Scaling-up treatment of depression and anxiety: a global return on investment analysis

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Summary

Background Depression and anxiety disorders are highly prevalent and disabling disorders, which result not only in an enormous amount of human misery and lost health, but also lost economic output. Here we propose a global investment case for a scaled-up response to the public health and economic burden of depression and anxiety disorders.

Methods In this global return on investment analysis, we used the mental health module of the OneHealth tool to calculate treatment costs and health outcomes in 36 countries between 2016 and 2030. We assumed a linear increase in treatment coverage. We factored in a modest improvement of 5% in both the ability to work and productivity at work as a result of treatment, subsequently mapped to the prevailing rates of labour participation and gross domestic product (GDP) per worker in each country.

Findings The net present value of investment needed over the period 2016–30 to substantially scale up effective treatment coverage for depression and anxiety disorders is estimated to be US$147 billion. The expected returns to this investment are also substantial. In terms of health impact, scaled-up treatment leads to 43 million extra years of healthy life over the scale-up period. Placing an economic value on these healthy life-years produces a net present value of $310 billion. As well as these intrinsic benefits associated with improved health, scaled-up treatment of common mental disorders also leads to large economic productivity gains (a net present value of $230 billion for scaled-up depression treatment and $169 billion for anxiety disorders). Across country income groups, resulting benefit to cost ratios amount to 2·3–3·0 to 1 when economic benefits only are considered, and 3·3–5·7 to 1 when the value of health returns is also included.

Interpretation Return on investment analysis of the kind reported here can contribute strongly to a balanced investment case for enhanced action to address the large and growing burden of common mental disorders worldwide.

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Introduction

Worldwide, investments in mental health are very meagre. Data from WHO's Mental Health Atlas 2014 survey[1] suggest that most low-income and middle-income countries spend less than US$2 per year per person on the treatment and prevention of mental disorders compared with an average of more than $50 in high-income countries. As a result of this limited investment in public mental health, a substantial gap exists between the need for treatment and its availability. This large treatment gap affects not just the health and wellbeing of people with mental disorders and their families, but also has inevitable consequences for employers and governments as a result of diminished productivity at work, reduced rates of labour participation, foregone tax receipts, and increased health and other welfare expenditures. Findings of several national and international studies[2–5] have shown the enormous economic challenge these disorders pose to communities and society at large as a result of foregone production and consumption opportunities as well as health and social care expenditures. In 2010, worldwide, an estimated US$2·5–8·5 trillion in lost output was attributed to mental, neurological and substance use disorders, depending on the method of assessment used.[2] This sum is expected to nearly double by 2030 if a concerted response is not mounted.[2] In view of this concern, the promotion of mental health and wellbeing have been explicitly included in the United Nations' 2015–30 Sustainable Development Goals.[6]

Cost-effectiveness studies have largely restricted themselves to a consideration of the specific implementation costs and health outcomes of an intervention, and have typically not extended to a full estimation of the wider socioeconomic value of investment in mental health innovation and service scale-up. As shown in the *Lancet* Commission on Investing in Health, elucidation and enumeration of these wider economic and social benefits provides a more comprehensive assessment of the returns on investment.[7] In particular, increasing attention and emphasis is being given to extending valuation to also include the intrinsic value of improved health (a so-called full income approach to national accounting).[7]

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Research in context

Systematic review
We did a systematic review of studies published until Jan 1, 2015, of the effect of treatment of depression and anxiety disorders on economic outcomes (return to work, absenteeism, and presenteeism rates). We searched an existing database on psychological treatments of depression, which has been described in detail by Cuijpers and colleagues, and has been used in a series of earlier published meta-analyses. We identified abstracts by combining terms indicative of psychological treatment and depression (both medical subject headings terms and text words; search terms listed in appendix p 4). For this database, we examined 17 061 abstracts from PubMed (4007 abstracts), PsycINFO (3147 abstracts), Embase (5912 abstracts), and the Cochrane Central Register of Controlled Trials (3995 abstracts). We included all randomised trials comparing a psychological treatment with a control condition (waiting list, care as usual, placebo), another psychological treatment, pharmacotherapy, or combined treatment. We excluded studies in adolescents, children, and inpatients, and maintenance trials. We scrutinised all 440 studies identified in this database for economic outcome data. Although four studies had data for functioning at work,

they did not report sufficient detail. Accordingly, we did an additional search on May 21, 2105, to widen our search to include anxiety disorders with greater emphasis on economic outcomes in PubMed, EMBASE, PsycINFO and the Cochrane Library (search terms listed in appendix p 5). We found few useful data and these could not be synthesised meta-analytically. The same conclusion was made in a similar review of the scientific literature.

Interpretation
This analysis sets out a model linking the prevalence of depression and anxiety disorders with expected health and economic benefits of scaled-up treatment, including restored labour participation and productivity. Results from the analysis suggest that monetised benefits of better health and labour force outcomes outweigh the costs of achieving them by 2·3–3·0 to 1 when economic benefits only are considered, and 3·3–5·7 to 1 when the value of health returns is also included.

Treatment of common mental disorders leads to improvements in economic production and health outcomes. Clinicians should increase the detection and management of people with depression and anxiety disorders.

Here we did a global return on investment analysis for mental health in people aged 15 years and older focusing on depression and anxiety disorders, which are the most prevalent mental disorders. These disorders lead to large losses in work participation and productivity, and yet lend themselves to effective and accessible treatment as part of an integrated programme of chronic disease management.[8–10]

Methods

Analytical framework
Because depression and anxiety disorders represent a public health challenge worldwide, we did a global investment appraisal in low-income, middle-income, and high-income countries. The 36 countries for which we modelled costs and benefits of scaled-up treatment, which span all six of WHO's major regions, account for 80% of the world's population and 80% of the global burden of depression and anxiety disorders (appendix p 1). Results for these countries were aggregated and reported by income level (low, lower-middle, upper-middle, high). We set the scale-up period at 2016–30, in line with the timeline of the post-2015 Sustainable Development Goals.

The economic and social benefits of good mental health include both its intrinsic value (improved mental health and wellbeing) and also its instrumental value, in terms of being able to form and maintain relationships, to work or pursue leisure interests, and to make decisions in everyday life. To assess the value of these benefits, first we estimated the population in need in each country,

then established the health effects of scaled-up coverage of effective intervention, and finally calculated the economic effect of improved mental health outcomes in terms of enhanced labour participation and productivity. Panel 1 provides more detail on the health and economic benefits captured in, and omitted from, the analysis. The key outputs of the model are year-on-year estimates of the total costs of treatment scale-up and system strengthening (ie, the investment), increased healthy life-years gained as a result of treatment (ie, health return), the value associated with better health (ie, the value of health returns), and enhanced levels of productivity (ie, economic return). The stream of costs incurred and benefits obtained between 2016 and 2030 were discounted at a rate of 3%, to give a net present value. All costs and monetised benefits were expressed in constant US$ for the year 2013.

Population and disease modelling
We used the mental health module of the inter-UN agency OneHealth tool to estimate the number of people with depression and anxiety disorders living in the 36 large countries until 2030. Estimates are based on UN population projections and Global Burden of Disease prevalence estimates for 2010.[11,12] The global point prevalence rate for anxiety disorders is 7·3%;[13] for depression it is 3·2% for men, and 5·5% for women.[14] The OneHealth tool also links the epidemiology of depression and anxiety disorders (prevalence, incidence, remission, excess mortality, and disability weight)[12–14] to country-specific life tables, so that cases averted and

healthy life-years gained over time at the population level can be estimated. Healthy life-years reflect time spent by the population in a particular state of health with a known degree of disability. Estimation of healthy life-years for depression took into account its association with excess mortality (due to suicide and other causes of death).[14]

Intervention effects, costs, and coverage

Intervention effects

We restricted the analysis of interventions within the OneHealth tool to treatment because the evidence on prevention of depression and anxiety is quite weak and of uncertain generalisability to low-income and middle-income country settings.[15] In line with WHO's Mental Health Gap Action Programme (mhGAP) intervention guide, modelled interventions included basic psychosocial treatment for mild cases, and either basic or more intensive psychosocial treatment plus antidepressant drug for moderate to severe cases.[16] Moderate to severe cases of depression were split into first-episode and recurrent episode cases. We calculated the health effect of treatment in terms of a proportionate improvement in the rate of remission, equivalent to a shortening of the duration of an episode of illness, and also, up to the point of recovery, an improvement in the average level of functioning as reflected in the disability weight for the disorder.[8,10] The appendix shows the effect size estimates and their derivation (appendix p 2); these take into account partial response, the lag time between onset of the disorder and treatment, and expected levels of non-adherence in treated populations.

Intervention costs

We worked out total costs in a given year for a country by multiplying resource use needs by their respective unit costs to give a cost per case, which was then multiplied by the total number of cases expected to receive a particular intervention. Country-specific unit costs of inpatient and outpatient care were taken from a WHO database, adjusted to 2013 price levels.[17] Treatment costs relied on previous cost-effectiveness studies and resource need profiles garnered from existing treatment guidelines and costing studies.[10,16,18,19] Key categories of resource use were: medication: 6 months continual antidepressant drug (generically produced fluoxetine) was included for moderate to severe cases; outpatient and primary care: regular visits were needed for all cases, ranging from four per case per year for basic psychosocial treatment, up to 14–18 visits for moderate to severe cases receiving antidepressant drug and intensive psychosocial treatment (half of whom are assumed to receive this on an individual basis, the other half in groups); in line with the mhGAP intervention guide, it is envisaged that this care and follow-up would largely be undertaken in non-specialist health care settings by doctors, nurses and psychosocial care

providers trained in the identification, assessment, and management of depression and anxiety disorders; and inpatient care: few cases are expected to be admitted to hospital (2–3% of moderate to severe cases only, for an average length of stay of 14 days).

Additionally, we included an estimate of the expected level of programme costs and shared health system resources needed to deliver interventions as part of an

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Panel 1: Health, economic, and social benefits of scaled-up treatment for depression and anxiety disorders

Health effects

To establish the effect of treatment, we used rates of improved recovery or remission and levels of functioning. Improved functioning translates into fewer life-years spent by the population in a state of diminished health, whereas an increased rate of remission leads to a decrease in the prevalence of these disorders over time. Depression is also associated with an excess risk of premature mortality because of suicide and other causes of death. We projected a reduction in excess mortality, amounting to an increase in healthy life expectancy, as a result of averting cases of depression in the population. Although depression and anxiety disorders are often comorbid with each other, and with a range of other health disorders (eg, substance use disorder, other non-communicable diseases and, in certain populations, in people with HIV/AIDS) we were not able to account for these comorbidities in the analysis. Additionally, we were unable to capture the positive effect of treatment on the mental and physical health of close family members, including infants of mothers with perinatal depression, despite robust evidence that depression can adversely affect infant attachment and subsequent child growth and cognitive development.

Economic effects

A direct potential benefit of successfully treating common mental disorders is a decrease in overall health-care costs. Although interventions have their own costs, these can be more than offset by a reduction in other services, notably hospital-based inpatient episodes or outpatient visits. Reduced use of informal and indigenous health-care providers, such as faith healers or traditional healers, is a further expected source of cost savings in many countries. Estimation of the predicted extent of these cost offsets is very challenging at the international level because it requires detailed information about both the varying level of comorbidity across diverse populations and the typical use of non-intervention related services. Accordingly, we did not explicitly consider such effects in our analysis. Similarly, we did not have sufficient information across countries to model the reduced need for other welfare-related services potentially available to people with depression and anxiety disorders, including unemployment benefit or income support and social or disability assistance. In the mainly high-income countries where such welfare support is widely available, depression and other common mental disorders account for a significant proportion of overall payments.[5] Instead, the analysis focused on the financial benefits flowing from increased rates of workforce participation and productivity. The analysis only considers the contribution to the economy as a whole through increased economic output; it does not estimate the various income shares of this output.

Social effects

Conceptually distinct from improvements in clinical functioning (health effect) and the restored ability to do paid work (economic effect), the successful treatment of depression and anxiety disorders leads to improved opportunities for individuals and households to pursue their leisure interests, participate more in social and community activities, and carry out household production roles. The economic worth of these non-market production and welfare gains is incorporated into our estimate of the intrinsic value of mental health.

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integrated model of chronic disease management. These include programme management and administration, training and supervision, drug safety monitoring, health promotion and awareness campaigns, and strengthened logistics and information systems. We expressed estimates as an on-cost to the estimated direct health-care costs. The baseline value for this on-cost was 10% (and therefore grows in absolute terms during scale-up).

Intervention coverage

The appendix provides coverage rates used for each individual intervention at different levels of national income (appendix p 3). Summing across all interventions and their respective populations in need, it is estimated that—depending on the income level of the country—between 7% and 28% of all people with depression currently receive treatment, equivalent to a treatment gap of 72–93% (table 1). A gradual, linear increase in treatment coverage to a third of all cases in low-income countries and to more than half of cases in high-income countries would close the current gap by 29–39%; the use of separate target coverage rates for low-income, middle-income, and high-income countries reflects differences in which they stand now with respect to treatment coverage, and are intended to reflect what has been achieved through programme scale-up efforts in countries such as Chile and the UK.[20] Because of even lower starting coverage levels, the modelled gap reduction for anxiety disorders is lower than for depression (16–25%).

Effect of labour force on treatment

We modelled the economic effect of decreased morbidity in terms of increased participation in and increased productivity of the workforce. With regards to labour force participation, very few studies have assessed the extent to which effective depression treatments get people back into work, and when measured, estimates have been subject to local factors such as prevailing levels of unemployment in the economy (panel 2).[21–24] For our

base case, we conservatively modelled a 5% restored ability to work as a result of treatment, with half and double that rate used under pessimistic and optimistic scenario analyses. Impaired productivity was assessed both with respect to whole days off work (absenteeism) and also partial days of impaired activity while an individual is at work (presenteeism). Compared with adults without common mental disorders in a range of low-income, middle-income, and high-income countries participating in the World Mental Health Survey, 4–15 more days out of role per year were recorded because of depression and 8–24 days because of generalised anxiety disorders; additional time lost per year due to presenteeism was 11–25 partial disability days for depression and 12–26 for generalised anxiety disorders.[25,26] Again, there are few empirical studies upon which to base estimates of the effect of effective treatment of depression and anxiety on productivity, and these point towards small differences between intervention and control groups (panel 2).[27–33] Expressed as a proportion of total working days per year (220 days), and allowing for both the onset of effect as well as the time lag between improved health and return to work, we modelled a 5% increase in working days as a result of reduced absenteeism, and a 5% increase through reduced presenteeism. Again, these baseline values were varied up and down by a factor of 2 and 0·5, respectively, in an uncertainty analysis. These losses in and returns to productivity were linked to the prevailing rates of labour participation in the working age population (age 15–65 years) and gross domestic product (GDP) per worker in each of the 36 assessed countries[34,35] to calculate productivity losses at current levels of treatment coverage and productivity gains after scaled-up treatment. The model does not account for potential changes in retirement age or working patterns over time, although an increase in retirement age and more flexible working patterns might enhance the overall productivity gains by people with depression and anxiety with treatment.

Economic value of health benefits

Improvements in labour force outcomes represent the instrumental value of improved mental health after effective treatment of common mental disorders. Independent of this instrumental value, being alive and healthy is also valuable in itself. For this analysis, we followed the approach adopted by Stenberg and colleagues,[36] who divided the overall value of a life-year into its economic (instrumental) and health (intrinsic) elements. For the *Lancet* Commission on Investing in health, the value of a 1 year increase in life expectancy in low-income and middle-income countries was estimated to be 2·3 times per person national income, and 1·6 times per person national income worldwide (using a discount rate of 3%).[7] Stenberg and colleagues[36] attributed two-thirds of that derived value to the instrumental components, which are measured here directly via the

	Current coverage	Target coverage	Current gap	Reduced gap	% gap reduction
Depression					
Low-income countries	7%	34%	93%	66%	29%
Lower middle-income countries	14%	42%	86%	58%	32%
Upper middle-income countries	21%	49%	79%	51%	35%
High-income countries	28%	56%	72%	44%	39%
Anxiety disorders					
Low-income countries	5%	20%	95%	80%	16%
Lower middle-income countries	10%	30%	90%	70%	22%
Upper middle-income countries	15%	35%	85%	65%	24%
High-income countries	20%	40%	80%	60%	25%

*Treatment coverage was modelled to increase from current to target rates linearly.

Table 1: **Current and target levels of scaled-up treatment coverage for depression and anxiety disorders (all interventions combined), by country income level***

Panel 2: Labour force effects of treatment

Labour force participation

There are very few studies showing the extent to which effective depression treatments get people back into work. Two studies undertaken in the USA reported a 6% increase in employment retention in patients with depression whose care was monitored and managed closely.[20,21] Findings of another US study[22] of patients in primary care showed that, at 6 months, employment rates were 52·5% for patients with no care versus 72·2% for patients with care. For low-income and middle-income countries, programme evaluation data for livelihoods from four countries—China, India, Ghana, and Pakistan—were made available by BasicNeeds, which showed that the proportion of people with depression undertaking income-generating activities increased by more than 50%, and in those with anxiety by more than 30% (Chris Underhill, BasicNeeds, personal communication). These estimates are in line with the assessment of the BasicNeeds programme in Kenya, which for a more mixed caseload showed an 43% improvement in the proportion of enrollees in income generation or productive work.[23] Because these data are based on observation rather than under controlled trial conditions, we can infer only a clear association between exposure to treatment and subsequent earnings rather than a definitive effect of intervention. For our base case, we therefore conservatively modelled a 5% restored ability to work as a result of treatment, with half and double that rate used under pessimistic and optimistic scenario analyses.

Labour force productivity

A comprehensive review of 440 published trials in an existing database of psychological and pharmaceutical interventions in depression[24] was specifically undertaken for this project (by researchers at the Vrije Universiteit Amsterdam, Amsterdam, Netherlands, and the Trimbos Institute, Utrecht, Netherlands) to identify the effect of effective treatment on productivity; unfortunately, very few trials reported these effects. However, some treatment trials done in the USA, Korea, and India have estimated the effect of intervention on productivity loss. The decrease in absenteeism reported in these studies was close to 1 day per month.[20,29–32] Only two studies reported the findings for presenteeism separately from days lost because of absenteeism: in the Korean study, treated patients had 24 more productive hours per month,[29] whereas in the Indian study, patients receiving the collaborative care had 4 fewer partial days lost than controls.[30] By conservatively assuming that 1 partial day is equivalent to a third of a whole day, we estimate that almost 1 complete day of unimpaired work is restored per month through reduced presenteeism. Expressed as a proportion of total working days per year (220 days), and allowing for both the onset of effect and the time lag between improved health and return to work, a 5% increase in working days is gained through reduced absenteeism, and a 5% increase through reduced presenteeism.

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labour force outcomes, leaving the remaining third for the intrinsic benefits of health, which is equivalent to 0·5 times per person income.

Uncertainty analysis

We assessed the sensitivity of results to plausible variations around these and other key input parameters by constructing optimistic and pessimistic scale-up scenarios. For the upper estimate: total investment costs were assumed to be 20% lower than baseline, as a result of lower than expected use of expensive hospital outpatient and inpatient care or the development of more efficient interventions, including internet-based treatments; and productivity effects were set at double their baseline rate (10% rather than 5%); the intrinsic value of a year of health life was set at 0·7 times GDP per person (rather than 0·5). For the lower estimate: total investment costs were assumed to be 20% higher than baseline, as a result of higher than expected drug prices, service use and programme management; productivity effects were set at half their baseline rate (2·5% rather than 5%); and the intrinsic value of a year of health life was set at 0·3 times GDP per person (rather than 0·5).

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Across the 36 largest countries in the world, in the absence of scaled-up treatment, it is projected that more than 12 billion days of lost productivity (equivalent to more than 50 million years of work) are attributable to depression and anxiety disorders every year, at an estimated cost of US$925 billion. Assuming the same distribution of costs across lower-income and higher-income countries holds for all other countries (representing 20% of the world's population), the global cost per year is $1·15 trillion. Compared with people without these disorders, 4·7 billion extra days are lost, at a cost of $592 billion (36% of the total cost); this figure can be termed the excess productivity loss of these disorders (figure 1).

Table 2 shows the estimated cost of scaling up treatment for depression and anxiety, expressed as the net present value of the total expenditure required over the scaling-up period between 2016 and 2030 (ie, the cumulative cost over 15 years of steady scale-up, but discounted at a rate of 3%). These costs relate to incremental treatment coverage in the population over and above current levels of coverage. For all 36 countries, the total cost amounts to US$91 billion for depression and $56 billion for anxiety disorders. Treatment of mild cases accounts for less than 10% of total costs for depression and 20% for anxiety

disorders. After standardising for population size, the cost is actually quite low; for depression treatment, the average annual cost during 15 years of scaled-up investment is $0·08 per person in low-income countries, $0·34 in lower middle-income countries, $1·12 in upper middle-income countries and $3·89 in high-income countries (table 2). Per person costs for anxiety disorders are nearly half that of depression.
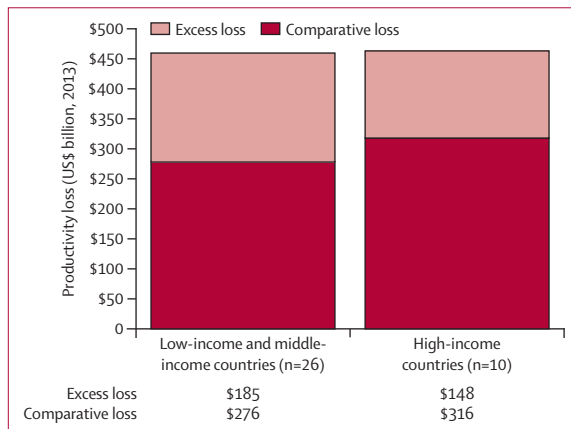

Figure 1: Lost productivity attributable to depression and anxiety disorders at current treatment coverage, by country income level (US$ billion, 2013)

Table 2 shows results for two key health outcomes: cases averted (reduced prevalence) and healthy life-years gained (equivalent to disability-adjusted life-years averted). Across the 36 countries represented in the analysis, we recorded a small decrease in the estimated prevalence of depression and anxiety disorders as a result of treated cases recovering from illness more quickly; in the next 15 years, this gradual decrease in prevalence translates into millions of averted cases (73 million fewer cases of depression, and 45 million fewer cases of anxiety disorder). Weighting these averted prevalent cases by the average level of improved functioning or reduced disability provides a measure of healthy life-years gained. For depression and anxiety disorders combined, the cumulative number of healthy life-years gained over 15 years is 43 million.

Table 2 also shows the difference in aggregate GDP between a continued current coverage scenario and one reflecting scaled-up treatment and enhanced productivity; again, this and the total economic return for the entire period of scale-up has been discounted at 3% to give a net present value. For all 36 countries combined, the net present value is $399 billion ($230 billion for depression and $169 billion for anxiety disorders). The intrinsic value of health returns show a net present value of more than $250 billion for scaled-up depression treatment and more than $50 billion for anxiety disorders (table 2).

	Low-income countries (N=6)	Lower middle-income countries (N=10)	Upper middle-income countries (N=10)	High-income countries (N=10)	All countries (N=36)
Total population of countries analysed (millions, 2013)	443	2215	2101	992	5751
Depression					
Total investment (net present value, US$ million)	517	7164	20338	63503	91522
Average annual investment (net present value, US$ per person)	0·08	0·34	1·12	3·89	1·50
Health returns (averted prevalent cases)	6150311	25989404	25607740	15750268	73497723
Health returns (healthy life-years gained)	2234781	15692290	11414429	7567211	36908711
Economic returns (US$ millions)	1190	18799	52732	157022	229744
Value of health returns (US$ millions)*	991	21679	56435	178588	257694
Benefit to cost ratio (economic returns)	2·3	2·6	2·6	2·5	2·5
Benefit cost ratio (economic and value of health returns)	4·2	5·7	5·4	5·3	5·3
Anxiety disorders					
Total investment (net present value, US$ millions)	304	3797	8966	42668	55735
Average annual investment (net present value, US$ per person)	0·05	0·16	0·52	2·44	0·88
Health returns (averted prevalent case)	3395363	1659719	12980180	12077053	45052316
Health returns (healthy life-years gained)	416232	2220716	1711767	1604069	5952783
Economic returns (US$ millions)	824	11578	26691	129705	168797
Value of health returns (US$ millions)*	181	2966	8453	40409	52009
Benefit cost ratio (economic returns)	2·7	3·0	3·0	3·0	3·0
Benefit cost ratio (economic and value of health returns)	3·3	3·8	3·9	4·0	4·0

*Healthy life-years gained multiplied by GDP per person multiplied by 0·5.

Table 2: Costs and benefits of scaled up treatment of depression and anxiety disorders, 2016–30

By summing the discounted costs and benefits for all countries in an income group, we derived a summary measure of the relationship between the benefits of scaled-up treatment and the associated costs of investment (table 2, figure 2). Restricting assessment to the economic returns to investment, benefit to cost ratios for scaled-up depression treatment across country income groupings were in the range of 2·3 to 2·6. For anxiety disorders the ratios were slightly higher (range 2·7–3·0). Extension of the benefit–cost analysis to include the estimated value of health returns increased the ratio of benefit to cost, especially for depression because of the higher health returns for this disorder compared with anxiety disorders. Benefit to cost ratios for depression now exceed those for anxiety disorders (range 4·2–5·7), and were more than double the ratio when only economic benefits of depression treatment scale-up were considered. Benefit to cost ratios for anxiety disorders increased by a third (range 3·3–4·0).

We did uncertainty analysis to ascertain the sensitivity of results to plausible changes in key study parameters. Benefit to cost ratios fell to or almost reached parity under the more pessimistic scenario when only economic benefits were considered, and did not exceed 3 even when the value of health benefits was included (figure 2). By contrast, the more optimistic scenario produces benefit to cost ratios of 5·5–7·2 (economic benefits only) and 7·5–11·3 when the value of health benefits was added in. As expected, results were quite sensitive to the estimated rate of enhanced labour participation and productivity. We also assessed the effect of changing the rate used to discount future costs and benefits to the present time. At a discount rate of 6%, the net present value of total investments and returns would be 25% less; with no discounting, they would be 35% higher in absolute terms. Because such a change in discount rate was applied to both costs and benefits, the ratio of benefit to cost, our summary return on investment metric, is not affected.

Discussion

This analysis sets out, for the first time, a global investment case for a scaled-up response to the massive public health and economic burden of depression and anxiety disorders. Previous international economic studies of mental health have assessed the economic effect of these disorders,[2,3] the cost-effectiveness of different intervention strategies,[8,10] and the cost of scaling up care,[18,19] but not the value of both economic and health benefits of intervention scale up.

Notwithstanding the general limitations of any projection modelling study, the analysis suggests that the investment needed to substantially scale up effective treatment coverage for depression and anxiety disorders in the 36 countries included in this analysis is substantial; the net present value of all investments between 2016
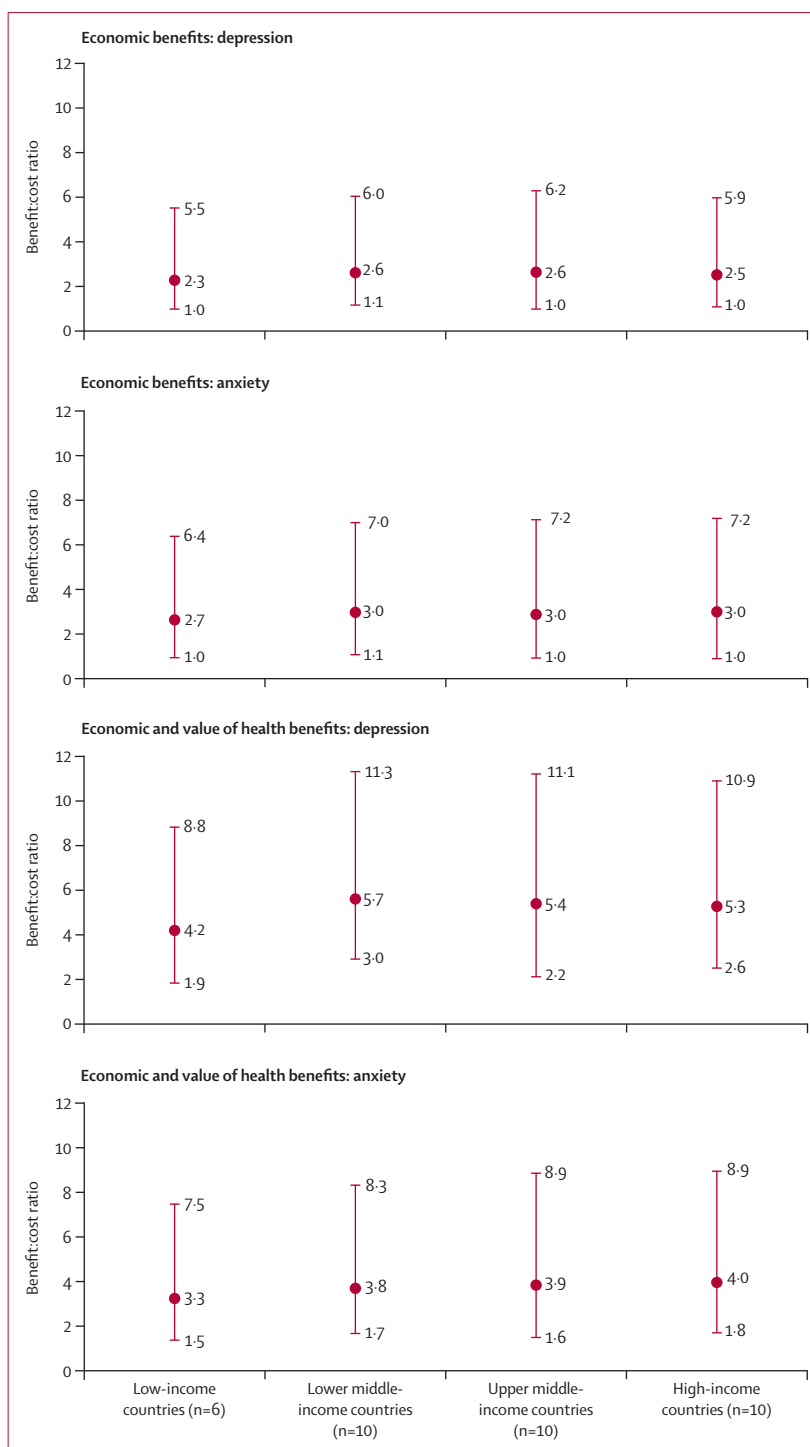

Figure 2: Baseline, upper, and lower benefit to cost ratios for scaled-up treatment of depression and anxiety disorders, by country income group

and 2030 is $147 billion, equivalent to less than $10 billion per year on average. Extending the scope to the 20% of the world's population not living in the 36 countries represented in the study would increase the cost by about 25% to $184 billion. However, the returns to this

investment are also substantial, with benefit to cost ratios of 2·3–3·0 when economic benefits only are considered, and 3·3–5·7 when the value of health returns are also included. To put these findings into context, any benefit to cost ratio exceeding 1 provides a rationale for investment. Compared with some other potential investments in health, ratios of the order reported here can be deemed relatively modest. For example, a return on investment analysis for malaria, also for 2016–30, but using the full value of a statistical life-year, estimated benefit to cost ratios in the range of 28:1 to 40:1.[37] An investment case done for maternal, reproductive, neonatal, and child health obtained a benefit to cost ratio of less than 10:1 for 2013–35,[36] which is closer to the results obtained in this study. Inclusion of other benefits arising from scaled-up treatment of common mental disorders that could not be captured though the present modelling exercise, notably reduced welfare support payments, and improved outcomes for other affected people (eg, partners and children of women with perinatal depression) would generate higher ratios of benefit to cost. Set against that, treatment programmes might cost more or achieve less than anticipated, as highlighted by the uncertainty analysis.

One limitation of our study is that although the projected level of overall prevalence of depression and anxiety disorders is quite well-established,[12-14] the same cannot be said for treated prevalence. The analysis done here allows for a gradual linear increase in effective service coverage for depression and anxiety disorders in all parts of the world in the next 15 years. However, for this to happen, not only will a new level of political commitment and resource mobilisation be required, but also a significant reorientation of public health systems towards chronic disease identification and management.[9] Partial or weak implementation of envisaged treatment programmes, including appropriate management of recurrent cases of depression or insufficient promotion and awareness programmes, will inevitably reduce the number of cases effectively reached and therefore the health and other benefits obtained. It is also possible that as treatment coverage in the population increases substantially, the average cost per case might go up, for example as a result of reaching out to more remote or less well-served parts of a country. Target coverage rates were accordingly set at a modest level in this analysis (an upper value of 56% of depression cases in high-income countries). Aside from projected treatment coverage and effectiveness, a further crucial parameter for this analysis concerns the effect of treatment on labour force participation and productivity, for which there remains a paucity of evidence. As concluded by a systematic review, such data are not hard to collect alongside clinical trials and other studies, and need to be uniformly measured more often.[27] More generally, population health models (eg, the OneHealth tool) rely on many input parameters, data sources, and assumptions regarding expected rates of disease, demographic change, and intervention effects in the future, which limits their precision.

Several effects were not included in the analysis. One was the negative effect of maternal depression on early child development, for which there is clear evidence;[38] the health, social, and economic benefits of effective treatment of maternal depression on the cognitive and physical development of newly born babies was not assessed, but there is some evidence that this could be substantial over the longer term.[39] Likewise, the monetary and non-monetary impact of effective treatment on family and other caregivers has not been factored in. Additionally, no account has been taken of the substantial effect of depression and its treatment on physical health outcomes; depression is a risk factor for disorders such as hypertension, stroke, coronary heart disease, and substance use disorders (just as these conditions are risk factors for depression), and adversely affects outcomes through reduced help-seeking and adherence.[40] Inclusion of these additional effects of treatment would bolster identified economic returns. Taking appropriate account of the regular co-occurrence of depression and anxiety in individuals would be expected to lead to strong synergies on the treatment side, leading to potentially reduced investment costs, but health and economic outcomes for these comorbid cases might be slower or harder to achieve.

Although the analysis accounted for age and sex (eg, in terms of disease prevalence, labour force participation and treatment eligibility), it was not possible to consider the effect of socioeconomic status as a mediator and predictor of good health and economic outcomes. Poverty has an adverse effect on the risk of depression and anxiety disorders through higher levels of stress, social exclusion, violence and trauma, but the evidence base for the mental health effect of interventions targeted at the poor remains insubstantial.[41] In many countries, poor people face significant barriers to accessing services, including the financial cost of seeking and paying towards health care. Finally, it should be acknowledged that the workplace itself can be a source of stress for many people, and that there is a consequent need to integrate mental health and wellbeing into new or existing employee support programmes.

A crucial issue related to but outside the scope of this return on investment analysis is the source of financing for investments required to scale-up services for depression and anxiety disorders. As previously noted, the absolute amount needed for investment (eg, on a per person basis) is modest, but because existing service coverage level is so low in most countries, the gap between current and required spending can be large.[18,19] Accordingly, both rich and poor countries need to carefully consider the merits of different health financing mechanisms. For many countries, the first question to address concerns the extent to which domestic financing

represents a feasible and sufficient method for financing mental health services, perhaps as part of a package of measures to be paid for from enhanced revenue generation. For low-income countries eligible for official development assistance, a second question might be to what extent external funding can complement domestically generated resources to catalyse service development. In countries where domestic or external funding mechanisms are expected to fall short of requirements or pose a risk to fiscal stability, a further question relates to the extent to which market-based financing options such as bonds offer a suitable and feasible approach to generating and providing funds for outcomes-based scale-up for mental health services.

The pursuit of any of these methods of financing will be affected by other factors, including the amount of investment needed, the level of political will and also fiscal space for raising new resources for health, and eligibility of the country for bilateral or multilateral funding. Faced with a new and broad development agenda,[6] governments need to assure themselves that investment in the mental health of their populations represents a sound and equitable investment of society's resources that leads to clear and definable health, economic, and social benefits. Our return on investment analysis, coupled with an assessment of health-system needs and priorities, and the broader macro-fiscal situation, can contribute to a balanced investment case for common mental disorders and the health sector more generally.

References
1 WHO. Mental health ATLAS 2014. Geneva: World Health Organization, 2015.
2 Bloom DE, Cafiero E, Jané-Llopis E, et al. The global economic burden of noncommunicable diseases. Geneva: World Economic Forum, 2011.
3 Hu TW. Perspectives: an international review of the national cost estimates of mental illness, 1990–2003. *J Ment Health Policy Econ* 2006; **9:** 3–13.
4 Gustavsson A, Svensson M, Jacobi F, et al, and the CDBE2010 Study Group. Cost of disorders of the brain in Europe 2010. *Eur Neuropsychopharmacol* 2011; **21:** 718–79.
5 OECD. Fit Mind, Fit Job: From Evidence to Practice in Mental Health and Work. Paris: OECD, 2015.
6 United Nations. Transforming our world: the 2030 agenda for sustainable development. New York: United Nations, 2015.
7 Jamison DT, Summers LH, Alleyne G, et al. Global health 2035: a world converging within a generation. *Lancet* 2013; **382:** 1898–955.
8 Hyman S, Chisholm D, Kessler R, Patel V, Whiteford H. Mental disorders. In: Jamison DT, Breman JG, Measham AR, et al, eds. Disease control priorities in developing countries, 2nd edn. Oxford University Press and The World Bank, 2006: 605–26.
9 Patel V, Chisholm D, Parikh R, et al. Addressing the burden of mental, neurological, and substance use disorders: key messages from Disease Control Priorities, 3rd edn. *Lancet* 2015; published online Oct 7, http://dx.doi.org/10.1016/S0140-6736(15)00390-6.
10 Chisholm D, Saxena S. Cost effectiveness of strategies to combat neuropsychiatric conditions in sub-Saharan Africa and South East Asia: mathematical modelling study. *BMJ* 2012; **344:** e609.
11 United Nations Population Division 2015, World Population Prospects, the 2015 Revision, at http://esa.un.org/unpd/wpp/
12 Whiteford HA, Degenhardt L, Rehm J, et al. Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *Lancet* 2013; **382:** 1575–86.
13 Baxter AJ, Scott KM, Vos T, Whiteford HA. Global prevalence of anxiety disorders: a systematic review and meta-regression. *Psychol Med* 2013; **43:** 897–910.
14 Ferrari AJ, Somerville AJ, Baxter AJ, et al. Global variation in the prevalence and incidence of major depressive disorder: a systematic review of the epidemiological literature. *Psychol Med* 2013; **43:** 471–81.
15 van Zoonen K, Buntrock C, Ebert DD, et al. Preventing the onset of major depressive disorder: a meta-analytic review of psychological interventions. *Int J Epidemiol* 2014; **43:** 318–29.
16 WHO. mhGAP (Mental Health Gap Action Programme) Intervention Guide. Geneva: World Health Organization, 2010.
17 WHO-CHOICE. Country-specific unit costs. http://www.who.int/choice/country/country_specific (accessed Nov 2, 2015).
18 Chisholm D, Lund C, Saxena S. Cost of scaling up mental healthcare in low- and middle-income countries. *Br J Psychiatry* 2007; **191:** 528–35.
19 Chisholm D, Burman-Roy S, Fekadu A, et al. Estimating the cost of implementing district mental healthcare plans in five low- and middle-income countries: the PRIME study. *Br J Psychiatry* 2016; **208** (suppl 56): s71–78.
20 De Silva MJ, Lee L, Fuhr DC, et al. Estimating the coverage of mental health programmes: a systematic review. *Int J Epidemiol* 2014; **43:** 341–53.
21 Wang PS, Simon GE, Avorn J, et al. Telephone screening, outreach, and care management for depressed workers and impact on clinical and work productivity outcomes: a randomized controlled trial. *JAMA* 2007; **298:** 1401–11.
22 Wells KB, Sherbourne C, Schoenbaum M, et al. Impact of disseminating quality improvement programs for depression in managed primary care: a randomized controlled trial. *JAMA* 2000; **283:** 212–20.
23 Schoenbaum M, Unützer J, McCaffrey D, Duan N, Sherbourne C, Wells KB. The effects of primary care depression treatment on patients' clinical status and employment. *Health Serv Res* 2002; **37:** 1145–58.
24 Lund C, Waruguru M, Kingori J, et al. Outcomes of the mental health and development model in rural Kenya: a 2-year prospective cohort intervention study. *In Health* 2013; **5:** 43–50.
25 Alonso J, Petukhova M, Vilagut G, et al. Days out of role due to common physical and mental conditions: results from the WHO World Mental Health surveys. *Mol Psychiatry* 2011; **16:** 1234–46.

26   Bruffaerts R, Vilagut G, Demyttenaere K, et al. Role of common mental and physical disorders in partial disability around the world. *Br J Psychiatry* 2012; **200:** 454–61.

27   Cuijpers P, van Straten A, Warmerdam L, Andersson G. Psychological treatment of depression: a meta-analytic database of randomized studies. *BMC Psychiatry* 2008; **8:** 36.

28   Nieuwenhuijsen K, Faber B, Verbeek JH, et al. Interventions to improve return to work in depressed people. *Cochrane Database Syst Rev* 2014; **12:** CD006237.

29   Harvey S, Joyce S, Modini M, et al. Work and depression/anxiety disorders: a systematic review of reviews. 2012. Commissioned review by University of South Wales for Beyond Blue. https://www.beyondblue.org.au/docs/default-source/research-project-files/bw0204.pdf?sfvrsn=4 (accessed April 16, 2015).

30   Woo J-M, Kim W, Hwang T-Y, et al. Impact of depression on work productivity and its improvement after outpatient treatment with antidepressants. *Value Health* 2011; **14:** 475–82.

31   Buttorff C, Hock RS, Weiss HA, et al. Economic evaluation of a task-shifting intervention for common mental disorders in India. *Bull World Health Organ* 2012; **90:** 813–21.

32   Rollman BL, Belnap BH, Mazumdar S, et al. A randomized trial to improve the quality of treatment for panic and generalized anxiety disorders in primary care. *Arch Gen Psychiatry* 2005; **62:** 1332–41.

33   Rost K, Smith JL, Dickinson M. The effect of improving primary care depression management on employee absenteeism and productivity. A randomized trial. *Med Care* 2004; **42:** 1202–10.

34   ILO. 2015 databases and subjects. http://www.ilo.org/global/statistics-and-databases/lang--en/index.htm (accessed April 2015).

35   World Bank. World development indicators. 2015. http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators (accessed April 13, 2015).

36   Stenberg K, Axelson H, Sheehan P, et al, and the Study Group for the Global Investment Framework for Women's Children's Health. Advancing social and economic development by investing in women's and children's health: a new Global Investment Framework. *Lancet* 2014; **383:** 1333–54.

37   World Health Organization on behalf of the Roll Back Malaria Partnership Secretariat. Action and Investment to defeat Malaria 2016–2030: For a Malaria-Free World. 2015. World Health Organization, Geneva.

38   Rahman A, Fisher J, Bower P, et al. Interventions for common perinatal mental disorders in women in low- and middle-income countries: a systematic review and meta-analysis. *Bull World Health Organ* 2013; **91:** 593–601.

39   Cuijpers P, Weitz E, Karyotaki E, Garber J, Andersson G. The effects of psychological treatment of maternal depression on children and parental functioning: a meta-analysis. *Eur Child Adolesc Psychiatry* 2015; **24:** 237–45. DOI:10.1007/s00787-014-0660-6.

40   Prince M, Patel V, Saxena S, et al. No health without mental health. *Lancet* 2007; **370:** 859–77.

41   Lund C, De Silva M, Plagerson S, et al. Poverty and mental disorders: breaking the cycle in low-income and middle-income countries. *Lancet* 2011; 378: 1502–14.