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Burden of disease

Methods of calculating disability from mental disorder

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Background The Global Burden of Disease studies are important because they encompass morbidity as well as mortality. Burden due to morbidity is calculated from incidence, duration and disability. There is a dearth of epidemiological measurements of disability.

Method Data from a quasi-community sample (n=1364) were analysed. Diagnoses of mental and physical disorders, and reports of disability, were based on established methods.

Results The disabilities reported in mental and physical disorders were comparable. Disability was correlated with comorbidity. The disability in mental disorders was examined by three methods: pure disorders, main problem and regression. It appears that major depression and substance disorder weights were overestimated, and anxiety disorder weights were underestimated in the Global Burden of Disease studies.

Conclusions A method for disentangling the effects of concurrent comorbidity is presented. The size of burden attributed to mental disorders is of potential benefit for funding mental health services. It is important that we get the estimates right.

Since publication of the *World Development Report* (World Bank, 1993) there has been interest in using the Global Burden of Disease data to set regional priorities in health care. Much of this interest has come from developing countries, where mortality is high and resources low. Such countries are eager to invest wisely in their health systems. The Global Burden of Disease methodology also offers a powerful tool for use in high income countries, as it allows a standardised comparison of mortality and morbidity across all diseases. The subsequent Global Burden of Disease report by Murray & Lopez (1996*a*) refined the method, producing detailed epidemiological and burden estimates for 107 ICD–9 (World Health Organization, 1978) disorders for more than 200 countries. Such data have important implications for evidence-based health policy (Murray & Lopez, 1996*b*), and a series of articles in the *Lancet* highlighted regional problems in mortality, disability, and expected patterns of burden over the next 30 years (Murray & Lopez, 1997*a*,*b*,*c*,*d*).

BURDEN OF MENTAL DISORDERS

A major finding of the Global Burden of Disease project was the importance of mental disorders as a cause of disease burden, accounting for a quarter of the world's disability, and 9% of the total burden, burden being the sum of premature death and years lived with disability (Murray & Lopez, 1996*a*). Five of the 10 leading causes of disability worldwide are mental disorders: major depression, alcohol use, bipolar affective disorder, schizophrenia and obsessive–compulsive disorder. In established market economies such as the US, UK and Australia, harmful drug use is also one of the 10 leading causes of disability. In these countries, mental disorders account for 43% of the disability and 22% of the total burden of disease, the latter being substantially more than the proportion of the health budget devoted to the prevention and treatment of mental disorders. Developed countries are recognising the importance of this methodology. A major burden of disease study is currently underway in the US, and preliminary burden estimates are available for an English region, where mental disorders were found to be the third most important cause of disease burden (Bowie *et al*, 1997). This world perspective on the importance of mental illness provided by the Global Burden of Disease study has been reflected in a United Nations initiative, 'Nations for Mental Health' (Jenkins, 1997).

These data on the burden of mental disorders do not mean that an epidemic of mental illness is sweeping the world. It is just that, as the burden of infectious diseases has decreased markedly, and the burden of many chronic diseases is being reduced through improved prevention and treatment, the mental disorders are now exposed as a significant burden. This epidemiological transition is also evident in the developing world, where changing population structure and changing patterns of disease highlight the importance of non-communicable, chronic diseases (Bulutao, 1993).

WHAT ARE DISABILITY-ADJUSTED LIFE-YEARS?

In light of the global impact of the Global Burden of Disease study and its importance for mental disorder service delivery, a tutorial on the method is presented. A composite measure for mortality and disability was used, with life-years lost as the unit of measurement. This new measure is called the disability-adjusted life-year (DALY), and adds, for each disorder, life-years lost due to premature death, to life-years lost due to living in a disabled state. The DALY is a variant of the quality-adjusted life-year (QALY), but unlike the QALY, the DALY assumptions are standardised. These value judgments, inherent in all methods of health state valuation, are made explicit in the Global Burden of Disease project (Murray & Lopez, 1996*a*). Discounting is applied because people value their current health more than future health, and age-weighting is applied because most societies would choose to save young to middle-aged adults over the very

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young or the very old. For example, data from the Cardiff Health Survey demonstrated that, all things being equal, individuals would choose to save an older child over a younger child, and a younger adult over an older adult (Lewis & Charny, 1989).

The DALY also has a uniform method for estimating disability by measuring preferences for different health states (the utility value applied to years lived in the given health state). This preference valuation is converted into a weight on a scale from zero (perfect health) to one (death), to enable years lived with disability to be equated to years lost from early death. The worse the health state is, the closer the value is to one (the value for death), whereas mild conditions attract values very close to zero, the value for perfect health. These disability weights were obtained using two variants of the person-trade-off method, a hypothetical exercise where clinicians and public health professionals were asked to choose between saving the lives of healthy people in comparison to people in a given health state, or extending the lives of healthy people *v.* restoring people in a given health state to full health (see Murray & Lopez, 1996*a*; Nord, 1995 for a detailed discussion of this methodology). Brief clinical descriptions of each disorder were provided to assist the raters to make their value judgements. Future work should provide much more detailed information to the raters, such as providing disability measures alongside the clinical descriptions. This paper is a contribution to that exercise. DALYs lost per incident case are calculated, and this is multiplied by the incidence in the reference year. The DALY is thus a composite measure of the mortality and the incidence, duration, and disability of each disease.

IMPORTANCE OF COMORBIDITY

Disability weights (and consequently burden) were developed for each disease sequela individually. This implies that disability weights, and thus burden, are simply added if a person has multiple conditions. This approach is likely to overestimate disease burden for disorders with high levels of comorbidity, such as the mental disorders. The disability due to two concurrent disorders is likely to be less than the sum of the disability due to each, were they to be suffered independently.

Some argue that this overestimation is less of a problem in light of the ethical problems encountered if disability is not added. If disability is not added, but is reduced in some way for the comorbid disorder, it may imply that the prevention or treatment of this secondary disorder in people already disabled is not as important as prevention or treatment in a healthy person who develops that same disorder, because the overall burden for that disorder will be lower. This is referred to as the double jeopardy argument (Harris, 1987). However, if resource allocation is done to maximise total number of DALYs averted, then it is the change in DALYs gained which is important, not necessarily the health end-point (Singer *et al*, 1995). Thus, the treatment of a disorder will be seen as beneficial if treatment gains are possible, regardless of whether it manifests alone or co-occurs with other disorders.

For this Global Burden of Disease methodology to be more applicable to psychiatry the issue of disability due to comorbidity must be addressed. Three types of comorbidity can be delineated (Andrews, 1996). Diseases can co-occur purely by chance, and have no reflection on the aetiology of the two diseases (such as arthritis and mania). This is termed independent comorbidity. Disorders can have the same aetiology, such that the co-occurrence of the two disorders is above chance, because they are operating under the same influence (generalised anxiety disorder and major depression are argued to be an example of shared aetiology). The development of one disorder could increase the risk of developing another (for example, panic disorder with secondary depression; Hunt & Andrews, 1995). These latter two comorbidity types can be referred to as dependent co-occurrences, because they occur at rates above change and do relate to aetiology (Murray & Lopez, 1996*a*). It is these types of comorbidity which should inform revisions of the disability weights.

Accounting for episode comorbidity (co-occurrence of disorders within 12 months) is important given the frequency and associated disability (Robins *et al*, 1991; Kessler, 1995; Goering *et al*, 1996), and because burden is calculated for a reference year. Murray (1996) has suggested that specific disability estimates should be derived for common disorder combinations, and target these combinations for future developments of the method, as it would not be practical to conduct the person-trade-off exercise for all possible combinations of disorders. Ideally, epidemiological data on the disabling consequences of these co-occurrences of disorders could be provided in the clinical descriptions that are used when the person trade-off method is applied.

Two surveys provide information on the relative disabilities of particular disorder combinations and both have drawn attention to the significant disability associated with anxiety disorders, disorders that many health services ignore. In the National Comorbidity Survey, highest work impairment days were reported by individuals with concurrent anxiety, affective and substance use disorders, with comorbid anxiety and affective disorders the next most disabling, followed by anxiety and substance comorbidity (Kessler & Frank, 1997). In a replication of the National Comorbidity Survey in Ontario, Goering *et al* (1996) found that individuals with mixed mental disorder comorbidity were more disabled than those with single disorder categories, with half of the mixed group reporting affective and anxiety comorbidity and a quarter, anxiety and substance use disorder comorbidity.

The disability associated with a particular disorder can be ascertained from people who have no comorbid conditions, but as these pure cases are in the minority the results might not be generally applicable. Given a sufficiently large data set statistical methods could be employed to identify the unique disability associated with a particular disorder when that disorder appears in combination with others. This can be done using regression techniques to identify the disability associated with particular disorders or groups of disorders. It can also be informed by examining disability associated with an individual's nominated main problem. The latter approach has a precedent in the quality of life literature, where individuals have been classified according to the problem they consider the most serious (Drummond *et al*, 1997). Such information can be used to identify those disorder pairings which are most disabling, and to provide data to assist the valuations of these comorbid health states.

The aims of this paper are therefore to: (a) describe the epidemiology of self-assessed comorbidity and disability in a

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quasi-community sample; and (b) to develop methods to examine the unique disability associated with disorder groups, whether they occur alone or in combination with other disorder groups, to inform burden calculations.

METHOD

A random sample of 15 000 telephone numbers in a semi-rural area of Australia were contacted. Of the 13 544 numbers which were residential, 9226 (68%) people (selected on the basis of the person in that household with the next birthday) completed a telephone screening instrument for mental disorders derived from that used by Mroczek & Kessler (1994). At the end of that screening interview respondents who were likely to meet criteria for at least one mental disorder (n=1512), and a sample of people unlikely to meet criteria (n=963), were then asked to participate in a three wave health survey. Of the likely cases of mental disorder 1316/1512 (87%) agreed to be interviewed, 729/963 (76%) of the controls also agreed. Of these 2045 people, 1364 (67%) actually completed the computer-assisted personal interview in their homes. This two stage procedure increased the number of cases and hence the power.

Diagnostic instrument

The instrument was designed for the Australian National Survey of Mental Health and Well-Being (Australian Bureau of Statistics, 1998). The focus of that survey was disorders present in the past 12 months. The CIDI–Auto v2.0 (1996) was used to identify respondents with ICD–10 (World Health Organization, 1992) affective, anxiety and substance use disorders. Neurasthenia was identified by an instrument developed by the World Health Organization, Geneva (Tacchini *et al*, 1995). The International Personality Disorder Examination Questionnaire (Slade *et al*, 1998) was used to identify the ICD–10 personality disorder types (here grouped into DSM–IV (American Psychiatric Association, 1994, clusters). Psychosis was not assessed. A modification of the Belloc scale (Andrews *et al*, 1977) was used to identify chronic physical disorders, respondents being asked to respond 'yes' or 'no' to a list of 12 chronic disorders. A listing of all disorders included in this study is provided in Table 1. At the conclusion of the interview, if the individual was likely to meet criteria for more than one disorder (either physical or mental), the symptom clusters they had endorsed were repeated and they were asked to nominate which of these symptoms or disorders 'troubled them the most'. This was taken to be the respondent's main problem.

Disability measures

Disability measures relevant to this study were of general functioning over the past four weeks, using two self-report instruments with established psychometric properties. The Short Form 12 of the Medical Outcomes Study (SF12; Ware *et al*, 1996) was administered at the beginning of the interview following the demographic questions. Two summary scales (physical health and mental health) are obtained, with lower scores indicating greater disablement. The Brief Disability Questionnaire (BDQ; Von Korff *et al*, 1996) was administered at the conclusion of the CIDI interview, and produced two scores: the total score is the sum of the first 11 items (range 0–22), and disability days are the total days over the past month spent in bed or kept from usual activities due to health (see Broadhead *et al*, 1990). Higher total scores and days indicate greater disablement.

Analysis

As this represents a small survey of a disorder-enriched sample, weighting to reconcile the sample demographics with those of the Australian population was not done. The value of the information is therefore relative, not absolute. The CIDI does not ascertain which of two (or more) co-occurring disorders is 'primary' and exclusion rules were not used. This approach is consistent with analyses conducted for the National Comorbidity Survey (Kessler *et al*, 1994) and the Epidemiological Catchment Area Study (Robins *et al*, 1991). The plan of analysis is to present disability data for all diagnoses irrespective of comorbidity, to show the effect of increasing comorbidity on disability, and to show the disability associated with disorder groups. Individual diagnoses were grouped to provide sufficient numbers for stable estimates. The groups were affective, anxiety, substance use and personality disorders. Disability of people with no comorbid disorders were examined first, then disability of people who nominated one disorder as their main problem, and finally we used regression techniques to explore, for each of the mental disorder groups, the effect of comorbidity with the other mental and physical disorder groups.

Multivariate analysis of variance was used to detect group differences for number of comorbid disorders, pure cases diagnostic group, and main problem diagnostic group, using Pillai's significance criterion. Tests of assumptions were satisfactory unless otherwise indicated, and multivariate outliers were removed ($P<0.001$). As the disability measures (dependent variables) were expected to be substantially correlated, Roy–Bargmann stepdown analyses were planned in the event of a significant overall F statistic (Tabachnik & Fidell, 1996). Order of entry of the dependent variables was prioritised on the basis of the size of their univariate F, with the dependent variables with the largest F entered first, followed by the remaining dependent variables in descending order. Higher order dependent variables act as covariates for lower order dependent variables, to determine if these lower order dependent variables account for any residual portion of the significant effect, once the more important dependent variables have been accounted for. The familywise error rate was controlled at 0.05 by setting alpha at 0.0125 for each of the univariate and stepdown tests. In the event of *post hoc* comparisons, a Scheffé-adjusted critical F was employed.

To investigate the relative importance of different combinations of mental disorder categories in determining disability, four separate hierarchical regression analyses were conducted, one for each of the four major diagnostic groups (affective, anxiety, substance use and personality). Hierarchical regression provided a method for assessing the relative importance of the different combinations of disorder groups in predicting disability for each of the diagnostic groups in turn, once the effects of age and gender, physical disorders and other mental disorder groups had been controlled. Assumptions underlying regression analysis were tested and were satisfactory for the four analyses.

RESULTS

Overview of sample

Nine hundred and eight of this enriched sample of 1364 people met criteria for at least one mental or physical disorder. A

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Table 1 Self-reported disability by disorder for all disorders, ranked according to the number of disability days (n=908). Higher Brief Disability Questionnaire (BDQ) scores and lower Short Form 12 of the Medical Outcomes Study (SF12) indicate greater disability

Disorder	n[1]	% comorbid[2]	BDQ days		BDQ total		SF12 physical		SF12 mental	
			Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
Obsessive–compulsive disorder	11	100	11.3	13.3	10.5	7.9	44.1	16.5	33.7	12.6
Kidney disease	20	95	10.6	11.7	9.5	7.4	36.1	16.6	44.6	12.0
Neurasthenia	53	94	10.4	11.2	9.4	5.0	41.6	10.6	38.3	11.9
Chronic bronchitis	53	92	9.9	11.3	9.3	6.7	36.8	15.8	45.1	11.6
Bipolar disorder or mania	23	96	8.6	10.3	6.6	6.6	48.0	11.1	38.4	13.4
Agoraphobia	23	91	8.4	11.9	9.5	7.4	43.2	12.3	37.8	13.5
Dysthymia	32	97	8.0	10.9	7.7	6.0	48.5	11.4	33.8	13.4
Chronic gallbladder or liver trouble	33	97	7.5	10.6	9.7	7.2	37.2	13.8	43.0	10.5
Stomach or duodenal ulcer	76	88	6.8	10.0	7.4	6.1	40.7	14.2	44.7	12.8
PD-Cluster A[3]	50	96	6.7	10.1	7.1	5.6	49.4	11.3	37.2	12.6
Generalised anxiety disorder	115	93	6.6	9.7	8.6	5.6	45.0	12.1	37.4	12.1
Post-traumatic stress disorder	94	91	6.5	9.5	8.1	6.0	44.2	12.3	41.2	12.4
Diabetes	36	81	6.4	9.8	7.5	6.7	39.5	14.6	49.3	11.3
Major depression	187	86	6.3	9.6	7.2	6.0	45.5	12.6	40.0	13.0
Panic disorder	62	90	6.3	10.2	6.9	6.3	46.8	11.3	40.7	11.8
Heart trouble	114	88	6.1	9.4	9.7	5.9	36.6	14.3	49.6	11.4
Cancer	30	77	6.1	9.4	8.1	6.5	40.4	13.6	49.9	11.9
Asthma	155	76	5.7	9.7	7.2	6.4	41.7	14.3	46.6	10.6
Social phobia	69	87	5.6	9.4	6.8	6.2	47.3	12.1	40.9	11.6
PD-Cluster B[4]	29	93	5.6	8.9	5.1	5.0	49.1	9.1	39.9	11.9
PD-Cluster C[5]	96	93	5.5	9.2	6.8	5.5	47.9	10.7	39.3	11.9
Alcohol dependence	43	95	5.4	9.0	6.5	6.1	49.3	10.3	45.3	10.7
Hernia or rupture	66	86	5.4	9.3	8.0	6.4	41.1	13.8	46.8	12.0
Arthritis	362	76	5.3	9.2	7.9	5.8	39.8	12.8	49.2	11.2
Anaemia	53	77	4.8	8.2	5.6	5.1	44.5	13.5	46.1	11.7
Alcohol misuse	73	89	4.4	7.8	6.0	5.6	47.8	10.4	45.3	10.3
High blood pressure	216	74	3.9	7.9	6.6	5.7	43.1	12.8	49.6	11.0
Drug dependence	44	84	3.6	7.2	5.2	5.2	49.7	10.1	42.3	12.6
Drug misuse	25	96	3.2	6.2	5.4	4.6	50.9	8.9	38.7	11.9
Any affective	218	87	6.6	9.8	7.2	6.1	45.9	12.3	39.9	13.0
Any anxiety	255	87	5.6	9.3	7.3	5.8	45.6	12.0	40.9	12.1
Any substance	124	85	4.4	8.1	5.6	5.5	48.4	10.5	44.7	11.1
Any personality	137	92	5.3	9.2	6.7	5.6	48.1	10.7	39.7	12.1
Any mental	465	80	4.9	8.6	6.4	5.8	46.2	12.1	42.9	11.7
Any physical	696	65	4.6	8.7	6.5	5.8	43.2	12.7	48.9	10.8
Any disorder	908	63	4.3	8.3	6.0	5.7	45.0	12.5	47.6	11.3

1. As comorbidity is not accounted for, respondents may appear more than once in the table.
2. Per cent with that diagnosis who met criteria for any other study diagnosis either physical or mental.
3. Refers to ICD–10 personality disorders: paranoid, schizoid.
4. Refers to ICD–10 personality disorders: dissocial, emotionally unstable (impulsive and borderline types), histrionic.
5. Refers to ICD–10 personality disorders: anankastic, anxious, dependent.

third of the sample met criteria for at least one of the surveyed mental disorders, and half reported at least one of the surveyed chronic physical conditions, indicating that the screening process had enriched the sample as intended. The five most common conditions were arthritis (27%), high blood pressure (16%), depression (14%), asthma (11%) and generalised anxiety disorder (8%).

Small differences in demographic characteristics across the five diagnostic groups were noted. People with physical disorders tended to be older (mean age of 54 years) and those with substance disorders tended to be younger (mean 39 years) than the other groups (affective, 45 years; anxiety, 43 years; personality, 43 years). The proportion of females within a diagnostic category was lower for substance use (41%) than the other categories (affective,

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68%; anxiety, 69%; personality, 58%; physical, 63%).

Disability for individual disorders

Self-reported disability was examined for each individual disorder by ranking disorders from highest to lowest on BDQ disability days for all individuals with that disorder (see Table 1 which contains the raw data for this study). This is the only disability measure that has been reported in large-scale survey data. Respondents appear in Table 1 as many times as they have disorders, and thus while the total number of days lost by the 908 respondents is 3866, 13 317 days appear in the table. Thus, the disability reported by the people who met criteria for particular disorders, without accounting for comorbidity, resulted in three times as many days being represented as there actually were. Clearly, while the disability days listed against each diagnosis were reported by people with that diagnosis, these days might equally have been due to a comorbid disorder and not to the listed disorder. Nevertheless, it is obvious from the summary tables that people with mental disorders report considerable disability, disability that is comparable to that reported by people with physical disorders.

Comorbidity and disability

Comorbidity was extensive. Close to two-thirds of those with any disorder (physical or mental) reported more than one disorder. Of this comorbid group, nearly two-thirds reported three or more disorders in the past year. Respondents with a physical disorder had an average of 0.7 other physical disorders while those with a mental disorder met criteria for 1.4 other mental disorders. The disability associated with comorbidity were investigated by determining if increasing numbers of concurrent disorders produced corresponding increments in disability (Table 2). Respondents were classified into one of six groups representing an increasing number of concurrent disorders. There were significant differences in disability across the groups ($F(20,5280) = 29.43$, $P < 0.001$), with the stepdown analysis indicating these differences were detected by all four disability measures (stepdown F's, significant at an adjusted P value of 0.0125: BDQ total $F(5,1320) = 95.13$; SF12 mental summary

Table 2 Number of disorders (physical or mental) and disability: means and standard deviations for disability measures (Short Form 12 of the Medical Outcomes Study (SF12) mental and physical summary scales and Brief Disability Questionnaire (BDQ) total and disability days) and MANOVA results for differences between number of disorders ($n=1326$)

Disability measure	Number of disorders											
	None, $n=435$		One, $n=328$		Two, $n=215$		Three, $n=157$		Four, $n=75$		Five or more, $n=116$	
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
BDQ total	1.5	2.4	3.8	4.5	5.2	5.1	7.6	5.8	8.6	5.8	9.4	5.8
SF12 mental scale	53.0	6.7	51.4	8.2	48.4	11.3	48.0	11.0	43.2	11.4	37.8	12.2
SF12 physical scale	52.8	6.1	48.3	10.5	45.8	11.6	42.2	13.4	40.8	14.3	42.0	13.2
BDQ disability days	0.6	1.9	2.2	6.0	2.3	5.8	4.3	7.4	7.2	11.0	8.9	10.7

Multivariate $F(20,5280)=29.43$, $P<0.001$.
Summary of contrasts of number of disorders (d.f.=5,1320, Scheffé critical F, $^*P<0.001$): 0 v. >0: BDQ total $F=381.67^*$, SF12 mental $F=164.29^*$, SF12 physical $F=198.27^*$, BDQ days $F=132.33^*$; 1 v. >1: BDQ total $F=149.63^*$, SF12 mental $F=114.56^*$, SF12 physical $F=55.00^*$, BDQ days $F=60.86^*$; 2 v. >2: BDQ total $F=68.76^*$, SF12 mental $F=43.14^*$, SF12 physical $F=20.51^*$, BDQ days $F=66.39^*$; 3 v. >3: BDQ total $F=8.11$, SF12 mental $F=54.58^*$, SF12 physical $F=0.42$, BDQ days $F=30.09^*$; 4 v. >4: BDQ total $F=1.33$, SF12 mental $F=15.79^*$, SF12 physical $F=0.63$, BDQ days $F=3.48$.

Table 3 Pure disorders (no comorbidity) and disability: means and standard deviations for disability measures (Short Form 12 of the Medical Outcomes Study (SF12) mental and physical summary scales and Brief Disability Questionnaire (BDQ) total and disability days) and MANOVA results for differences between pure disorder diagnostic groups: affective, anxiety, substance use, personality, and physical disorders ($n=325$)

Disability measure	Pure disorder diagnostic categories									
	Affective, $n=27$		Anxiety, $n=34$		Substance, $n=18$		Personality, $n=10$		Physical, $n=236$	
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
SF12 mental scale	49.8	9.4	44.2	10.0	50.2	6.2	50.2	6.9	52.7	7.8
SF12 physical scale	48.7	10.5	49.8	11.5	51.4	10.7	49.2	11.1	47.6	10.4
BDQ total	3.4	4.2	4.3	6.0	2.6	4.1	2.9	4.2	3.9	4.6
BDQ disability days	2.5	5.7	2.7	6.8	0.6	1.7	0.7	1.9	2.7	7.1

Multivariate $F(16,1280)=2.42$, $P<0.01$.
Summary of contrasts of differences between groups (d.f.=4,320, Scheffé critical F, $^*P<0.001$): physical v. mental: SF12 mental $F(4,320)=14.64^*$; anxiety v. other mental: SF12 mental $F(4,320)=10.40^*$; affective v. other mental: SF12 mental $F(4,320)=0.72$; substance v. other mental: SF12 mental $F(4,320)=0.92$; personality v. other mental: SF12 mental $F(4,320)=0.61$.

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Table 4 Main problem analysis: means and standard deviations for disability measures (Short Form 12 of the Medical Outcomes Study (SF12) mental and physical summary scales and Brief Disability Questionnaire (BDQ) total and disability days) and MANOVA results for differences between nominated main problem diagnostic groups: affective, anxiety, substance use, personality, and physical disorders (n=609)

Disability measure	Main problem diagnostic categories									
	Affective, n=80		Anxiety, n=78		Substance, n=23		Personality, n=21		Physical, n=407	
	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
SF12 mental scale	38.8	13.0	39.1	12.3	49.4	6.5	40.6	10.6	51.2	9.5
SF12 physical scale	47.3	11.1	46.1	12.0	49.7	7.6	48.0	12.5	40.4	12.8
BDQ total	7.3	5.6	7.6	5.4	5.7	5.4	6.4	4.7	7.5	5.3
BDQ disability days	6.1	9.7	5.4	8.9	2.6	4.7	5.7	9.7	4.9	8.9

Multivariate $F(16,2416)=10.87$, $P<0.001$.
Summary of contrasts of differences between groups (d.f.=4,604, Scheffé critical F, *$P<0.001$): physical v. mental: SF12 mental $F=80.87$*, SF12 physical $F=37.00$*; substance v. other mental: SF12 mental $F=17.71$*, SF12 physical $F=0.83$; affective v. other mental: SF12 mental $F=4.67$, SF12 physical $F=0.12$; anxiety v. other mental: SF12 mental $F=5.78$, SF12 physical $F=1.35$; personality v. other mental: SF12 mental $F=0.56$, SF12 physical $F=0.01$.

scale $F(5,1319)=38.71$; SF12 physical summary scale $F(5,1318)=3.26$; BDQ days $F(5,1317)=6.45$). *Post hoc* contrasts indicated that increasing numbers of disorders resulted in greater disability: disordered individuals were more disabled than non-disordered, comorbid individuals were more disabled than those with pure or single disorders, and those with three or more disorders were more disabled than those with only two disorders. In addition, respondents with four or more disorders reported significantly more disability days than those with three disorders, and were lower functioning on the SF12 mental scale. The SF12 mental scale also showed a significant difference between those with five or more disorders against those with only four, not surprising given that this survey focused on identifying people with mental disorders.

Disability by diagnosis in the absence of comorbidity

A simple approach to determining the impact of diagnosis on disability is to compare disability across disorder groups for people with only one disorder, referred to as pure disorders. As can be seen in Table 3, the numbers in each group were small, however there were significant differences across the groups ($F(16,1280)=2.42$, $P<0.01$). Only the SF12 mental health summary scale detected these differences ($F(4,320)=8.85$, $P<0.001$). Pure anxiety disorders were associated with significantly more disability than the other pure mental disorders. The information in the general disability measure (BDQ total and BDQ days) was similar but the differences were not significant.

Disability associated with the main problem

An alternative method of determining differences in disability between these five diagnostic groups was to compare disability for these disorders when they are nominated as main problems by respondents (see Table 4). A significant difference across the five groups was found on the combined disability measures ($F(16,2416)=10.87$, $P<0.001$), with the stepdown analysis indicating this effect was due to differences on both the SF12 mental health scale (stepdown $F(4,604)=42.21$, $P<0.0125$) and physical health scale (stepdown $F(4,603)=8.35$, $P<0.0125$). *Post hoc* contrasts indicated a significant difference between the physical and mental health main problems on both SF12 summary scales, with the physical group more physically disabled than the mental disorders groups, and the mental disorders groups reporting greater mental health disability than the physical disorders group. Within the mental disorder groups, even when substance use disorders were selected as the principal complaint, these disorders were still significantly less disabling on the SF12 mental scale than the other three mental disorders. Similar levels of disability were reported for affective, anxiety and personality disorder groups.

Regression analysis of disability associated with diagnostic groups

The final method in elucidating disability associated with diagnostic group was to determine, among the mental disorders, whether different combinations of diagnoses were equally disabling. Because of better psychometric properties, the SF12 mental health summary scale was chosen as the dependent measure. Table 5 presents the results of four hierarchical regressions. All four models were significant at $P<0.001$ (affective $F(7,210)=6.19$, anxiety $F(7,247)=8.77$, substance ($F(7,116)=6.18$, and personality ($F(7,129)=4.31$). Age and gender were controlled in Step 1, comorbidity with physical disorder in Step 2 and comorbidity within the disorder group (i.e. the presence of more than one anxiety disorder in the anxiety disorders group) in Step 3. With these confounds controlled, the contribution of one disorder group to the disability noted in another disorder group could be ascertained in Step 4. Comorbidity with an anxiety disorder group predicted additional disability in all other disorder groups. Comorbidity with affective and personality disorder predicted additional disability in anxiety and personality, and affective and anxiety disorder groups, respectively. Comorbid substance disorder did not predict additional disability in any other disorder group.

DISCUSSION

This study reports a method and the results of determining the disability due to a particular disorder or group of disorders when individuals suffer from more than one disorder. It was not a population survey, respondents being selected on the basis of likely morbidity and their preparedness to complete a series of interviews over a

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Table 5 Four hierarchical regressions to determine the relative importance of different comorbidities in predicting mental health disability (after accounting for differences due to age or gender). A separate regression analysis is presented for affective disorders, anxiety disorders, substance use disorders, and personality disorders. The Short Form 12 of the Medical Outcomes Study mental health summary scale was selected as the measure of mental disorder disability due to its sensitivity in detecting differences in the mental disorders

	Affective, n=218			Anxiety, n=255			Substance, n=124			Personality, n=137		
	B	β	sr^2	*B*	β	sr^2	*B*	β	sr^2	*B*	β	sr^2
Age/gender												
Age	−0.10	−0.10		−0.04	−0.05		−0.09	−0.10		−0.11	−0.12	
Gender	1.18	0.04	0.01	2.77	0.11	0.02	−5.10**	−0.23	0.08**	0.29	0.01	0.01
Physical comorbidity[1]	0.55	0.02	0.00	−2.44	−0.10	0.00	−1.35	−0.06	0.00	−0.16	−0.01	0.00
Within category[2] comorbidity[1]	3.86**	0.13	0.04**	2.15**	0.08	0.03**	2.72**	0.12	0.04**	1.41	0.06	0.01
Diagnostic comorbidity[1]												
Affective	–	–		8.38***	0.34		3.74	0.15		8.07***	0.33	
Anxiety	6.65***	0.26		–	–		5.32*	0.23		4.44*	0.18	
Substance	−1.74	−0.04		0.33	0.01		–	–		0.51	0.02	
Personality	5.01*	0.17	0.12***	3.81*	0.15	0.15***	3.78	0.16	0.15***	–	–	0.17***
		R^2=0.17			R^2=0.20			R^2=0.27			R^2=0.19	
		adj. R^2=0.14			adj. R^2=0.18			adj. R^2=0.23			adj. R^2=0.15	
		R=0.41***			R=0.45***			R=0.52***			R=0.44***	

*P < 0.05.
**P < 0.01.
***P < 0.001.
1. Dichotomous variables (present or absent for that disorder).
2. Comorbidity within that mental disorder type.

number of years. None the less, while the prevalence rates are inflated, the relationship among the variables should be reflective of that in full population surveys. Confirmation of results from a population survey will be needed and is forthcoming.

The aims of this study were to describe the patterns of comorbidity and disability observed in this sample, and to develop methods to determine which disorder groups (anxiety, affective, substance use and personality disorder) were important in producing disability based on pure case, main problem and regression techniques.

The first part of the analysis provided a comparison of disorders based on self-reported disability and showed that the mental disorders were significant causes of disability, comparable to the disability produced by physical disorders, and that disability increased according to the number of disorders reported. When the respondent reported only one mental disorder, then disability was highest if that was an anxiety disorder. However, comorbidity was the norm rather than the exception, and this was most apparent among the mental disorders. When disability associated with the nominated main problem was examined, the anxiety, affective and personality disorder groups showed comparable disability, and substance use disorders were associated with less disability. The regression analysis allowed the effect of age, gender, physical disorder comorbidity and within group disorder comorbidity to be controlled, before estimating the effect of any comorbid disorder on the disability reported by respondents with one of the four major groups of disorders. The significant comorbidity that contributed to additional disability was any co-occurrence with the anxiety disorder group (Andrews, 1996), and to a slightly lesser extent, with the affective or personality disorder groups. These unexpected findings, while not novel (Goering *et al*, 1996; Kessler & Frank, 1997), certainly need to be explored further. Comorbidity with either physical disorders or substance use disorders did not predict additional disability over and above that due to the mental disorder being studied. Thus, whether the problem is approached statistically or by asking the respondent, the conclusions are that comorbidity with substance disorders is not as disabling as comorbidity between affective, anxiety or personality disorders, and of these three, comorbidity with anxiety disorders is the most significant.

The major difference between these and the Murray & Lopez data are the lowered estimates of disability associated with either affective disorders or substance use disorders, in comparison to the other mental disorders. The first possible cause for this difference involves the methodology of the original study, and can apply to both depression and substance disability weights. The case of depression used in the Global Burden of Disease weightings was, in terms of number of symptoms, above the median number of symptoms reported in population surveys. For substance use, the clinician estimates used in the burden of disease calculations would tend to inflate the disability due to substance use, as only a small minority of such people are seen in clinical practice, and they are the more severe. Moreover, as the person-trade-off method of estimating disability weights incorporates societal values, clinician ratings will be inflated by the current concern over drug use. These possibilities can be addressed with revisions of the person-trade-off methodology, work

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which is currently underway. Other explanations for the differences relate to aspects of this current study. It is possible that the diagnostic classification system could be less conservative for substance use, and thus more milder cases are included in this analysis, decreasing the average level of disability. This is unlikely, for the ICD–10 classification system is more conservative than DSM–IV in the diagnosis of harmful use (Grant, 1996). It could also be that low levels of disability in this study may be a function of this particular sample, as the survey area is one where recreational drug use is often seen as part of the lifestyle. This possibility will be addressed in analysis of a national survey of mental disorders, which is currently underway.

Personality disorders were not included in the Global Burden of Disease study, and they have rarely been included in population surveys. This survey reports disability for the full complement of ICD–10 personality disorders, albeit grouped in clusters for this analysis. The present data would indicate they produce similar levels of disability as the anxiety and affective disorders.

Further work is required on using self-report disability to inform Global Burden of Disease calculations, with particular consideration given to the measure of disability chosen. There is a role for self-report data in expanding the descriptive information provided for the health state valuation exercise, and these data can also be used to refine the epidemiological estimates for calculating years of life lost due to disablement. For these purposes, the scoring of the SF12 makes it particularly sensitive to differences in either physical or mental health disability, and thus it detected differences that the BDQ did not. The BDQ was designed primarily as a measure of physical disability (Ormel *et al*, 1995). Nevertheless, disability days are a convenient measure of disability and have been used in mental health surveys (Broadhead *et al*, 1990; Kouzis & Eaton, 1994; Kessler, 1995; Goering *et al*, 1996), however, in comparison to the other measures used in this study, BDQ days were not a particularly sensitive measure, even when outliers were excluded.

This study suggests that not all comorbidities produce equivalent disability. While comorbidity *per se* is disabling, with the multiply comorbid being shown to be more disabled than those with only two disorders, differences were also detected between disorder combinations. If disability weights were to be developed for selected comorbid combinations, as has been suggested by Murray (1996), it would not just be the prevalence of comorbidity that is important, but the more complex calculation of disability associated with each of these co-occurrences. Comorbidity with affective, anxiety and personality disorders is predictive of disability, so these combinations could provide a starting point for the development of unique weights for disorder combinations. Disability associated with the main problem disorder produced similar findings.

There is debate on whether high prevalences for comorbidity are an artefact of the diagnostic classification systems (Lilienfeld *et al*, 1994; Wittchen, 1996). Furthermore, the validity of the concept of comorbidity has itself been questioned, given that the latent structure of many disorders themselves are poorly understood, particularly for the personality disorders (Lilienfeld *et al*, 1994). Lilienfeld *et al* (1994), like Murray & Lopez (1996*a*), draw the distinction between diagnostic co-occurrence (equivalent to independent comorbidity) and diagnostic covariation (equivalent to dependent comorbidity). Accuracy of the diagnostic classification system used, and how overlapping symptom clusters are categorised, also requires consideration. Recent work on the concordance (or lack of) between the DSM–IV and ICD–10 classifications in the present data also give cause for caution (Andrews & Slade, 1998; Andrews *et al*, 1998).

This study is unusual in producing standardised disability measurements for all the major mental disorders, including neurasthenia and personality disorder, and for common chronic physical disorders. The effects of episode comorbidity can be severe, but this study has allowed the identification of diagnostic combinations that are of particular importance in producing such disability. Examining disability associated with the main problem as a method for teasing out the effects of comorbidity is also novel within the psychiatric epidemiology literature, and provides a complimentary analysis to the main data set. Clear questions for future research include the use of a large epidemiological data set to estimate the disability associated with individual disorders, alone and in combination, and understanding the mechanism behind perceptions of comorbidity and how people choose between them to nominate a main problem. Furthermore, it will be important to recalculate the burdens attributed to the individual mental disorders, controlling for comorbidity, so that psychiatry can use the information from the Global Burden of Disease studies to argue for appropriate funding. We will need to be very sure of our data if we are to obtain funds commensurate with the burden of mental disorder and the health gains likely from good treatment.

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CLINICAL IMPLICATIONS

- Disability associated with mental disorders is comparable to disability associated with physical disorders.
- Despite the comorbidity which is endemic in mental disorders, it is possible to estimate the disability to be attributed to each disorder.
- Comorbidity is an important issue to be addressed in burden of disease studies.

LIMITATIONS

- Data were derived from a two-stage survey in which there were appreciable numbers of non-responders.
- Survey material does not contain direct observations of disability.
- The sample size did not allow combinations of individual diagnoses to be examined for their disabling consequences.

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