders shows considerable variation in severity. The use of a single DW for a disease implicitly assumes an average distribution of severity but does not give the flexibility to adapt the weight to populations with different severity distributions. The big difficulty in our approach lay in matching epidemiological data with the severity categories for which DWs had been derived.

We decided not to derive DWs separately for Australia in order to concentrate on the epidemiological inputs to the burden of disease calculations. This was made easier by the availability of the

Dutch weights covering the main sources of disability in Australia. However, this left us with the task of finding Australian data on mental disorders to fit the Dutch severity levels as defined by the six domains of the EQ5D+. Because the MHS did not use the EuroQol, we mapped six questions of the SF-12 to two domains of the EuroQol in order to distinguish between levels of severity. This was not a tested method but in comparison to ICD-10 diagnoses it showed greater distinction between levels of mild, moderate and severe depression on all other measures of disability in the survey. We then assumed that the same method could distinguish between levels of severity for the other disorders included in the same survey. The very large contribution of mental disorders to the overall burden of disease means that there is a need for longitudinal studies of people identified with a mental disorder in community samples. This would allow a better understanding to be obtained of the level of disability suffered during the course of illness.

- Our revised disease models for anxiety disorders and bipolar disorder as chronic conditions were more in line with the literature than the durations estimated in the GBD study. Follow-up studies of people with anxiety disorders justified our choice of disease models of long duration with periods of remission and relapses (34, 36, 42–43). As we had only cross-sectional data on mental disorders in Australia we used the ratio of one-year prevalence and point prevalence to represent the proportion of time during the chronic course of illness which was

spent with symptoms. Because the one-year prevalence figures may be influenced by recall bias it would be helpful to examine whether our estimates of the proportion of time with symptoms can be confirmed in longitudinal follow-up studies. Similarly, there is uncertainty about the amount of disability associated with alcohol dependence and harmful use. On the advice of local alcohol experts, we reduced YLD estimates for alcohol dependence by assuming no disability for the proportion of respondents not reporting disability on the SF-12. That was an arbitrary decision made in relation to alcohol dependence but not in relation to the other mental disorders. Again this identifies a critical need for follow-up data on people identified in community surveys of mental disorders.

- Ignoring the common comorbidity between mental disorders can lead to significant double counting and overestimation of the burden of disease. This is particularly important if a large number of mental disorders are included. We were able to assess the occurrence of comorbidity between five substance use disorders, six anxiety disorders, two affective disorders and borderline personality disorder from the results of a representative Australian mental health survey. The proportion of comorbidity ranged from 49% in people identified with social phobia to 94% in people with borderline personality disorder. The latter figure raised the question as to whether borderline personality disorder should be excluded from the burden of disease list of mutually exclusive conditions and, instead, valued separately as a risk factor for other mental disorders. Our method of adjusting for comorbidity assumed that each diagnosis contributed equally to the overall level of disability. By capturing severity separately from the SF-12 we were able to allow for the fact that people with more than one diagnosis were likely to experience greater disability than people with only one of the comorbid conditions. It is possible that in this method some individuals with two or more diagnoses contribute less YLD than a person with the severest of these conditions. A laborious procedure would be required in order to analyse this on a case-by-case basis for each possible combination of comorbid conditions. We decided against this because we did not think it would make a great difference to our overall results.
- Contrary to the sensitivity analyses for the GBD study, which showed only a marginal difference between results that were age-weighted and those that were not, in Victoria age-weighting increased the contribution of mental disorders to overall DALYs by 57%. Thus mental disorders surpassed cardiovascular diseases and cancer as a leading cause of burden. Although the authors of the GBD study mentioned that age-weighting pre-

ferentially gave more weight to mental disorders, their overall conclusion that results were insensitive to assumptions such as age-weighting did not hold for the Victorian study. In the debate about age-weighting in summary population health measures it is important to note that its impact may not be as slight as is commonly assumed.

Conclusions

Using different detailed methods and data sources, the Australian burden of disease studies have confirmed that mental disorders are a leading cause of disease burden in developed countries. Partly as a result of methodological differences (including the use of different weights, analysis of severity distributions and adjustments for comorbidity) the Australian estimates showed marked differences in comparison to the results of the GBD study for particular disorders. Lower severity weighting for alcohol dependence in younger men together with differences in prevalence resulted in lower burden in Australia. Lower estimates of burden for major depression were predominantly attributable to lower estimated severity. Despite using higher DWs, our estimates for OCD were less than a quarter of the estimates of the GBD study because of much lower prevalence estimates. Much lower estimates of the burden for panic disorder and higher estimates for PTSD were derived from disease models with higher DWs, higher prevalence estimates and adjustments for symptom-free periods during the chronic course of illness.

Estimates of the total burden attributable to anxiety disorders in Australia were almost twice as high as in the GBD study because four additional conditions were included in the Australian work.

We hope that our efforts to improve disease modelling for mental disorders make a useful contribution to disease burden methodology. We believe that our models are an improvement over those used in the GBD study. There is still much scope for further developments, particularly in the measurement of severity over the course of mental disorders and in dealing with comorbidity. Full details of our calculations are available on the Internet (19). ■

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Résumé

La charge de morbidité des troubles mentaux : comparaison entre les méthodes employées dans les études australiennes et dans l'étude sur la charge de morbidité dans le monde

Les études sur la charge de morbidité effectuées pour l'ensemble de l'Australie et l'Etat de Victoria visent à examiner d'un œil critique les méthodes utilisées dans l'étude sur la charge de morbidité dans le monde pour estimer la charge représentée par les troubles mentaux. Les études australiennes se servent d'une série de coefficients de pondération des incapacités différents de ceux employés dans l'étude précitée, permettant des estimations plus détaillées selon le degré de gravité. En outre, on a effectué des ajustements pour tenir compte de la comorbidité entre les troubles mentaux et on a mesuré un plus grand nombre de ces derniers ; par ailleurs, on a rassemblé les troubles liés à la consommation de substances, les troubles anxieux et les troubles bipolaires en un modèle d'affections chroniques. En conséquence, les estimations australiennes ont montré des différences marquées par rapport à celles de l'étude sur la charge de morbidité dans le monde. En Australie, le nombre d'années de vie ajustées sur l'incapacité (DALY) inférieur de 48 % ainsi obtenu pour la dépendance alcoolique chez l'homme a été en partie attribué à des différences dans la prévalence de cette affection et en partie aux ajustements effectués pour tenir compte d'une comorbidité avec d'autres troubles mentaux, et à une pondération moins importante en fonction de la gravité. En Australie, les estimations plus basses qui ont été faites du coefficient de pondération de l'incapacité en cas de dépression majeure ont fait que cette dernière représente une charge inférieure de 36 % chez les hommes et de 45 % chez les femmes, mais l'inclusion de la dysthymie a diminué de moitié au moins les écarts observés. Bien que nous ayons utilisé un coefficient de pondération de l'incapacité plus élevé, nos estimations relatives aux troubles obsessionnels compul-

sifs ont représenté moins du quart de celles de l'étude précitée du fait d'estimations de la prévalence bien inférieures. Des estimations bien plus faibles de la charge de morbidité des troubles paniques et bien plus élevées de celle de l'état de stress post-traumatique ont été tirées de modèles de morbidité dans lesquels le coefficient de pondération de l'incapacité et les estimations de la prévalence étaient plus élevés et qui comportaient des ajustements tenant compte des périodes asymptomatiques survenues au cours de la maladie chronique. Les estimations relatives à la charge de morbidité totale attribuable aux troubles anxieux ont été presque deux fois plus élevées du fait que quatre autres pathologies ont été incluses dans les études australiennes. L'absence de pondération en fonction de l'âge dans les études australiennes a donné des estimations considérablement plus faibles de la charge de morbidité imputable aux troubles mentaux, par comparaison avec les DALY pondérés en fonction de l'âge. Avec une telle pondération, la part représentée par les troubles mentaux dans l'ensemble des DALY a progressé de 57 % dans l'Etat de Victoria et a dépassé en importance les maladies cardio-vasculaires et le cancer. L'absence de données relatives au suivi des patients présentant un trouble mental identifiés lors d'enquêtes transversales constitue le problème le plus important pour déterminer plus précisément la charge de morbidité des troubles mentaux. Si les améliorations apportées dans les méthodes présentées dans cet article constituent un progrès important vers plus de précision dans le calcul de la charge de morbidité des troubles mentaux, les perspectives de développement ultérieur restent importantes.

Resumen

Carga de trastornos mentales: comparación de los métodos empleados en los estudios de la carga de morbilidad en Australia y en el estudio sobre la Carga Mundial de Morbilidad

Se estudió la carga de morbilidad en el conjunto de Australia y en el Estado de Victoria de ese país al objeto de analizar críticamente los métodos empleados en el estudio sobre la Carga Mundial de Morbilidad (CMM) para estimar la carga de trastornos mentales. En los estudios de Australia se utilizó un sistema de ponderación de la discapacidad que, a diferencia del empleado en el estudio CMM, permitía hacer estimaciones más detalladas en función del nivel de gravedad. Además, se hicieron ajustes para la comorbilidad entre trastornos mentales, se midió un mayor número de trastornos mentales, y se modelizaron como enfermedades crónicas el abuso de sustancias, los trastornos de ansiedad y el trastorno bipolar. En consecuencia, las estimaciones australianas difirieron notablemente de las del estudio CMM. Así, en Australia, en lo que concierne a la

dependencia del alcohol en los hombres, el hallazgo de unas tasas de AVAD inferiores en un 48% podía explicarse en parte por las diferencias en la prevalencia observada de la afección y en parte por los ajustes para la comorbilidad por otros trastornos mentales y la menor ponderación de la gravedad. Las ponderaciones más bajas de la discapacidad consideradas para la depresión grave en Australia se tradujeron en una carga de depresión grave inferior en un 36% entre los hombres y en un 45% entre las mujeres, pero la inclusión de la distimia redujo esas diferencias en más de la mitad. Pese a que ponderamos más la discapacidad correspondiente, nuestras estimaciones para los trastornos obsesivo-compulsivos fueron inferiores a la cuarta parte de las realizadas en el estudio CMM, debido a que se usaron estimaciones mucho más bajas de la prevalencia. Las

muy inferiores cifras calculadas para la carga de trastorno de pánico, y las superiores para el trastorno de estrés postraumático, se obtuvieron a partir de modelos de las enfermedades que introducían una mayor ponderación de la discapacidad, estimaciones mayores de la prevalencia, y ajustes para los periodos asintomáticos registrados durante la evolución crónica de la enfermedad. Las estimaciones de la carga total de trastornos de ansiedad fueron casi del doble debido a que en los estudios australianos se incluyeron otras cuatro dolencias. La ponderación uniforme por edades utilizada en los estudios australianos arrojó estimaciones considerablemente inferiores de la carga de trastornos mentales en comparación con los AVAD ponderados en función de la

edad. Con la ponderación según la edad, la cifra de trastornos mentales en Victoria aumentó en un 57% como proporción de los AVAD globales, superando a las enfermedades cardiovasculares y al cáncer en orden de importancia. La falta de datos de seguimiento sobre las personas con trastornos mentales identificadas en las encuestas transversales constituye el mayor obstáculo para poder determinar más exactamente la carga de trastornos mentales. Si bien las mejoras de los métodos presentados en este artículo son un paso importante para calcular con más exactitud la carga de trastornos mentales, queda todavía amplio margen para perfeccionar esas estimaciones.

References

1. Neugebauer R. Mind matters: the importance of mental disorders in public health's 21st century mission. *American Journal of Public Health*, 1999, **89**: 1309–1311.
2. Üstün TB. The global burden of mental disorders. *American Journal of Public Health*, 1999, **89**: 1315–1318.
3. Jenkins R. Reducing the burden of mental illness. *Lancet*, 1997, **349**: 1340.
4. Appleby L et al. Global burden of disease. *Lancet*, 1997, **350**: 143.
5. Eisenberg L. Global burden of disease. *Lancet*, 1997, **350**: 143.
6. Barendregt JJ, Bonneux L, Van der Maas PJ. DALYs: the age-weights on balance. *Bulletin of the World Health Organization*, 1996, **74**: 439–443.
7. Anand S, Hanson K. Disability-adjusted life years: a critical review. *Journal of Health Economics*, 1997, **16**: 685–702.
8. Sayers B McA, Fliedner TM. The critique of DALYs: a counter-reply. *Bulletin of the World Health Organization*, 1997, **75**: 383–384.
9. Barker C, Green A. Opening the debate on DALYs. *Health Policy and Planning*, 1996, **11**: 179–183.
10. Williams A. Calculating the global burden of disease: time for a strategic appraisal. *Health Economics*, 1999, **8**: 1–8.
11. Ugalde A, Jackson JT. The World Bank and international health policy: a critical review. *Journal of International Development*, 1995, **7**: 525–541.
12. Andrews G, Sanderson K, Beard J. Burden of disease. Methods of calculating disability from mental disorder. *British Journal of Psychiatry*, 1998, **173**: 123–131.
13. Murray CJL, Lopez AD, eds. *The Global Burden of Disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020*. Cambridge, MA, Harvard School of Public Health on behalf of the World Health Organization and the World Bank, 1996 (Global Burden of Disease and Injury Series, Vol. I).
14. Murray CJL, Lopez AD, eds. *Global health statistics*. Cambridge, MA, Harvard School of Public Health on behalf of the World Health Organization and the World Bank, 1996 (Global Burden of Disease and Injury Series, Vol. II).
15. Murray CJL, Lopez AD. *Health dimensions of sex and reproduction*. Cambridge, MA, Harvard School of Public Health, 1998 (Global Burden of Disease and Injury Series, Vol. III).
16. Mathers C, Vos T, Stevenson C. *The burden of disease and injury in Australia*. Canberra, Australian Institute of Health and Welfare, 1999 (also available at <http://www.aihw.gov.au/publications/health/bdia.html>).
17. Mathers C, Vos T, Stevenson C. *The burden of disease and injury in Australia – summary report*. Canberra, Australian Institute of Health and Welfare, 1999 (also available at <http://www.aihw.gov.au/publications/health/bdiasr.html>).
18. Vos T, Begg S. *The Victorian Burden of Disease Study: mortality*. Melbourne, Public Health and Development Division, Department of Human Services, 1999 (also available at <http://www.dhs.vic.gov.au/phd/9903009/index.htm>).
19. Vos T, Begg S. *The Victorian Burden of Disease Study: morbidity*. Melbourne, Public Health and Development Division, Department of Human Services, 1999 (also available at <http://www.dhs.vic.gov.au/phd/9909065/index.htm>).
20. Murray CJL, Salomon J, Mathers CD. *A critical examination of summary measures of population health*. Geneva, World Health Organization, 1999 (GPE Discussion Paper No. 2).
21. Stouthard M et al. *Disability weights for diseases in the Netherlands*. Rotterdam, Department of Public Health, Erasmus University, 1997.
22. Stouthard M et al. Disability weights for diseases in the Netherlands. *European Journal of Public Health*, 2000, **10**: 24–30.
23. DisMod v1.0. Harvard, Burden of Disease Unit, Harvard University, 1994 (available at <http://www.hsph.harvard.edu/Organizations/bdu/dismod/index.html>).
24. *Mental health and wellbeing profile of adults, Australia 1997*. Canberra, Australian Bureau of Statistics, 1998 (cat. No. 4326.0).
25. Peters L, Slade T, Andrews G. A comparison of ICD-10 and DSM-IV criteria for post-traumatic stress disorder. *Journal of Traumatic Stress*, 1999, **12**: 335–343.
26. Angst J, Preisig M. Course of a clinical cohort of unipolar, bipolar and schizoaffective patients. Results of a prospective study from 1959 to 1985. *Schweizer Archiv für Neurologie und Psychiatrie*, 1995, **146**: 5–16.
27. Kendler KS et al. Lifetime prevalence, demographic risk factors, and diagnostic validity of nonaffective psychosis as assessed in a US community sample. The National Comorbidity Survey. *Archives of General Psychiatry*, 1996, **53**: 1022–1031.
28. Jablensky A et al. *National Survey of Mental Health and Wellbeing Report 4: people living with psychotic illness: an Australian study 1997–98*. Canberra, Commonwealth of Australia, 1999.
29. *1998 National Drug Strategy Household Survey: first results*. Canberra, Australian Institute of Health and Welfare, 1999 (Drug Statistics Series, cat. No. PHE15).
30. Angst J, Wicki W. The Zurich Study. XI. Is dysthymia a separate form of depression? Results of the Zurich Cohort Study. *European Archives of Psychiatry and Clinical Neuroscience*, 1991, **240**: 349–354.
31. Keller MB. Dysthymia in clinical practice: course, outcome and impact on the community. *Acta Psychiatrica Scandinavica Supplementum*, 1994, **383**: 24–34.
32. Judd LL. The clinical course of unipolar major depressive disorders. *Archives of General Psychiatry*, 1997, **54**: 989–991.

33. **Solomon DA et al.** Recovery from major depression. A 10-year prospective follow-up across multiple episodes. *Archives of General Psychiatry*, 1997, **54**: 1001–1006.
34. **Angst J, Volrath M.** The natural history of anxiety disorders. *Acta Psychiatrica Scandinavica*, 1991, **84**: 5446–5452.
35. **Murphy JM.** Trends in depression and anxiety: men and women. *Acta Psychiatrica Scandinavica*, 1986, **73**: 113–127.
36. **Allsopp M, Verduyn C.** A follow-up of adolescents with obsessive-compulsive disorder. *British Journal of Psychiatry*, 1989, **154**: 829–834.
37. **Davidson JR et al.** Post-traumatic stress disorder in the community: an epidemiological study. *Psychological Medicine*, 1991, **21**: 713–721.
38. **Kessler RC et al.** Post-traumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry*, 1995, **52**: 1048–1060.
39. **Kelly C et al.** Nithsdale schizophrenia surveys. 17. Fifteen year review. *British Journal of Psychiatry*, 1998, **172**: 513–517.
40. **Leff J et al.** The International Pilot Study of Schizophrenia: five-year follow-up findings. *Psychological Medicine*, 1992, **22**: 131–145.
41. **Stein et al.** Obsessive-compulsive disorder: an epidemiological survey with clinical reappraisal. *American Journal of Psychiatry*, 1997, **154**: 1120–1126.
42. **Keller MB, Hanks DL.** Course and outcome in panic disorder. *Progress in Neuropsychopharmacology and Biological Psychiatry*, 1993, **17**: 4551–4570.
43. **Pollack MH, Smoller JW.** The longitudinal course and outcome of panic disorder. *Psychiatric Clinics of North America*, 1995, **18**: 4785–4801.