Estimating the true global burden of mental illness

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We argue that the global burden of mental illness is underestimated and examine the reasons for under-estimation to identify five main causes: overlap between psychiatric and neurological disorders; the grouping of suicide and self-harm as a separate category; conflation of all chronic pain syndromes with musculoskeletal disorders; exclusion of personality disorders from disease burden calculations; and inadequate consideration of the contribution of severe mental illness to mortality from associated causes. Using published data, we estimate the disease burden for mental illness to show that the global burden of mental illness accounts for 32·4% of years lived with disability (YLDs) and 13·0% of disability-adjusted life-years (DALYs), instead of the earlier estimates suggesting 21·2% of YLDs and 7·1% of DALYs. Currently used approaches underestimate the burden of mental illness by more than a third. Our estimates place mental illness a distant first in global burden of disease in terms of YLDs, and level with cardiovascular and circulatory diseases in terms of DALYs. The unacceptable apathy of governments and funders of global health must be overcome to mitigate the human, social, and economic costs of mental illness.

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Introduction

Mental health is defined by WHO as "a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community".[1] This state, however, is disrupted in one of every three individuals— or more—during their lifetimes.[2,3]

Worldwide the magnitude of mental illness has been emphasised by studies on the global burden of disease.[4] Yet, in spite of the very considerable burden and their associated adverse human, economic, and social effects, global policy makers and funders have so far failed to prioritise treatment and care of people with mental illness.[5,6] Consequently, people with mental illness worldwide are largely neglected.[6] Pervasive stigma and discrimination[7,8] contributes, at least in part, to the imbalance between the global burden of disease attributable to mental disorders, and the attention these conditions receive. Stigma, embodied in discriminatory social structures, policy, and legislation, produces a disparity between services geared to physical health and mental health, with lower availability, accessibility, and quality of services for the latter.[9]

Globally, rapid economic, demographic, and epidemiological transitions mean a growth in populations that are living longer, but with greater morbidity and disability.[10–13] Mental disorders are a major driver of the growth of overall morbidity and disability globally.[14,15]

Five types of mental illness appear in the top 20 causes of global burden of disease (GBD): major depression (second), anxiety disorders (seventh), schizophrenia (11th), dysthymia (16th), and bipolar disorder (17th) were leading causes of years lived with disability (YLDs) in 2013.[11] In this context, this Personal View aims to: offer a constructive critique of current estimates of GBD related to mental illness; argue that in aggregate mental illness is underestimated; and explore an alternative approach to produce more realistic GBD estimates of mental disorders worldwide. We do not propose a different nosology of disorders, but aim to better gauge the disease burden of mental illness. An important benefit of a new GBD estimation is to inform prioritisation of health needs and resource allocation, so our aim is to provide decision makers, who rely on specialists to design and implement policies, with a new set of assumptions and tools to produce more accurate estimations using existing data.

Burden of mental illness: measurement challenges

We argue that the burden of mental illness has been underestimated due to five reasons: the overlap between psychiatric and neurological disorders; the grouping of suicide and behaviours associated with self-injury as a separate category outside the boundary of mental illness; the conflation of all chronic pain syndromes with musculoskeletal disorders; the exclusion of personality disorders in mental illness disease burden calculations; and inadequate consideration of the contribution of severe mental illness to mortality from associated causes.

We discuss each of these measurement issues and methodological considerations. Diagnostic classifications such as the ICD-10 system present challenges: they need to consider both the clinical syndrome and the aetiology of each disorder, with the goal of providing a system that is meaningful at the individual explanatory and therapeutic levels, considering the presentation of the illness as well as its natural history. Further, ICD-11, which is under development and is expected to be released in 2018 by the World Health Organization, is identified by the Advisory Group for ICD-11 as a better method for categorising burden of mental illness than ICD-10, but without specific mention of improvements in the estimation of GBD related to mental disorders as a goal for the revision.[16]

The GBD estimation framework uses a comprehensive, mutually exclusive hierarchical list of disorders based on the ICD-10 classification mainly for two reasons: to take advantage of a common nosological language, and to

account for 100% of the disease burden without double counting (appendix). But GBD differs from nosological systems: instead of the individual level, it is mainly concerned with the population level; and instead of informing individual aetiology and therapy, it needs to allow for a better understanding of disease distribution and transitions, to guide prioritisation of population health needs and organisation of health services.

The actual grouping of disorders used by the GBD—a hierarchical cause list comprising four levels of aggregation—is sometimes based on clinical grounds (such as with cardiovascular and circulatory conditions, a level 2 aggregation), and sometimes on a mix of disease or anatomical criteria (such as diabetes, urogenital, blood, and endocrine disorders, also level 2).[17] Consideration of more pertinent criteria for aggregation is warranted (appendix).

The psychiatric–neurological interface

Traditionally, disorders both affecting the central nervous system and producing mental disorders were divided between psychiatric and neurological conditions: if the syndrome had a clear neuroanatomical or neurophysiological basis it was considered neurological; if not, it was deemed psychiatric. However, this dual distinction has more to do with professional areas of competence than scientific logic. For example, schizophrenia, considered a psychiatric disorder, affects the brain's anatomy and physiology, and secondarily produces the cognitive, affective, and behavioural symptoms that constitute the mental syndrome. On the other hand, epilepsy, typically considered a neurological disorder, includes conditions such as temporal-lobe epilepsy, in which a clearly identifiable psychiatric syndrome is frequently accompanied by an absence of electroencephalographic abnormalities. Given that the nosological classification for these disorders is in flux and the division between them is somewhat arbitrary, other criteria should be used when aggregating diseases for measuring burden. In this respect, in addition to their presentation as psychiatric syndromes, these disorders pose a common challenge at the primary care level, particularly in low-income and middle-income countries, and a common grouping would make this more visible to planners and funders.

Categorising suicide and intentional self-harm

In 2013, mental illness accounted for 21·2% of the YLDs worldwide—higher than any other group of conditions.[11] However, using the composite measure disability-adjusted life-years (DALYs), the burden of mental illness accounted for 7·1%, ranking fifth overall in terms of GBD.[18,19] The gap between the burden of mental illness as measured by years lived with disability and that measured by DALYs is explained by the fact that DALYs underestimate mental illness mortality due to suicide, to the disease process itself, and to reasons secondary to the mental disorder. Suicide and all forms of self-harm, which are to a large extent imputable to mental disorders, are coded under injuries, and are excluded from calculations of the effect of mental illnesses.[10,20,21]

Ferrari and colleagues[21] studied mental disorders as risk factors for suicide by reviewing existing literature, pooling relative-risk estimates, and then estimating what percentage of deaths by suicide could be causally linked to several mental disorders (mainly mood and anxiety disorders, substance misuse, and schizophrenia). After reviewing the psychological autopsy studies available, the authors assign ceiling values to account for cultural variability in the causal relation between mental illness and suicide, and suggest an addition of 22 million DALYs amounting to 0·9% of total DALYs to the mental illness burden. These estimates would have been higher if all self-harm (suicide, attempted suicide, and self-injurious behaviour) due to mental illness and sub-syndromal conditions were included. Ferrari and colleagues reduce the attribution of lethal self-harm to the mental illness burden based on two arguments: the authors put a cap of 68% to suicides attributable to mental illness taking place in China, India, and Taiwan, which account for 50·0% of the world's suicides, and of 85·0% to those happening elsewhere, and they do not include suicides in the context of sub-syndromal states (eg, impulsive states, which are common in the context of personality disorders, also excluded from the GBD).

From a clinical and public health perspective we have three caveats with the approach used by Ferrari and colleagues:[21] first, it does not account for non-lethal self-harm, which includes both attempted suicide and self-injurious behaviour; second, by excluding suicides in the context of sub-syndromic states and restricting the assessment to specific disorders, it leaves around 25·0% of the world's suicides and 39·0% of suicide burden in the category of injuries, along with traffic accidents, where they clearly do not belong; and third, the assignment of a low ceiling due to cultural considerations in China, India, and Taiwan is questionable because cultural differences could mean that stigma associated with mental illness but not with suicide leads to under-reporting of the causal link. For example, in China, suicide has been established as a frequent outcome in the context of mental syndromes, even in the absence of full diagnostic criteria. Case-control studies of non-lethal attempted suicide have shown that people had substantially higher stress, impulsiveness, and aggression, more severe depressive symptoms, and were more likely to meet criteria for a psychiatric diagnosis. Of the psychological factors, severity of depressive symptoms in the two preceding weeks was the most substantial, to the extent that suicide in China is linearly related to severity of depression.[22,23] The limitations of the psychological autopsy studies on which Ferrari and colleagues base their rationale for excluding a third of the global self-harm disease burden from mental disorders

allow for a very different conclusion: the existence of a psychiatric diagnosis was established indirectly by interviewing family members, and personality disorders were excluded from the assessment, potentially leading to substantial under-registry.[24] In this context, the attribution of self-harm—lethal or not—to impulsiveness, aggression, and availability of a lethal tool, does not disprove the existence of an underlying mental disorder. The authors draw attention to these limitations, acknowledging that the conventional wisdom that suicide is almost always the outcome of mental illness will not be altered by their studies.[25] In other words, the absence of unequivocal evidence of the causal link is not evidence of absence of a causal link. Hence, the decision to allocate disease burden from suicides to injuries or to mental disorders needs to be carefully considered.

In this context, and with insufficient evidence, what is the preferred choice between different burden estimation methods? The rationale by Ferrari and colleagues[21] to leave all non-lethal self-harm and a quarter of the world's suicides—therefore more than a third of self-harm DALYs—in the injuries aggregation does not seem justifiable. We find it preferable from a population health perspective to aggregate all self-injuries with the mental health-related disease burden, with the caveat that it is likely to incorrectly include the burden of suicides that can be judged to be non-mental health related, such as assisted suicide (producing a much smaller error than the alternative approach).

Chronic pain syndromes

Musculoskeletal conditions were the second major cause of YLDs[11] and seventh ranked cause of DALYs in 2013 globally.[26] These conditions include anatomically based disorders (such as osteoarthritis and rheumatoid arthritis), and also syndromes and symptoms (eg, fibromyalgia, low back pain) characterised by pain but without specific anatomical correlates. The allocation of the burden corresponding to these syndromes in total to the musculoskeletal aggregation is problematic because: a substantial proportion of these disorders, which account for up to 6·1% of DALYs globally, should actually be classified as either chronic pain syndrome (considered

as disorders of the nervous system by the ICD-10 classification but should be considered as mental and behavioural disorders) or somatoform disorder (considered as mental and behavioural disorders in ICD-10); the prevalence of these pain disorders in patients with a major affective, anxiety, or stress-related disorder exceeds 30%, and in certain samples with post-traumatic stress disorder reaches 80%; and they converge with chronic mental illness at the therapeutic and service delivery level. These caveats suggest the existence of subpopulations with a common syndrome, which are difficult to classify from a nosological perspective (appendix). We argue that when estimating disease burden, it is reasonable to attribute a proportion of these conditions to mental illness.

Including people with personality disorders

Personality disorders are common (4–15% in point prevalence community surveys)[27] and when severe impose a substantial burden both at personal, family, community, and population levels. People with personality disorders have shorter life expectancy and higher comorbidity with other general and mental illnesses than the general population.[27] However, due to the inconsistent quality of the evidence, personality disorders were not included in GBD 2013 estimates within the overall category of mental illness.[26] Although a proportion of the disease burden of personality disorders might be under the other mental and substance use disorders aggregation, this hardly captures their true relevance and the need to consider them in their own right. Another portion, arguably substantial, might be captured under the musculoskeletal aggregation, given that 30% of people diagnosed with chronic pain syndromes also have personality disorder.[28] Finally, we have seen that personality traits such as impulsivity and aggression, as well as depressive symptoms, frequently provide the psychological context in which self-harm occurs, providing a rationale to aggregate self-harm under the mental disorder burden. Though our re-allocation of self-harm and a fraction of chronic pain (see below) partially recaptures this burden, there is not enough data to comprehensively account for the burden of personality disorders.

For the **Global Burden of Disease Study 2013 data downloads** see http://ghdx. healthdata.org/global-burden-disease-study-2013-gbd-2013-data-downloads

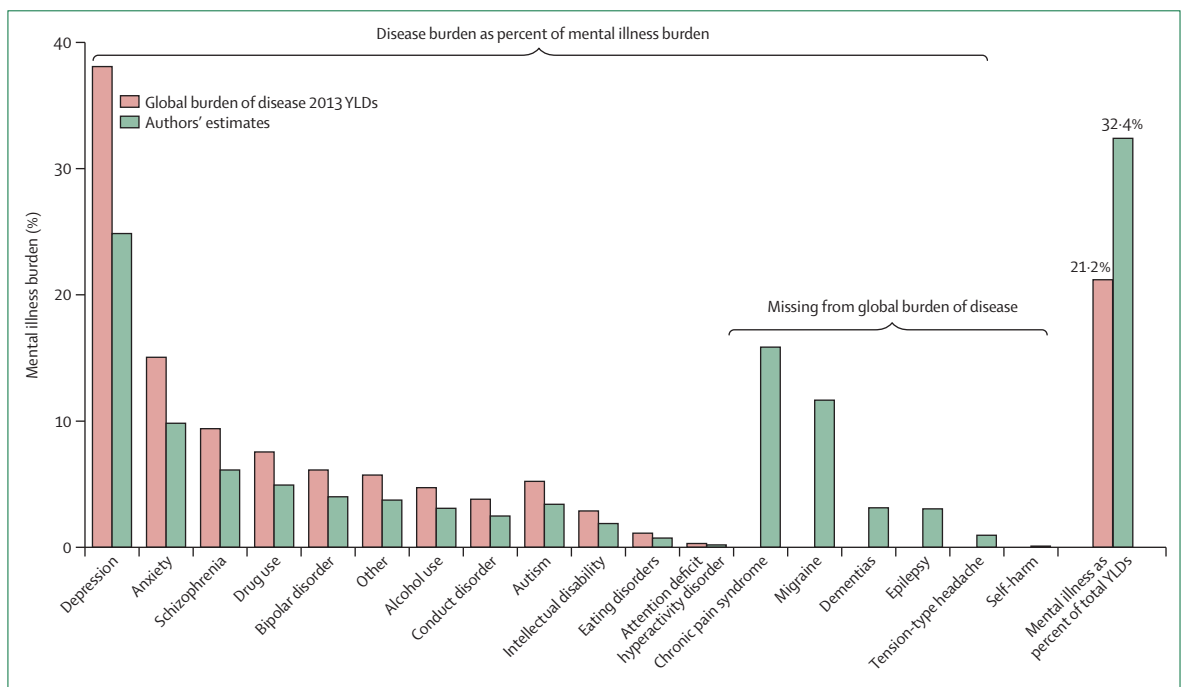|	Global burden of disease 2013	DALYs (%)	Reallocating neurological disorders*	DALYs (%)	Reallocating self-harm†	DALYs (%)	Reallocating chronic pain syndrome‡	DALYs (%)
Rank 1	Cardiovascular disease	13·5%	Cardiovascular disease	13·5%	Cardiovascular disease	13·5%	Cardiovascular disease	13·5%
Rank 2	Common infections	10·2%	Common infections	10·2%	Mental Illness	11·2%	Mental illness	13·0%
Rank 3	Cancer	8·1%	Mental illness	9·8%	Common infections	10·2%	Common infections	10·2%
Rank 4	Neonatal	7·7%	Cancer	8·1%	Cancer	8·1%	Cancer	8·1%
Rank 5	Mental illness	7·1%	Neonatal	7·7%	Neonatal	7·7%	Neonatal	7·7%

Analysis based on data from Murray and colleagues (2015)[19] and from the Global Burden of Disease Study 2013 data download website. *Neurological disorders repositioned to mental illness: dementias, epilepsy, migraine, tension-type headache (66 872 300 DALYs). †Self-harm repositioned to mental illness: 35 170 400 DALYs. ‡A third of the 131 697 900 DALYs (1·8%) of potential chronic pain syndrome currently attributed to musculoskeletal disorders is reattributed to mental disorders.

Table 1: Effect of reallocating disability-adjusted life-years (DALYs) of neurological disorders, self-harm, and a fraction of chronic pain syndrome

	Global burden of disease 2013	YLDs (%)	Reallocating neurological disorders*	YLDs (%)	Reallocating self-harm†	YLDs (%)	Reallocating chronic pain syndrome‡	YLDs (%)
Rank 1	Mental illness	21·2%	Mental illness	27·2%	Mental illness	27·3%	Mental illness	32·4%
Rank 2	Musculoskeletal	20·9%	Musculoskeletal	20·9%	Musculoskeletal	20·9%	Musculoskeletal	15·7%

Analysis based on data from Global Burden of Disease Study 2013 Collaborators.[11] *Neurological disorders repositioned to mental illness: dementias, epilepsy, migraine, and tension-type headache (46 579 100 YLDs). †Self-harm repositioned to mental illness: 231 600 YLDs. ‡Applying the same rationale and repositioning the same proportion as in table 1 from musculoskeletal to mental illness (5·1 percentage points [about a third of 15·7%], which are the YLDs attributable to chronic pain syndromes and other musculoskeletal disorders, excluding anatomically based lesions).

Table 2: Effect of reallocating years lived with disability (YLDs) of neurological disorders, self-harm, and chronic pain syndrome

Figure 1: Comparison of Global Burden of Disease 2013 years lived with disability (YLDs) with the authors' estimates
Analysis based on data from Global Burden of Disease Study 2013 Collaborators.[11]

Premature mortality

People with severe mental illness have up to 60% higher chances of dying prematurely from non-communicable diseases[29] that are neglected because of the underlying mental condition. They die 10–20 years younger than their peers in high-income countries, and 30 years younger in low-income countries.[30–32] Charlson and colleagues[33] estimate that up to 8% of years of life lost globally corresponded to excess deaths due to mental health-related conditions including dementia, epilepsy, and migraine. A recent systematic review estimated that 14·3% of deaths worldwide, or about eight million deaths each year, are attributable to mental disorders.[32] However, mental disorders appear to only account for 0·5% of total years of life lost because GBD estimates only show deaths directly attributed to mental disorders recorded in death certificates (mostly due to schizophrenia and substance misuse), which leads to zero global deaths attributed to bipolar disorder, depression, and other mental illnesses.

The result with current methods, which does not count excess deaths due to self-harm and increased overall mortality, is that in the case of mental illness, DALYs are basically YLDs. The issue of self-harm can be partially addressed through aggregation (see below), but the issue of increased mortality due to general conditions poses a very complex challenge. GBD methodology is based on zero-sum attribution, which means that if a patient with schizophrenia suffers a fatal myocardial infarction at age 55 years as a result of smoking, for which she is at increased risk, and neglected metabolic syndrome—a likely consequence of antipsychotic medication—then her years of life lost will be included in the cardiovascular DALYs. In the context of increasing non-communicable disease comorbidities, the tradition of attributing mortality to a single disease should be reassessed, and alternative approaches explored, such as partial attribution of years of life lost resulting from a single death to different frequently co-occurring disorders.
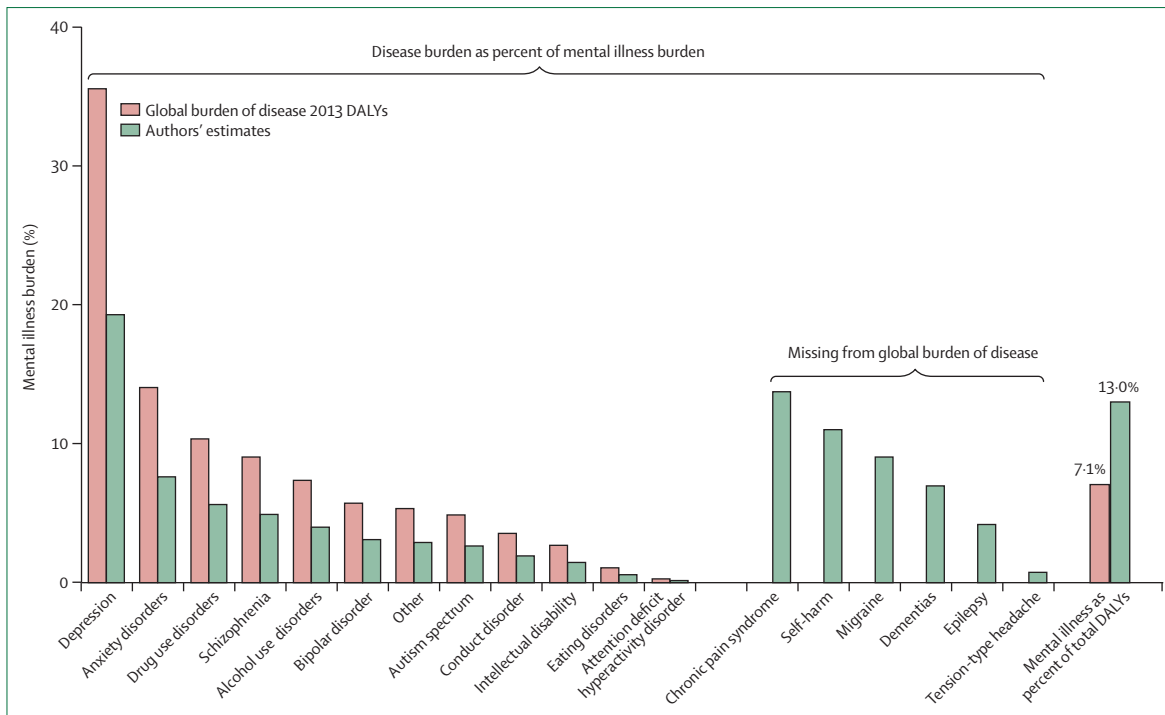
Figure 2: **Comparison of Global Burden of Disease 2013 disability-adjusted life-years (DALYs) with the authors' estimates**
Analysis based on data from GBD 2013 DALYs and HALE Collaborators.[19]

## Revising DALYs (2013) estimates for mental illness

For the reasons set out above we propose that when estimating disease burden, certain neurological syndromes (ie, the dementias, epilepsy, tension-type headache, and migraine) should be aggregated within the overall category of mental illness. This adjustment would move the total rank of mental illnesses in the GBD tables from fifth to third place overall, accounting for 9·8% of DALYs globally (table 1). Repositioning all DALYs related to self-harm from the category of injuries to mental health would increase the number of DALYs from 9·8% to 11·2%, placing it second in the ranking (table 1).

Chronic pain syndromes can potentially account for a substantial fraction of the 5·4% of DALYs currently attributed to low back, neck pain plus other musculoskeletal pain, once we exclude entities for which there is evidence of a musculoskeletal critical mechanistic level (such as arthritides and gout). As shown in the appendix, a proportion of the burden resulting from these syndromes should be aggregated to the mental rather than musculoskeletal disorder burden. However, due to a lack of primary disaggregated data it is not possible to gauge with any precision which portion of the burden of musculoskeletal disorders corresponds to these chronic pain syndromes or which portion of chronic pain syndrome burden corresponds to centrally caused syndromes (and therefore to the mental or neurological burden as previously defined).

Considering that a fraction of low back, neck pain, and 50% of other musculoskeletal pain potentially corresponds to chronic pain syndromes, and for the purposes of producing a more accurate estimation and stimulating debate, we assume given the limited data that one third (rather than zero percent, as it is now) of the disease burden of these pain syndromes is potentially attributable to mental disorders and explore the effect on mental illness burden calculations: re-allocating 1·8% of global DALYs would increase mental illness burden from 11·2% (with certain neurological disorders and self-harm added) to 13·0% of total, practically tied with all cardiovascular and circulatory disorders, which account for 13·5% (table 1).

Revising YLDs (2013) estimates for mental illness

In 2013, mental illness accounted for 21·2% of global YLDs, 3·5 times greater than the disability associated with all infectious diseases (6·0% of YLDs), four times that for all injuries combined (5·0% of YLDs), eight times the disability associated with all cardiovascular and circulatory diseases (2·8% of YLDs), and 24 times the disability associated with all cancers (0·9% of YLDs). Musculoskeletal disorders (plus fractures and soft tissue injuries) accounted for 20·8% of total YLDs.[11] As we have argued above, a substantial portion, which we assume to be 5·1 percentage points (table 2), potentially corresponds to chronic pain syndromes that should not be considered musculoskeletal, but are rooted in the CNS and therefore
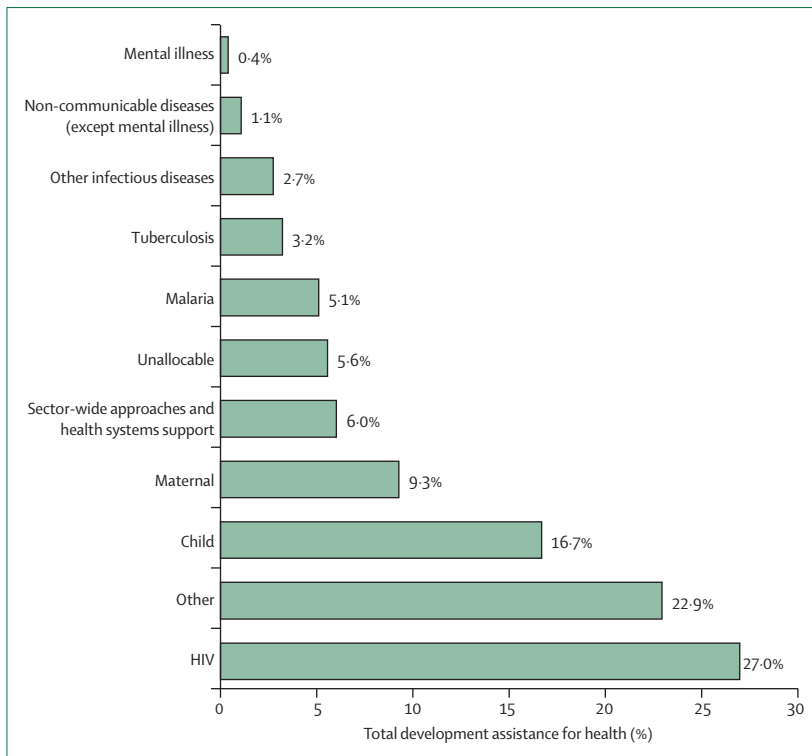
Figure 3: Development assistance for health per area as a percentage of total (US$372·2 billion) from 2000 to 2014

Total funding in 2000–04, $372·2 billion; HIV, $100·4 billion; non-communicable diseases (less mental illness), $4·0 billion; mental illness, $1·5 billion. Analysis based on data from the Institute for Health Metrics and Evaluation (2015).[35]

better understood as part of the burden of mental illness. Applying our framework, the new YLD estimation of mental health-related burden is 32·4%.

Our estimations of disability alone (YLDs) and combined with mortality (DALYs) show that by excluding certain conditions from the mental illness burden current assessments underestimate both YLDs and DALYs by more than a third (figures 1 and 2). We also show that mental illness accounts for a third of the global disability (table 2), instead of a fifth, as currently estimated.

Disproportionately weak global response to mental illness

The global development assistance for health allocated to mental illness is far below the levels warranted by the effect of these disorders. The Millennium Development Goals (MDGs)[34] prioritised child health (MDG 4), maternal health (MDG 5), and communicable diseases (MDG 6), which collectively accounted for 46·9% of DALYs 25 years ago,[18] and attracted most of the development assistance for health reaching 68·0% of the $35·9 billion disbursed in 2014.[35,36] Despite the changing burden of disease, characterised by multi-morbidity and disability,[12] from 2000 to 2014 only 1·5% of the development assistance for health was invested globally

in non-communicable diseases (combined, accounting for 82·0% of YLDs; figure 3),[35,37] whereas none of the MDGs referred to mental illness, which received 0·40% of the development assistance for health despite accounting for 32·4% of YLDs.

The imbalance between disease burden, financing, and service access is reported in countries of different income levels (appendix): global median spending in mental health stands at 2·8% of total government health spending, more than two thirds of which is on average allocated to neuropsychiatric hospitals in spite of international evidence-based recommendations for community-based services.[29] Low-income countries spend a very modest 0·5% of national health budgets on mental health, with up to 90·0% going to stand-alone psychiatric institutions that provide, in population terms, very low rates of treatment (contact) coverage. Although high-income countries provide more services for mental illness than low-income and middle-income countries, there are variations in accessibility and coverage for geographical and socio-economic groups.[38–40]

Discussion

The recent GBD (DALY and YLD) estimates produce an underestimate of the true effect of mental disorders on populations due to: the overlap between psychiatric and neurological disorders; the grouping of suicide and behaviours associated with self-injury as a separate category outside the boundary of mental illness; the conflation of all chronic pain syndromes with musculoskeletal disorders; the exclusion of personality disorders in mental illness disease burden calculations; and inadequate consideration of the contribution of severe mental illness to mortality from associated causes. Using the currently available evidence and specified assumptions to correct the overlap between psychiatric and neurological disorders, the grouping of suicide and behaviours associated with self-injury as a separate category outside the boundary of mental illness, and the conflation of all chronic pain syndromes with musculoskeletal disorders, we provide a more accurate picture of mental illnesses as a leading cause of GBD.

Mental disorders—in various forms and intensities—affect most of the population in their lifetime.[2,3] In most cases, people experiencing mild episodes of depression or anxiety deal with them in ways that allow them to continue living a productive life. A substantial minority of the population, however, experience more disabling conditions such as schizophrenia, bipolar disorder type I, severe recurrent depression, and severe personality disorders. Whereas common mild disorders are amenable to self-management and relatively simple educational or support measures, severe mental illness demands complex, multi-level care that might need a longer-term engagement with the individual, and with the family. Hence, a more nuanced and accurate picture of mental health-related burden is crucial to effectively

allocate resources and appropriately design health systems in proportion to the nature and the scale of these challenges.

Universal health coverage, identified as a Sustainable Development Goal,[41] offers opportunities for addressing the neglect for mental illnesses, which constitute, along with all cardiovascular plus circulatory disorders (13·0% and 13·5%, respectively), the leading causes of global disease burden. Of particular importance is the inclusion of the mental health indicators proposed in the 2015 Global Reference List of Core Health Indicators[42] (appendix).

The main limitation of this study is the difficulty of quantifying the disease burden associated with personality disorders, excess all-cause mortality secondary to mental illness, and chronic pain syndrome burden as part of the mental illness burden. Regarding personality disorders and excess all-cause mortality, data for further evidence-based assumptions are required, so their contribution remains to be determined. Regarding chronic pain syndromes, there is partial evidence to make a scientifically informed assumption that in our view provides a better estimate than the current hypothesis of zero percent attribution. However, the speculative nature of the portion of the chronic pain burden considered by the authors to be related to mental health—one third—remains hypothetical.

Globally, achieving effective coverage will demand concerted global stewardship to increase funding for mental illness, better allocate resources, and improve integration of services for mental illness with other health services.

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