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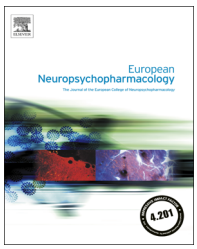

Evolution of public and non-profit funding for mental health research in France between 2007 and 2011

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Abstract
Since 2007, actions have been undertaken in France to foster mental health research. Our objective was to assess their utility by estimating the evolution of public and non-profit funding for mental health research between 2007 and 2011, both in terms of total funding and the share of health research budgets. Public and non-profit funding was considered. Core funding from public research institutions was determined through a top-down approach by multiplying their total budget by the ratio of the number of psychiatry-related publications to the total number of publications focusing on health issues. A bottom-up method was used to estimate the amount of project-based grants and funding by non-profit organizations, which were directly contacted to obtain this information. Public and non-profit funding for mental health research increased by a factor of 3.4 between 2007 and 2011 reaching €84.8 million, while the share of health research funding allocated to mental health research nearly doubled from 2.2% to 4.1%. Public sources were the main contributors representing 94% of the total funding. Our results have important implications for policy makers, as they suggest that actions specifically aimed at prioritizing mental health research are effective in increasing research funding. There is therefore an urgent need to further undertake such actions as funding in France remains

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particularly low compared to the United Kingdom and the United States, despite the fact that the epidemiological and economic burden represented by mental disorders is expected to grow rapidly in the coming years.

1. Introduction

Worldwide, it is estimated that one in three individuals will experience a mental disorder. In addition, these disorders represent the second cause of loss of quality of life just after cardiovascular diseases (World Health Organization, 2005) and they are responsible for increased somatic comorbidities and mortality (Viron and Stern, 2010). In Europe, 38.2% of the population suffer from mental illnesses each year (Wittchen et al., 2011) and France is among the countries with the highest prevalence of mood disorders, percentage of individuals suffering from psychological distress, consumption of psychotropic drugs and suicide rate in the European Union (European Commission, 2004; Organization for economic co-operation and development, 2011). It is also estimated that mental disorders account for 14% of the overall disease burden in France (World Health Organization, 2012). Moreover, the global burden of mental illnesses seems to increase worldwide, in terms of raw incidence, prevalence, as well as total burden of diseases, and mental disorders are expected to represent the main cause of disability by 2020 (Murray et al., 2012; Vos et al., 2015; World Health Organization, 2002). The World Health Organization Mental Health Action Plan 2013–2020 has therefore underscored the need to generate new knowledge through research to ensure that policies and actions are based on evidence and best practices (World Health Organization, 2013).

Nevertheless, mental disorders currently do not seem to be a priority for public policy makers with little support expressed by political leaders, a limited number of policies enacted to address their specific issues, and insufficient resources allocated both for the care of those disorders and to related research (Kingdon, 2006; Tomlinson and Lund, 2012). In France, research on mental disorders has been estimated to be relatively underfunded: a first study showed that the share of public and non-profit funding allocated to mental health research in 2007 represented only 2% of health research budgets, compared to 7% in the United Kingdom and 16% in the United States (Chevreul et al., 2012). Indeed mental health research in France is particularly under-developed and does not attract sufficient numbers of strong prominent researchers and clinicians (Gorwood, 2009). However, the political will to encourage mental health research and researchers has been apparent in France since 2007. Two successive national action plans for psychiatry and mental health underscored the necessity to develop adequate research (Ministère de la santé et de la cohésion sociale, 2005; Ministère du travail, de l'emploi et de la santé, 2012). Furthermore, a network for scientific collaboration in mental health, the FondaMental foundation (www.fondation-fondamental.org), was created in 2007 by the French Ministry of Higher Education and Research to accelerate the development of mental health research in France through cooperative networks between basic neuroscience and expert centers to foster translational research, to communicate with policy makers and to raise private funds for financing mental health research. In addition, specific public calls for proposals to fund mental health research were developed.

In order to assess the effectiveness of those actions, the objectives of our study were to estimate the evolution of public and non-profit funding for mental health research in France between 2007 and 2011, both in terms of total funding and the share of health research budgets.

2. Experimental procedures

2.1. Scope of the study

We used the scope and method first defined for the 2007 study assessing the French mental health research funding level (Chevreul et al., 2012) as the basis for measuring such funding for 2009 and 2011 in order to ensure comparability.

Our study was restricted to public and charitable funding allocated to mental health research. Private sources of funding such as pharmaceutical industries were not included in the analysis for two reasons. First, their investment in research is mostly global and cannot be allocated to a specific country. In addition, they consider information on research budgets to be proprietary thus they do not wish to communicate such data. Moreover, private funds invested in mental health research are estimated to be both relatively low and decreasing, as the pharmaceutical industry has withdrawn from the major areas of neuroscience research and in particular psychiatry-related research (Kingdon, 2006; Nutt and Goodwin, 2011).

In considering the mental health field, we included mental disorders from the chapter V of the International Classification of Diseases, tenth revision (ICD-10) (World Health Organization, 2010) except for intellectual disability and dementia such as Alzheimer's disease (Haro et al., 2014), which receive specific care that differs from psychiatric care and have dedicated research funding programs.

2.2. Public funding

Public funding includes both core budgets attributed to research institutions and public project-based grants.

2.3. Core funding

Core funding refers to financial support that covers the basic organizational and administrative costs of an organization. This includes salaries of permanent staff, facilities, equipment, communications, and the direct expenses of day-to-day work. In order to determine how much of such funding is allocated to mental health research, we identified public research institutions conducting health research in France. They include public institutions for sciences and technologies, such as the French National Institute of Health and Medical Research (INSERM), the French National Center for Scientific Research (CNRS) and the French Atomic Energy and Alternative Energies Commission (CEA), as well as

institutions for life sciences research (the Pasteur Institute) and universities (including university hospitals).

The accounting systems of public research institutions in France do not allow for direct identification of funds spent on materials, staff or overhead costs dedicated to mental health research. Thus, it was not possible to determine within a multidisciplinary organization the funds dedicated to mental disorders for each category of spending. For this reason we used a top-down approach which consists of allocating part of the global budget of each research institution to mental health research by using an allocation key. This enabled us to take into account all spending generated by research activities, including fixed costs and additional spending. Publications have previously been used as a surrogate for overall research activities (Lewison et al., 2010), and we based our allocation key on the ratio of the number of psychiatry-related publications to the total number of publications focusing on health issues for each institution and for each year of the study. Psychiatry-related publications written in English in international peer-reviewed journals were selected from the Web of Science using keywords for mental disorders based on the ICD-10 and previously validated by a psychiatrist (Chevreul et al., 2012). Titles and abstracts were searched for those keywords, and specific requests were used to limit the results to publications from the included institutions (see Supplementary data). Two researchers independently reviewed all articles selected and excluded publications that were not within the scope of the study.

The total annual budgets of INSERM, CNRS, CEA and universities allocated by the State to health research were obtained from the French Public Finance Acts for 2009 and 2011 (Mission interministérielle, 2013, 2011). The budget of the Pasteur Institute is partially comprised of subsidies from the State as well as the Institute's own charitable funds. We extracted those amounts from the Institute's annual reports (Institut Pasteur, 2012, 2010).

Finally, as this top-down approach relies up on the hypothesis that mental health researchers are as productive as researchers working on other health issues, we carried out a sensitivity analysis in which mental health researchers' productivity was either 20% lower or 20% higher than researchers working in other fields of health research.

2.4. Project-based grants

Project-based grants refer to funds awarded in order to finance specific projects or objectives only. We identified the main types of public project-based grants used to fund health research in France. These are (1) grants financed by the statutory health insurance (SHI) through the French Ministry of Health, including the Clinical Research Program (PHRC), which supports research projects conducted in hospitals according to national public health priorities, and the Health Economics Research Program (PRME), which funds economic evaluations of innovations whose clinical benefit has already been assessed; (2) the calls for proposals of the French National Research Agency (ANR) financed by the State which funds research projects in biology and health among other; (3) the calls for proposals of the French Institute for Public Health Research (IReSP) financed by the State and several SHI organizations and funds research projects in public health.

Projects dedicated to mental health research were identified within all the attributed project-based grants. Amounts allocated to these projects and total amounts allocated to all projects focusing on health through those research grants were obtained directly from the funding institutions.

2.5. Non-profit funding

We included the following non-governmental non-profit organizations funding health research in France: the Orange Foundation, the Foundation of France, the Brain Research Foundation, the Medical Research Foundation and the Pasteur Charitable Fund. For 2009 and 2011, the FondaMental foundation, which was created in 2007, was also included. Funding allocated to mental health research by these organizations was obtained by directly contacting the person in charge of budgeting within each organization except for the Pasteur Charitable Fund, for which we used the same allocation key as for the governmental funding for similar accounting reasons.

3. Results

3.1. Core funding

3.1.1. Evolution of the number of publications

The total number of psychiatry-related publications for all of the main public research institutions was 462 in 2009 and 784 in 2011, while it was 339 in 2007 (Chevreul et al., 2012). The share of psychiatry-related publications compared to all types of publications in health research was 2.6% in 2009 and 4.1% in 2011, while it was 2.2% in 2007 (Chevreul et al., 2012).

3.2. Evolution of funding

Core funding allocated to mental health research was more than three times higher in 2011 than in 2007 (see Table 1), growing from €19.9 million to €71.8 million. Core funding increased for all main research institutions; however, the university research budget increase was by far the highest, increasing from €1.5 million in 2007 to €26.4 million in 2011. The share of core funding for health research allocated to mental health research increased by a factor of 1.9 on the same period, reaching 4.1% in 2011. However, this increase was not homogenous among public institutions. It was particularly high for the CNRS and the Pasteur Institute (2.8–3 times higher) while only 1.4–1.8 times higher for INSERM, universities and the CEA.

3.3. Project-based grants

The amount allocated to mental health research through project-based grants was 2.3 times higher in 2011 (€8.6 million) than in 2007 (€3.8 million) (Chevreul et al., 2012) and reached a high of €11.8 million in 2009. This increase was particularly significant for ANR and PHRC.

The share of health research budgets allocated to mental health research through project-based grants was 1.8 times higher in 2011 (5.4%) than in 2007 (3.0%). This evolution mostly resulted from an increase in the share of ANR grants allocated to projects focusing on mental health. The share of health research budget allocated to mental health by IReSP was 2.6 times higher in 2011 than in 2007 but the corresponding amounts remained low and did not impact significantly the total results for project-based grants (see Table 1).

3.4. Non-profit funding

The total amount dedicated to mental health research by non-profit organizations tripled ($\times$ 3.1) between 2007 and 2011, reaching €4.5 million. The share of health research budgets allocated to mental health by such organizations nearly tripled ($\times$ 2.8), growing from 0.9% in 2007 to 2.6% in 2011. Individually, all non-profit organizations dedicated less than 3.0% of

Table 1 Evolution of public and non-governmental non-profit funding allocated to mental health research between 2007 and 2011.

Source of funding	2007 (Chevreul et al., 2012)		2009		2011	
	Amount (M€)	% of health research budget	Amount (M€)	% of health research budget	Amount (M€)	% of health research budget
Core funding	19.9	2.2	**32.9**	**2.6**	**71.8**	**4.1**
INSERM	10.1	2.9	14.2	3.6	22.4	5.2
CNRS	5.5	1.2	10.1	2.0	17.1	3.4
CEA	2.5	3.3	2.2	2.3	4.9	4.7
Universities	1.5	2.4	6.0	2.6	26.4	4.1
Pasteur Institute	0.3	0.6	0.4	0.8	0.9	1.8
Project-based grants	3.8	3.0	**11.8**	**4.9**	**8.6**	**5.4**
PHRC	2.2	6.3	6.2	7.0	5.6	6.9
PRME	0	0	0	0	0	0
ANR	1.6	2.1	5.5	4.8	2.6	4.3
IReSP	0.1	4.3	0	0	0.4	11.1
Non-profit funding	1.5	0.9	**3.2**	**1.9**	**4.5**	**2.6**
Orange Foundation	0.3	100	0.4	100	0.3	100
Foundation of France	0.09	2.6	0.03	0.5	0.2	3.0
Brain Research Foundation	0.0	0.0	0.0	0.0	0.0	0.0
Medical Research Foundation	0.4	1.3	1.4	4.5	1.0	2.7
Pasteur Charitable Fund	0.7	0.6	1	0.8	2.3	1.8
FondaMental Foundation	-	-	0.3	100	0.6	100
Total	**25.2**	**1.9**	**47.8**	**2.8**	**84.8**	**4.1**

their funding to mental health research with the exception of the Orange Foundation and the FondaMental Foundation whose funds for research were entirely allocated to psychiatry-related projects (see Table 1).

3.5. Total public and non-profit funding

Public and non-profit funding allocated to mental health research increased by a factor of 3.4 between 2007 and 2011, reaching €84.8 million in 2011. The share of health research funding devoted to mental health doubled ($\times$ 2.1), reaching 4.1% in 2011 (see Table 1).

The distribution of funding for mental health research among public and non-profit funders remained stable over time with public contributions amounting to 94%. Core funding represented the main source of funding (79% of the total in 2007, 69% in 2009 and 85% in 2011) and has risen slightly faster than the other categories (see Figure 1). Funding allocated through project-based grants increased significantly over the period, particularly in 2009 when it reached 25% of the total amount dedicated to mental research. This was the result of an increase in the amount of funding of ANR project-based grants allocated to mental health research in that year. The State (through core funding and ANR project-based grants) and the SHI (mainly through the PHRC project-based grants) were the main sources of funding for mental health research in all years considered.

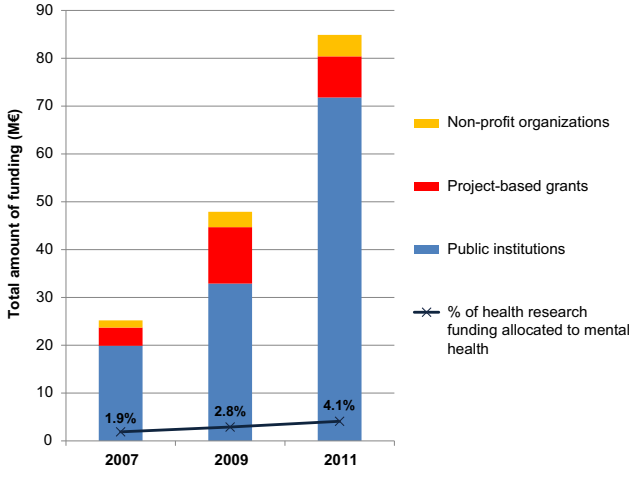

Figure 1 Global evolution of public and non-profit funding for mental health research between 2007 and 2011.

3.6. Sensitivity analysis

When we performed the analysis with assumptions of 20% higher and lower productivity for mental health researchers, the total funding and the share of health research

budget allocated to mental health ranged from 14% lower (in 2009) to 17% higher (in 2011) (see Tables 2a and 2b).

The evolution of both the total amount of funding and the share of health research dedicated to mental health between 2007 and 2011 was not significantly impacted as it was only 0.01 times lower and higher under the sensitivity analysis.

4. Discussion

A steady increase in public and non-profit funding for mental health research in France occurred between 2007 and 2011. This increase can be observed both in the total amount of funding which tripled, reaching €84.8 million, and in the share of health research budget allocated to mental health which nearly doubled, reaching 4.1%. All sources of funding (core funding, project-based grants and non-profit organizations) increased their contributions to mental health research. The distribution of these contributions between public and non-profit funders remained stable, while contributions from project-based grants increased significantly within public funding in 2009 before returning to 2007 levels in 2011.

Among public institutions, the most significant evolution was observed for the total amount of funding allocated by universities. This must be interpreted in the light of a 2007 policy change regarding universities' budgets. Indeed, the law of August 10th, 2007 relative to the freedom and responsibilities of universities enabled them to become autonomous in managing their budgets and human resources (Legifrance, 2007). It resulted in a global increase in the budget of universities with a progressive application over the years. However, the share of funding dedicated to mental health research compared to the total health research funding in universities followed a similar trend as the average increase of core funding (1.7 times higher in 2011 than in 2007) and was lower than the increase observed in other public institutions, most notably the CNRS and the Pasteur Institute, which tripled the share of their budgets allocated to mental health research. This would seem to indicate that the dramatic evolution in the amount of funding allocated by universities did not result from massive investments in mental health but rather from structural changes.

The total amount of funding allocated to mental health research through general project-based grants globally

Table 2a Variations in core and total funding assuming that productivity was 20% higher for mental health researchers than for researchers working in other fields of health research.

Source of funding	2007 (Chevreul et al., 2012)		2009		2011	
	Amount (M€)	% of health research budget	Amount (M€)	% of health research budget	Amount (M€)	% of health research budget
Core funding	15.9	1.6	26.3	2.1	57.4	3.3
INSERM	8.1	2.3	11.4	2.9	17.9	4.2
CNRS	4.4	1.0	8.1	1.6	13.7	2.7
CEA	2.0	2.6	1.7	1.8	3.9	3.8
Universities	1.2	1.9	4.8	2.1	21.1	3.3
Pasteur Institute	0.2	0.5	0.3	0.6	0.7	1.4
Total funding	**21.2**	**1.7**	**41.2**	**2.5**	**70.5**	**3.4**

Table 2b Variations in core and total funding assuming that productivity was 20% lower for mental health researchers than for researchers working in other fields of health research.

Source of funding	2007 (Chevreul et al., 2012)		2009		2011	
	Amount (M€)	% of health research budget	Amount (M€)	% of health research budget	Amount (M€)	% of health research budget
Core funding	**23.9**	**2.4**	**39.5**	**3.1**	**86.1**	**5.0**
INSERM	12.2	3.4	17.0	4.3	26.9	6.2
CNRS	6.5	1.5	12.2	2.4	20.6	4.1
CEA	3.0	3.9	2.6	2.7	5.9	5.6
Universities	1.8	2.9	7.2	3.2	31.7	4.9
Pasteur Institute	0.3	0.7	0.4	0.9	1.1	2.2
Total funding	**29.2**	**2.3**	**54.4**	**3.3**	**99.2**	**4.8**

increased. However, the share of funding dedicated to mental health research projects in the PHRC general call for proposals was essentially stable over time. While this type of general call for proposals is perceived as a means of selecting teams based on merit and supporting high-quality research (Cour des Comptes, 2013), it is not well-suited to less-developed fields of research such as psychiatry. Indeed, this funding approach maintains a self-perpetuating cycle in which only highly developed and visible research fields receive funding and encourages the concentration of the best researchers in fields which are the most likely to get funding. On the other hand, calls for proposals specifically dedicated to psychiatric disorders, more common in other European countries, could attract strong prominent researchers who are not mental health professionals to the field of psychiatry. This is greatly needed, as one of the main shortcomings of mental health research in France is the lack of research staff attracted to this field of research. Indeed, the significant contribution of project-based grants to global funding for mental health research in 2009 resulted from the development of such dedicated calls for proposals by the ANR that year.

The highest increase in the share of health research budget allocated to mental health between 2007 and 2011 was observed for non-profit organizations ($\times$ 2.8 vs. 1.9 for core funding and 1.8 for project-based grants) even if its impact on the overall amount of funding was limited (5.3% in 2011). This evolution can mostly be explained by the increase in the share of health research funding that non-specialized health research foundations allocated to mental health even if the evolution was not linear over the study period. This suggests that non-profit organizations are becoming increasingly aware of the importance of prioritizing mental health issues even if on-going efforts are needed so that this trend may persist over time. The share of health research budget allocated to mental health by non-profit organizations between 2007 and 2011 was also slightly impacted by the creation of a foundation dedicated to mental disorders whose development was supported by public investment and whose funds mainly originated from donations from private industries.

Despite the positive evolution in the total amount and share of health research budgets allocated to mental health over time, funding is still particularly low compared to the current epidemiological and economic burden of the diseases involved, which is a generally accepted factor to be taken into account when funding research (Carter and Nguyen, 2012; Nutt and Goodwin, 2011). Previous works have shown that research on diabetes, asthma, cancer, arthritis, cardiovascular diseases and neurological disorders all receive more funding per attributable disability-adjusted life-year than mental health research in high-income countries (Christensen et al., 2011; Kingdon and Wykes, 2013; Mitchell et al., 2009). Moreover, while we estimate that 4.1% of the health research budget is dedicated to mental health, societal costs incurred by mental disorders are particularly high (Kingdon and Wykes, 2013), representing 8% of health spending in France (€13.4 billion) (Chevreul et al., 2013). Decreasing these discrepancies between burden and research investment should be a high priority on the policy agenda, particularly given that both the epidemiological and economic burdens associated with mental disorders are expected to increase over the next few years in tandem with the predicted increase in the overall prevalence of mental illnesses (World Health Organization, 2002). In addition, the expected rate of return on investment of mental health research has been estimated at 37% in the United Kingdom, divided between 7% for health gains (measured by the difference between the monetary value of total Quality-Adjusted Life Years (QALYs) gained thanks to research and the health services costs of generating them, adjusted on research expenditure for mental health) and 30% for the impact on gross domestic product (measured by the economic growth enabled by research). Each euro invested in mental health research can therefore avoid spending €0.37 euro per year in perpetuity, in particular as a consequence of positive spillovers of current research on future research (through for instance better performance or an increase in the number of new patents). In addition, while the impact on health gains is less significant than on GDP, the UK study suggests that new treatments developed through research do have the potential to increase productivity and quality of life of patients suffering from mental disorders (Buxton et al., 2008). The implications for the French context are considerable as indirect costs represent more than 80% of the total cost of mental disorders in France, amounting to €90 billion each year (Chevreul et al., 2013) which could be lowered by investing more in research.

There are some limitations to our study. We used a top-down approach to determine core funding allocated to mental health research while bottom-up methods (such as the one we used for project-based grants and non-profit organizations) are often deemed more informative for decision-making (Tarricone, 2006). Nevertheless, it enabled us to take into account all core funding dedicated to mental health research, including overheads and supply materials which are indirectly linked to it. We could not have been as inclusive with a bottom-up approach because the information available regarding French institutions' budgets is not detailed enough. Furthermore, while the analysis of research funding through bibliometrics has been used in other fields of research (Eckhouse et al., 2008), it has several limits. First, only the main funders of mental health research in France were considered (while 13–20% of psychiatry-related publications were written by French teams that did not belong to any of the institutions included), and only publications in English were selected. We estimated that the number of publications missed by not including publications in French would be negligible, as only one journal publishing articles in French is referenced in the Web of Science in the field of psychiatry. In addition, the incentives for researchers to publish the results of funded works in French journals are limited by the small impact factor of such journals. Moreover, our method relies on the hypothesis that mental health researchers are as productive as researchers working on other health issues. However, our sensitivity analysis confirms that the assumption we made regarding productivity does not impact our findings in terms of increased funding. Nonetheless, we did not take into account that the level of productivity of mental health researchers compared to other researchers may have not been constant over the five-year-period considered.

Our results have important implications for policy makers. They suggest that the development of actions specifically aimed at enhancing mental health research at the national level, such as establishing of a dedicated foundation and launching specific calls for proposals, are effective in increasing research funding. Indeed, these specific calls should be maintained over the long-term as their absence in 2011 was associated with a decrease in funding for mental health research from project-based grants that have the advantage of promoting excellence. On a broader basis, in France, there is an urgent need to further undertake such actions. Indeed, an important raise in both the epidemiological and economic burden of mental disorders is anticipated in the coming years while, despite the increase observed between 2007 and 2011, the share of health research funding dedicated to mental health in France in 2011 (4%) was still inferior to that observed in the United Kingdom (7%) and in the United States (16%) in 2007 (Chevreul et al., 2012).

Role of funding source

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Contributors

Coralie Gandré and Karine Chevreul participated in the study design, in the collection, analysis and interpretation of data and in the writing of the report. Amélie Prigent, Marie-Louise Kemel and Marion Leboyer participated in the study design, in the collection of data and in the writing of the report. All authors contributed to and have approved the final manuscript.

Conflict of interest

None.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.euroneuro.2015.10.006.

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