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Mental health disorders research in Europe, 2001–2018

Mursheda Begum,¹ Grant Lewison ,² Eva Wölbert,³ Karen Berg Brigham,^{4,5} Meryl Darlington ,^{4,5} Isabelle Durand-Zaleski,^{4,5} Richard Sullivan²

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¹Business Studies, Queen Mary University of London, London, UK

²Cancer Policy Unit, Guy's Hospital, King's College London, London, UK

³MQ Transforming Mental Health, London, UK

⁴URC ECO, AP-HP, Paris, France

⁵UPEC, Creteil, Île-de-France, France

Correspondence to

Dr Grant Lewison, King's College London, London SE1 9RT, UK; grantlewis@aol.co.uk

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ABSTRACT

Background The burden of mental health disorders in Europe is well above the world average and has increased from 11.5% to 13.9% of the total disease burden in 2000 and 2015. That from dementia has increased rapidly, and overtaken that from depression as the leading component. There have been no analyses of the research activity in Europe to combat this burden.

Methodology We identified research papers in the Web of Science (WoS) with a complex mental health disorders filter based on title words and journal names in the years 2001–18, and downloaded their details for analysis.

Results European mental health disorders research represented less than 6% of the total biomedical research. We estimate that research expenditure in Europe on mental health disorders amounted to about €5.4 billion in 2018. The Scandinavian countries, with Croatia and Estonia, published the most relative to their wealth, but the outputs of France and Romania were less than half the amounts expected.

Discussion and conclusions The burden from mental health disorders is increasing rapidly in Europe, but research was only half what would have been proportional. Suicide & self-harm, and alcohol misuse, were also neglected by researchers, particularly since the latter also causes many physical burdens, such as foetal alcohol syndrome, interpersonal violence, and road traffic accidents. Other relatively neglected subjects are sexual disorders, obsessive compulsive disorder, post-traumatic stress disorder, attention-deficit hyperactivity and sleep disorders. There is an increasing volume of research on alternative (non-drug) therapies, particularly for post-traumatic stress and eating disorders, notably in Germany.

INTRODUCTION

This study was part of a major project called Mapping_NCD, which was intended to map the research taking place in Europe (defined here as EUR31: the 28 Member States of the European Union, plus Iceland, Norway and Switzerland) in five non-communicable diseases (NCDs) in 12 years, from 2002 to 2013. (For the list of countries, with their digraph ISO codes, see [table 1](#).) We subsequently extended the study to cover 2001 and the five most recent years for which complete data were available (2014–2018).

WHO data on the disease burden in European countries show that they suffer relatively more from mental health disorders (as a percentage of the total disease burden) than the rest of the world, although

it is likely that they are seriously underdiagnosed in many countries.^{1–3} The burden of mental health disorders is also increasing, accounting for 6.2% of all disability-adjusted life years (DALYs) in 2000 worldwide (11.5% in EUR31 countries) and 8.2% in 2015 (13.9% in EUR31), according to WHO data. (DALYs take account both of premature death (compared with Japan) and time spent living with pain or a disability.)

These are likely to be underestimates, because there are large indirect effects as well. For example, people with mental illness may neglect the symptoms of other diseases such as diabetes^{4,5} and not adhere to the treatment regimens.⁶ There are also serious effects on other people caused by alcohol misuse,^{7,8} including interpersonal violence,⁹ fetal alcohol syndrome¹⁰ and road traffic accidents, of which perhaps one-sixth are attributable to drivers being impaired by alcohol.¹¹ Alcohol can also contribute to the aetiology of many physical diseases,¹² including diabetes,¹³ epilepsy,¹⁴ ischaemic heart disease¹⁵ and stroke.¹⁶ Estimates of the worldwide health burden attributable to alcohol are as high as 4.6%,⁸ and in Europe 5.1%, based on the situation in Germany.¹⁷ These estimates are several times the WHO figure of 1.0%, which is based only on mental health disorders suffered by the patient. Addiction to proscribed drugs also has many indirect health effects. These include tens of thousands of deaths, mainly in South and Central America, in the supply chain of illegal drugs, which add to the worldwide addiction burden of only 0.9%. There were also 63 600 opioid-related deaths in the USA in 2016, although many of them were from overuse of prescription pharmaceuticals.¹⁸

Within the total burden from mental health disorders in Europe, two make major contributions: unipolar depression and dementia. Over the 15 years between 2000 and 2015, depression has remained fairly constant at about 22% of the mental health disorders total, but dementia has increased from 15% to 26%.¹⁹ There has, however, been a decline in suicide and self-harm from 17% to 13%, possibly as a result of better preventive measures.^{20,21} Within Europe, mental health disorders exacted the highest relative toll in the Scandinavian countries (Finland, 21%; Iceland, 19%; and Norway, 18%, in 2015) and the least in Eastern Europe (Romania, 8%; Bulgaria, 9%; Czech Republic, Latvia, Slovakia, Croatia and Hungary, all 10%). The relative burden has increased most rapidly in the UK (+53% between 2000 and 2015) and Ireland (+34%) and has actually declined in Lithuania (–4%) over the 15-year period.



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Table 1 List of European countries with their International Standards Organization (ISO2) (digraph) codes

Country	Code	Country	Code	Country	Code
Austria	AT	Greece	GR	Norway	NO
Belgium	BE	Hungary	HU	Poland	PL
Bulgaria	BG	Iceland	IS	Portugal	PT
Croatia	HR	Ireland	IE	Romania	RO
Cyprus	CY	Italy	IT	Slovakia	SK
Czech Republic	CZ	Latvia	LV	Slovenia	SI
Denmark	DK	Lithuania	LT	Spain	ES
Estonia	EE	Luxembourg	LU	Sweden	SE
Finland	FI	Malta	MT	Switzerland	CH
France	FR	The Netherlands	NL	United Kingdom	UK
Germany	DE				

Previous bibliometric studies of research publications on mental health disorders have mainly focused on individual disorders such as depression,^{22 23} Alzheimer's disease^{24 25} and anxiety.^{26 27} (Papers were sought without language restrictions.) However, few have examined mental health disorders together so as to reveal whether the overall portfolio is well distributed to respond to the changing disease burden. This is a serious *lacuna*.

Our objective in this study was to investigate how the published papers over 18 years (2001–2018) covered the different aspects of mental health disorders research in the 31 European countries. This analysis might indicate the relative neglect of important disorders in some countries, or an overall shortfall of research commensurate with the burden being suffered. We also made a preliminary investigation into the funding of this research, and used an earlier survey²⁸ of the cost of biomedical research papers to estimate the amount of money used to support mental health disorders research in Europe in 2018.

METHODS

Outputs of research papers

This paper deals with the outputs of European research in mental health disorders. These were defined to cover those disorders classed by the WHO as 'Mental and substance use disorders', plus 'Alzheimer disease and other dementias', and 'Self-harm' which includes suicide. Decisions on which mental health disorders were to be included were discussed between all partners of the Mapping_NCD project at its outset, in which some were excluded because they involved large genetic predispositions, very early-onset manifestations, and for which interventions have little impact in curing or greatly improving the condition. Thus, neurological conditions (eg, Parkinson's disease and multiple sclerosis) and developmental and intellectual disorders (eg, autism and idiopathic intellectual disability) were excluded.

Mental health disorders research papers (articles and reviews) by the EUR31 countries were identified in the Web of Science (WoS) Science Citation Index-Extended (SCI-E), the Social Science Citation Index (SSCI), and (since 2015) the Emerging Sources Citation Index (ESCI) databases by means of a complex filter. This filter comprised specialist journals and title words listing specific mental health disorders (eg, schizophrenia), specialist drugs (eg, galantamine), and therapies and interventions (eg, psychotherapy). It also contained a list of research fields whose papers were to be excluded. (For example, this removed papers on depression that were concerned with economics, geology or meteorology rather than with the mental disorder.)

The filter was developed in consultation with ID-Z and her colleagues, KBB and MD, and was calibrated by MD and GL, and had a precision or specificity of $p=0.74$ and a recall or sensitivity of $r=0.79$ (see Lewison²⁹ for the calibration method). This means that it overestimated the true number of mental health disorders research papers by 6%.

The bibliographic details of all papers identified by the mental health disorders filter were downloaded as text files, 500 at a time, and were then combined and converted into a single Excel spreadsheet with a visual basic program (written by Philip Roe of Eval-uametrics). For each paper, the fractional presence of each of the EUR31 countries (and others) was calculated from the numbers of addresses so that the individual fractions summed to unity. For example, a paper with one French and two German addresses would be characterised as FR 0.33 and DE 0.67.

We compared mental health disorders research outputs with those in all biomedical research. These were identified within the WoS by means of a complex filter based on address words, such as *anat* (anatomy), *Bethesda* (MD, USA), *canc* (cancer), *dis* (disease), *epidemiol*, *family* and *Glaxo*.*.³⁰ This filter nicely discriminated between biomedical and other papers in multidisciplinary journals such as *Nature* and *Science*. We determined the research level (RL) of the papers as a decimal number on a scale from RL=1.0 for clinical observation to RL=4.0 for basic research.³⁰

Outputs of individual industrialised countries' medical research papers normally correlate quite positively with their wealth, as measured by gross domestic product (GDP), but for mental health disorders the relative burden in Europe varies by more than a factor of two (see above in the fourth paragraph of the Introduction). We therefore modified the comparator to account for the percentage of countries' total DALYs that were attributable to mental health disorders, and because outputs in Eastern Europe were expanding relatively rapidly we confined the comparison to fractional counts of papers in 2014–2018 plotted against GDP in 2015.

Classification of papers by subject area

Papers were classified by the mental disorder they described, and by their research type or domain, with a series of subfilters. These each contained title words and journal name strings that were combined into two Excel macros. Some papers had more than one of these codes as they covered several disorders or research domains, while others did not have any. The performance of the leading EUR31 countries for each disorder and research domain was then calculated for the 5 years (2014–2018) relative to the European average (the mean for EUR31 as a whole). For clinical trials, we determined the percentages of the leading countries' outputs that described such work using a series of title words and phrases, such as *clinical trials*, *double-blind*, *phase II* and *randomized controlled*. We also compared overall European research outputs on the individual mental health disorders with their disease burden (both as percentages of the total for mental health disorders).

One of these research domain subfilters served to identify drug and alternative therapeutic interventions. The names of specific drugs and interventions relevant to mental health disorders were collected from a variety of sources. These included online sites such as those of the UK National Institute for Health Research Horizon Scanning Research and Intelligence Centre, the UK National Health Service Choices, and the UK charities Mind and Rethink. We also parsed the titles of all the selected papers from 2012 to 2013 into single words and then sought the names of drugs by first matching them to the names of drugs listed in the British National Formulary and all aforementioned online sources, and then manually assessing the words for particular

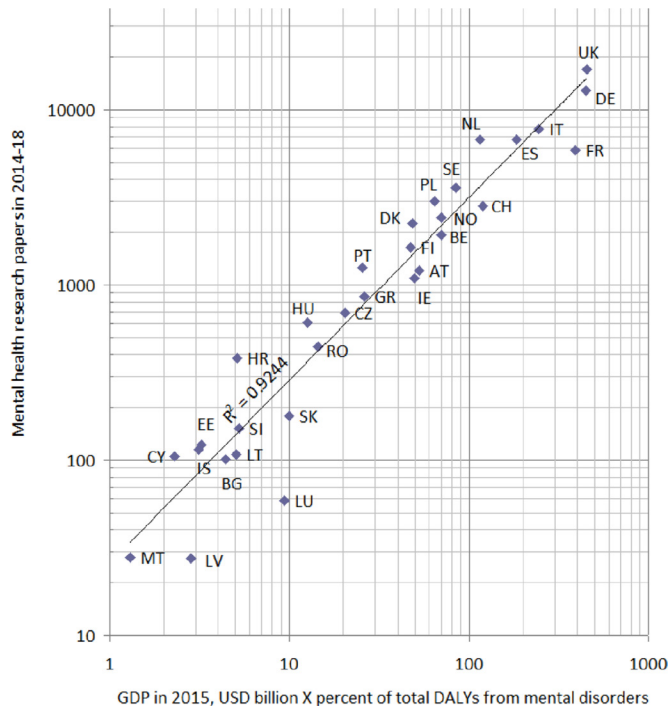


Figure 1 Plot of outputs of mental health research papers by different European countries in 2014–2018 (fractional counts) against their GDP in 2015 (US\$ billion) multiplied by the fraction of their total disease burden in that year attributable to mental disorders. For country codes, see table 1. DALYs, disability-adjusted life years; GDP, gross domestic product.

suffixes in which drug names could possibly end (eg, ics, pion, lic, tan, ant(s), lants, ide, ine, ate, lin, ker(s), ium), and long words with many letters.

Funding and estimated cost of mental health disorders research in Europe

We hypothesised that some mental health disorders, types of research and the outputs of different countries might vary in their ability to attract explicit funding. Since 2009, the SCI-E has recorded acknowledgement data, and we have analysed them by a standard method involving codes.³¹ However, this is very labour-intensive, and so we have used a much simpler method that involves just a count of the numbers of explicit funding acknowledgements (which are separated by semicolons in the funding list field) in order to show the mean number of acknowledgements per paper, and the percentage with one or more, for the different groups of papers from 2014 to 2018.

We also estimated the total cost of mental health disorders research in Europe in 2018 that is in the public domain. This was based on the mean cost of a biomedical research paper in 2013, which was estimated to be approximately €260 000.²⁸ This figure was obtained from a survey of leading researchers in several countries who were asked about their research budgets, which were then compared with their output of papers, duly fractionated to allow for their coauthors. We multiplied the total number of papers in 2018 by this figure, and then corrected the amount for the overestimate of the numbers of papers (6%) and for inflation in the Eurozone between 2013 and 2018 (which was 4.1%: <https://www.rateinflation.com/inflation-rate/euro-area-historical-inflation-rate>).

RESULTS

Outputs of mental health disorders research papers and their growth

From 2001 to 2018, a total of 244 790 papers were published in the SCI-E, SSCI and ESCI by the EUR31 countries, and the European fractional contribution was 215 690, the difference (12%) representing contributions by non-European countries. Over the 18-year period, European mental health disorders research averaged 41% of the world total, and this percentage varied little from year to year. The number of European papers increased annually by 5.6% on average, from 7408 in 2001 to 17 974 in 2018 on a fractional count basis. However, after correction for the 6% overestimate of European mental health disorders research papers, they amounted to only 4.8% of its total biomedical research output in 2001, increasing to 6.3% in 2018. These figures are less than half the corresponding percentages of the overall disease burden in Europe attributable to mental health disorders, estimated at 11.5% and 13.9% in the 2 years, even without allowance for the underestimation of the burdens from alcohol misuse and drug addiction discussed above. They represent a serious shortfall in the amount of European research devoted to mental health disorders, particularly compared with diseases such as cancer.³²

Outputs of individual European countries and research levels

Figure 1 compares the outputs of papers from individual countries in 2014–2018 with their GDP in 2015, multiplied by the fraction of their DALYs caused by mental health disorders. The correlation is good ($r^2=0.924$), but a few countries (Luxembourg, Latvia and France) are publishing less than would be expected from the least-squares trend line, and Croatia and the Netherlands are publishing more.

The growth in country outputs varied greatly, from that of Austria, which was slightly over 2% per annum (pa), to that of Romania, at over 27%, but from a very small base. The outputs from all the Eastern European countries, except for Hungary, grew rapidly, nearly all of them at more than 10% pa.

The overall mean RL of the papers steadily decreased (ie, became less basic and more clinical). It was 1.62 in 2001 and had gone down to 1.38 in 2018. Papers from Eastern Europe were the most basic, possibly because some of their clinical journals were not covered in the WoS. The RL of Polish papers, for example, was 2.68 in 2001–2007, but 1.65 in 2014–2018. In the first period, only 6% of papers with a Polish address were in Polish, but in the latter period the percentage had risen to 15% (568 papers out of 3704). Norwegian papers were much the most clinical (RL=1.24 in 2001–2007 and 1.18 in 2014–2018), and more so than the ones from Sweden, where RL decreased from 1.57 to 1.36.

Individual mental health disorders

In total, 72% of all the mental health disorders papers could be categorised as being about one or more of 15 specific mental health disorders. Depression and Alzheimer's disease/dementias received the most research attention, which accords with their disease burden. In contrast, little research attention was given to many disorders, particularly sexual disorders, obsessive compulsive disorder, post-traumatic stress disorder, attention-deficit hyperactivity, suicide and self-harm, and sleep disorders (all <2.5%). However, research outputs on all the disorders, including these neglected ones, have increased their annual paper outputs, some much faster than the 5.6% growth of all mental health disorders papers on average. The fastest growing

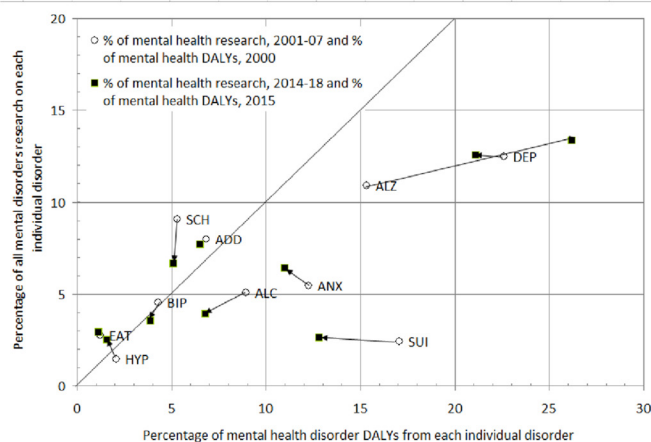


Figure 2 Percentages of total European mental disorders research output on different disorders in 2001–2007 and 2014–2018 plotted against the percentages of the total European mental disorders disease burden in 2000 and 2015 that are attributable to them. ADD, addiction; ALC, alcohol misuse; ALZ, Alzheimer's disease; ANX, anxiety; BIP, bipolar; DALYs, disability-adjusted life years; DEP, depression; EAT, eating; HYP, hyperactivity; SCH, schizophrenia; SUI, suicide and self-harm.

areas were attention-deficit hyperactivity disorder (13%pa) and sexual disorders (11%pa), while schizophrenia (4.7%pa), alcohol misuse (5.4%pa) and bipolar disorder (3.5%pa) were the slowest growing areas.

A comparison of the amount of research on the main disorders in 2001–2007 and 2014–2018 with the European disease burdens in 2000 and 2015 (both as percentages of the total for mental health disorders) is shown in figure 2. The results go from the open circles to black squares and show whether the correspondence between these two parameters is becoming closer to the main diagonal or departing from it. Thus the situation with Alzheimer's disease is clearly getting worse and the amount of research is not keeping pace with the rapidly growing burden. The situation with regard to suicide and self-harm is improving, but clearly there is a dearth of research into the third largest source of mental disorder burden. On the other hand, eating disorders are attracting relatively more research.

Table 2 shows how well the leading European countries performed on research on each mental disorder in 2014–2018, so as to reveal which ones are concentrating on which subject areas. This may enable countries that are underperforming to seek partners in those that are relatively strong. The results are very heterogeneous. Of the 10 leading countries and 15 disorders (in terms of papers), Poland concentrates on schizophrenia, depression and alcohol misuse, whereas Italy's strengths are eating, sexual disorders and bipolar disorders. The Netherlands is strong in post-traumatic stress disorder and hyperactivity (as is Norway), and Sweden is active in suicide and self-harm. Most countries were reasonably active in depression, and also in dementia, with the exception of Poland and Switzerland.

Table 3 shows the same relative commitments by the leading countries to the different types of research and to clinical trials.

Pharmaceutical drugs versus alternative treatments

In 2001–2018 there were more mental health disorders papers on treatment with drugs (26 206 or 10.7%) than on non-drug treatments (12 951 or 5.3%). The latter included talking therapies and some relatively unconventional areas, such as music therapy and electric shock therapy. Although outputs for both

Table 2 Fractional commitment of leading European countries to different mental disorders research, relative to the European average, 2014–2018

	UK	DE	IT	NL	FR	ES	SE	CH	PL	NO
ALZ	1.01	0.75	1.38	0.96	1.26	1.21	1.35	0.70	0.57	0.91
DEP	0.82	1.00	0.77	1.31	0.84	0.80	0.97	0.75	1.58	0.98
ADD	0.95	0.73	1.09	0.72	1.20	1.36	1.00	1.11	0.95	1.39
SCH	0.86	0.83	0.89	0.68	1.13	1.12	0.49	1.15	1.60	1.03
ANX	0.91	1.03	0.74	1.38	0.60	1.23	1.15	0.73	1.01	1.13
ALC	0.90	0.66	0.90	0.74	1.21	1.22	1.49	0.94	1.53	1.25
BIP	0.83	0.66	1.50	0.67	1.35	1.02	0.77	0.79	1.25	0.96
PER	0.93	1.08	1.26	1.49	0.58	1.15	0.67	1.26	0.80	0.98
SLE	0.62	0.85	1.32	0.83	1.44	0.81	1.27	1.72	0.52	1.29
EAT	1.00	1.09	1.58	0.54	0.89	1.20	1.33	0.61	1.22	1.26
SUI	0.91	0.70	0.82	0.51	1.33	0.89	1.67	1.04	0.88	1.25
HYP	0.77	1.08	0.63	1.69	0.52	1.56	1.60	1.18	0.29	1.76
PTS	1.01	1.16	0.59	1.69	0.82	0.42	0.57	1.21	1.02	1.39
OBS	0.96	1.07	1.37	1.21	0.65	1.33	1.13	0.80	0.45	1.44
SEX	0.97	1.27	1.55	1.22	0.70	0.95	0.64	0.88	0.76	0.73

For country codes, see table 1. Disorder codes are given below.

Cells with values >1.414 tinted green, with values <0.707 tinted yellow and with values <0.5 tinted pink.

ADD, addiction; ALC, alcohol misuse; ALZ, Alzheimer's disease; ANX, anxiety; BIP, bipolar; DEP, depression; EAT, eating; HYP, hyperactivity; OBS, obsessive compulsive; PER, personality; PTS, post-traumatic stress; SCH, schizophrenia; SEX, sexual; SLE, sleep; SUI, suicide and self-harm.

forms of treatment have increased over time, research on alternative treatments has increased faster than that on drug treatments. The ratio of the two was only 33% in 2001–2007, but 72% in 2014–2018. Countries that espoused non-drug treatments in these years particularly were Germany (63% of all treatment papers), Norway and Sweden (both 53%), and Austria and the UK (both 50%). They were less used in Eastern Europe (eg, Estonia 9%, Poland 22%) except in Romania (35%).

Some disorders were more likely to be treated with non-drug methods than others. Non-drug treatments were most researched in 2014–2018 for eating disorders (85%), obsessive-compulsive disorder (77%), post-traumatic stress syndrome (76%) and personality disorders (75%). However, five disorders were largely treated with pharmaceutical drugs, including depression, although other treatments are now gaining ground. Thus, non-drug treatments accounted for 11% of depression treatment research papers in 2001–2007, but 27% in 2014–2018.

Table 3 Fractional commitment of leading European countries to different types or domains of mental disorders research, relative to the European average, 2014–2018

	UK	DE	IT	NL	FR	ES	SE	CH	PL	NO
DIAG	1.00	1.13	1.03	0.83	0.88	1.33	1.23	1.06	1.11	0.75
DRUG	0.80	0.69	1.23	0.84	1.09	1.01	0.85	0.71	2.18	0.76
EPID	0.97	0.83	0.76	1.17	0.84	0.92	1.34	0.98	0.93	1.15
GENE	0.87	0.82	1.08	1.02	0.82	1.06	1.16	0.79	1.14	0.92
PROG	1.08	0.85	0.86	1.25	0.73	0.96	1.49	0.92	0.46	1.14
TREA	1.09	1.63	1.02	1.06	0.70	0.72	1.33	0.99	0.84	1.20
CLTR	1.17	0.92	0.54	1.65	0.64	0.70	1.49	1.02	0.21	1.27

For country codes, see table 1. Research domain codes are given below.

Cells with values >1.414 tinted green, with values <0.707 tinted yellow and with values <0.5 tinted pink.

CLTR, clinical trials; DIAG, diagnosis; DRUG, drug treatment; EPID, epidemiology; GENE, genetics; PROG, prognosis; TREA, alternative treatment.

Table 4 Number of explicit funding sources, F, acknowledged in European mental disorders research papers, 2014–2018, on different disorders and research types

Disorder	F=1+%	F mean	Disorder	F=1+%	F mean	Research type	F=1+%	F mean
ALZ	72.0	3.45	ANX	57.2	1.76	CLTR	77.6	2.26
SCH	67.0	2.58	OBS	52.4	2.06	GENE	75.9	3.87
DEP	64.8	2.37	PTS	50.7	1.66	EPID	67.1	3.00
HYP	64.7	2.66	SUI	48.2	1.51	DRUG	66.4	2.26
ALC	64.6	2.06	EAT	47.3	1.37	PROG	65.3	2.63
BIP	62.4	2.65	PER	43.6	1.21	DIAG	54.1	2.09
SLE	59.4	1.98	SEX	26.8	0.64	TREA	39.2	1.00
ADD	59.0	1.80						

ADD, addiction; ALC, alcohol misuse; ALZ, Alzheimer's disease; ANX, anxiety; BIP, bipolar; CLTR, clinical trials; DEP, depression; DIAG, diagnosis; DRUG, drug treatment; EAT, eating; EPID, epidemiology; GENE, genetics; HYP, hyperactivity; OBS, obsessive compulsive; PER, personality; PROG, prognosis; PTS, post-traumatic stress; SCH, schizophrenia; SEX, sexual; SLE, sleep; SUI, suicide and self-harm TREA, alternative treatment.

Funding of mental health disorders research in Europe

The 31 countries varied in their ability to attract explicit funding for their mental health disorders research in 2014–2018. The average was 57% of papers with funding, and the mean number of funding sources acknowledged was 2.03. Five countries achieved a funding level of 70% or more (Estonia, Sweden, Finland, Czech Republic and Denmark), but there were six with fewer than 40% of their papers reporting funding (Cyprus, Croatia, Greece, Slovenia, Italy and Malta). There was, however, almost no correlation between this percentage and the mean number of funders per paper, which varied from 8 in Bulgaria to 1.2 in Cyprus.

However, the correlations were more positive for the various disorders ($r^2=0.84$) and research domains ($r^2=0.62$) (see table 4). The most generous funding in 2014–2018 was for Alzheimer's disease and other dementias, followed by schizophrenia. There was very little funding for sexual disorders, and for personality disorder, eating disorder, or for suicide and self harm. It was not surprising that clinical trials were most frequently funded, but with only 2.3 funders per paper. Genetics was also well funded, as it is for other NCDs. However, there was very little financial support for alternative treatments, that is, those not involving drugs.

In 2018, the corrected tally of European mental health disorders research papers was $21\,153 \times 0.94 = 19\,865$ papers on an integer count basis. At an average cost per paper of €260 000 in 2013, which should be increased to €271 000 in 2018 to allow for inflation in the Eurozone, we estimate that the overall cost of this research would have been €5.38 billion. Not all of this sum would have come from European sources; approximately 12%, or €0.65 billion, would likely have come from other continents, principally North America.

DISCUSSION

Our analysis has shown that, while mental health disorders represent roughly 12% of the EUR31 overall burden of disease, they represented only 5% of its biomedical research output. Unipolar depression and Alzheimer's disease/dementias had the highest percentages of publications. Relative to the European burden of disease, schizophrenia and eating disorders benefited from a high level of research. However, suicide and self-harm, and also alcohol misuse, depression and Alzheimer's disease, appeared seriously under-researched. Relative to countries' GDP and their mental health disorders burden, France, Luxembourg and Latvia had the lowest mental health disorders research outputs, while Estonia, Sweden, Finland, Czech Republic and Denmark had the highest.

The European Commission-funded 'Roadmap for Mental Health Research in Europe' (ROAMER) project has conducted extensive literature reviews and expert and stakeholder consultation to identify six research priorities where mental health disorders research in Europe is most likely to deliver impact in the coming years. Key research priorities are well aligned with identified policy goals and include research into prevention and mental health promotion in children and young people, advances in ehealth, and the need for appropriate mental health outcome measures and effective use of data.³³ Publications from the ROAMER project also emphasise that, relative to the burden of disease, there is stark underinvestment in mental health disorders research both at the European and national levels, and point out that good data on research funding in mental health disorders are not readily available and often not comparable across countries.

This study has a number of limitations. First, the precision and recall of the filter were the lowest of the five that were developed and used for the Mapping_NCD project, so that a significant number of papers were not identified and analysed, and there were still many false positives despite our attempts to identify and remove them. Second, as the data in the Introduction section showed, the DALY burden from mental health disorders may be much higher than the WHO figures because of indirect effects. This is manifestly so for alcohol misuse, but it may also occur for other disorders, notably bipolar disorder, dementia and depression. This means that the disorders for which data are given in figure 2 may actually be more under-served by researchers than appears. Third, our selection of mental disorders may be questioned. In particular our exclusion of autism could be challenged, because there are many treatments that can improve the condition. Finally, we have focused almost entirely on the mental health disorders of adults, and a new paper would be needed to cover the disorders of children and young people.

With research funding for mental health disorders research falling short of matching the burden of disease imposed by mental illness across Europe, there is a clear case for governments to increase research funding in this area as a whole. This analysis has further highlighted areas within mental health disorders research that have been particularly underfunded in the past and require increased attention. The ROAMER project has outlined six priority areas where mental health disorders research in Europe can deliver impact in the upcoming years. Thus, in combination with portfolio analyses like the current one, there is now good knowledge on which to build a coordinated effort. For example, the UK Department for Health is now

developing a concerted mental health disorders research strategy in collaboration with the major funders.

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ORCID iDs

Grant Lewison <http://orcid.org/0000-0002-4493-1216>

Meryl Darlington <http://orcid.org/0000-0001-8029-1925>

REFERENCES

- Nielsen TR, Vogel A, Phung TKT, *et al.* Over- and under-diagnosis of dementia in ethnic minorities: a nationwide register-based study. *Int J Geriatr Psychiatry* 2011;26:n/a.
- Bongards EN, Zaman R, Agius M. Can we prevent under-diagnosis and misdiagnosis of bipolar affective disorder? repeat audits to assess the epidemiological change in the caseload of a community mental health team when bipolar disorder is accurately assessed and diagnosed. *Psychiatr Danub* 2013;25:S129–34.
- Lao C-K, Chan Y-M, Tong HH-Y, *et al.* Underdiagnosis of depression in an economically deprived population in Macao, China: underdiagnosis of depression among the poor. *Asia-Pac Psychiatry* 2016;8:70–9.
- Chue P, Cheung R. Minimising the risk of diabetes in patients with schizophrenia and bipolar disorder. *Int J Psychiatry Clin Pract* 2006;10:105–16.
- C-Y W, Chang C-K, Hayes RD, *et al.* Clinical risk assessment rating and all-cause mortality in secondary mental healthcare: the South London and Maudsley NHS Foundation trust biomedical research centre (SLAM BRC) case register. *Psychol Med* 2012;42:1581–90.
- Gibson M, Carek PJ, Sullivan B. Treatment of co-morbid mental illness in primary care: how to minimize weight gain, diabetes, and metabolic syndrome. *Int J Psychiatry Med* 2011;41:127–42.
- Schneider M, Norman R, South African Comparative Risk Assessment Collaborating Group, *et al.* Estimating the burden of disease attributable to alcohol use in South Africa in 2000. *South Afr Med J Suid-Afr Tydskr Vir Geneeskde* 2007;97:664–72.
- Markle WH, Fisher MA. *Understanding global health*. 2nd edn. New York: McGraw-Hill, 2014: 529.
- Rehm J, Iltiaz S. A narrative review of alcohol consumption as a risk factor for global burden of disease. *Subst Abuse Treat Prev Policy* 2016;11.
- Popova S, Lange S, Probst C, *et al.* Estimation of national, regional, and global prevalence of alcohol use during pregnancy and fetal alcohol syndrome: a systematic review and meta-analysis. *Lancet Glob Health* 2017;5:e290–9.
- WHO. 2015. Global status report on road safety 2015. 1–326. Geneva: World Health organization. Available: http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/ [Accessed 14th Sep 2017].
- Rehm PDJ, Borges G, Gmel G, *et al.* The comparative risk assessment for alcohol as part of the global burden of disease 2010 study: what changed from the last study? *Int J Alcohol Drug Res* 2013;2.
- Baliunas DO, Taylor BJ, Irving H, *et al.* Alcohol as a risk factor for type 2 diabetes: a systematic review and meta-analysis. *Diabetes Care* 2009;32:2123–32.
- Samokhvalov AV, Irving H, Mohapatra S, *et al.* unprovoked seizures, and epilepsy: A systematic review and meta-analysis: Alcohol & Epilepsy. *Epilepsia* 2010;51:1177–84.
- Roerecke M, Rehm J. Alcohol consumption, drinking patterns, and ischemic heart disease: a narrative review of meta-analyses and a systematic review and meta-analysis of the impact of heavy drinking occasions on risk for moderate drinkers. *BMC Med* 2014;12:182.
- Patra J, Taylor B, Irving H, *et al.* Alcohol consumption and the risk of morbidity and mortality for different stroke types--a systematic review and meta-analysis. *BMC Public Health* 2010;10:258.
- Effertz T, Mann K. The burden and cost of disorders of the brain in Europe with the inclusion of harmful alcohol use and nicotine addiction. *Eur Neuropsychopharmacol* 2013;23:742–8.
- Hedegaard H, Warner M, Miniño AM. *Drug overdose deaths in the United States, 199–2016*. NCHSA data brief, no 294. Hyattsville, MD: National Center for Health Statistics, 2017.
- WHO. 2016. Global health estimates 2015: disease burden by cause, age, sex, by country and by region, 2000–2015. Geneva: World Health organization, 2016. Available: http://www.who.int/healthinfo/global_burden_disease/estimates/en/index2.html
- Pridemore WA, Snowden AJ. Reduction in suicide mortality following a new national alcohol policy in Slovenia: an interrupted time-series analysis. *Am J Public Health* 2009;99:915–20.
- Havárnanu GM, Bonneau M-H, Colliard J. Lessons learned from the collaborative European project RESTRAIL: reduction of suicides and trespasses on Railway property. *Eur Transp Res Rev* 2016;8.
- Gonzalez-Forteza C, Echeagaray FAW, Tapia AJ. Center of epidemiological studies of depression scale (CES-D) in Mexico: bibliometric analysis. *Salud Mental* 2012;35:13–20.
- Geraei E, Shakibaei F, Mazaheri E. Depression: detecting the historical roots of research on depression prevention with reference publication year spectroscopy. *Int J Prev Med* 2018;9:53.
- Serrano-Pozo A, Aldridge GM, Zhang Q. Four Decades of Research in Alzheimer's Disease (1975–2014): A Bibliometric and Scientometric Analysis. *JAD* 2017;59:763–83.
- Dong R, Wang H, Ye J, *et al.* Publication trends for Alzheimer's disease worldwide and in China: a 30-year bibliometric analysis. *Front Hum Neurosci* 2019;13.
- Boschen MJ. Publication trends in individual anxiety disorders: 1980–2015. *J Anxiety Dis* 2008;22:570–5.
- Asmundson GJG, Asmundson AJN. Are anxiety disorders publications continuing on a trajectory of growth? A look at Boschen's (2008) predictions and beyond. *J Anxiety Dis* 2018;56:1–4.
- Begum M, Lewison G, Wright JSF, *et al.* European non-communicable respiratory disease research, 2002–13: bibliometric study of outputs and funding. *PLoS One* 2016;11:e0154197.
- Lewison G. The definition of biomedical research subfields with title keywords and application to the analysis of research outputs. *Res Eval* 1996;6:25–36.
- Lewison G, Paraje G. The classification of biomedical journals by research level. *Scientometrics* 2004;60:145–57.
- Begum M, Lewison G. Web of science research funding information: methodology for its use in analysis and evaluation. *J Scientometr Res* 2017;6:65–73.
- Begum M, Lewison G, Lawler M, *et al.* Mapping the European cancer research landscape: an evidence base for national and pan-European research and funding. *Eur J Cancer* 2018;100:75–84.
- Wykes T, Haro JM, Belli SR, *et al.* Mental health research priorities for Europe. *Lancet Psychiatry* 2015;2:1036–42.