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Comparative bibliometric study of the publications in Spanish and other European country publications

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Introduction. Investigation in biomedicine carried out in Spain presently has a good level and has evolved positively in the last two decades. In order to know the research situation in psychiatry, the bibliometric study was used as a method of approach to the mentioned analysis.

Objectives. To identify the Spanish scientific production in psychiatry during the last decade, its repercussion worldwide and to compare it to other countries of our surroundings.

Method. Bibliographical revision of the psychiatric magazines with greater impact factor at present. Thematic magazines of psychiatry and other areas (child and adolescent psychiatry and the addictions) are reviewed. The articles of Spanish authors were analyzed and compared with other countries of the surroundings (Germany, France, Holland, Italy and Sweden). The data obtained are linked with the economic data of the countries in question, it being possible to obtain how much each one of the investigations in the diverse countries cost per citizen.

Results. Globally, the countries analyzed have increased their international scientific production and, specifically, Spain has doubled its scientific activity in psychiatry.

Conclusions. Investigation in psychiatry in Spain is represented in publications of greater impact factor of the speciality and is comparable in volume to the other countries of our surroundings.

Key words:
Scientific production. Publications of impact. Bibliographical revision. International projection. Psychiatry of impact.

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Estudio bibliométrico comparativo de las publicaciones en psiquiatría españolas y de otros países europeos

Introducción. La investigación en biomedicina realizada en España tiene actualmente un buen nivel y ha evolucionado de forma positiva en las dos últimas décadas. Con el fin de conocer la situación en la que se encuentra la investigación en psiquiatría se ha utilizado el estudio bibliométrico como fórmula de aproximación al citado análisis.

Objetivos. Identificar la producción científica española en psiquiatría durante la última década, su repercusión a nivel mundial y contrastarla con respecto a otros países de nuestro entorno.

Método. Revisión bibliográfica de las revistas psiquiátricas con mayor factor de impacto del momento. Se revisan revistas de psiquiatría y otras áreas temáticas particulares (psiquiatría infantojuvenil y adicciones). Se analizaron los artículos de autores españoles y se comparan con otros países del entorno (Alemania, Francia, Holanda, Italia y Suecia). Los datos obtenidos se vinculan con los datos económicos de los países en cuestión, llegando a obtener cuánto cuesta a cada ciudadano cada una de las investigaciones en los diversos países.

Resultados. Globalmente los países analizados han aumentado su producción científica internacional y, en particular, se ha duplicado la actividad científica española en psiquiatría.

Conclusiones. La investigación en psiquiatría en España está representada en las publicaciones de mayor factor de impacto de la especialidad y es comparable en volumen a la de los países de nuestro entorno.

Palabras clave:
Producción científica. Publicaciones de impacto. Revisión bibliográfica. Proyección internacional. Psiquiatría de impacto.

INTRODUCTION

The utility of bibliometric studies to analyze scientific activity and as a complement of other indicators, such as

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expert's opinion, is a widely admitted fact at present[1]. Biomedical journals having greater prestige and distribution share a series of common characteristics that accredit them as a good evaluation mechanism, basically the existence in them of peer-review systems and the great competition to publish (high percentage of unaccepted articles). These conditions classify them as an acceptable instrument to assess the result of biomedical investigation. A good indicator that makes it possible to quantify the relevance of an original article is the impact factor, a value assigned yearly to the journals in which the original articles have been published. Thus, the impact factor analyzes the relative importance of the journal, and not the specific article, in competition with all the others published[2]. However, a well designed and conducted quality investigation should provide sufficiently valid and clinically relevant results to be published in national or international journals, which will have a greater impact factor the greater its future citation[3].

This study aims to identify the Spanish scientific production in psychiatry in the last decade, through an analysis limited to the publications of Spanish authors appearing in a sample of internationally prestigious psychiatry journals having a high impact factor, assessing the evolutive process during the last two five year periods and comparing this production with that done by authors of five other European countries.

The structural, thematic and methodological analysis of the Spanish scientific production in psychiatry will facilitate an indirect assessment of its quality and will complete the present study of initial approach.

MATERIAL AND METHODS

The bibliometric study has been performed with the Medline® bibliographic database, in its public access format via Internet PUBMED®, available at the address www.ncbi.nlm.nih.gov. In order to compare the evolutive transition, two five-year study periods were selected: 1993-1997 and 1998-2002, with the following search strategy:

Journal

In order to include the presently most relevant scientific publications, we based our selection on those having the greatest impact factor. To identify the journals, the *Science Citation Index* (SCI) corresponding to 2001 and its complementary publication, the *Journal Citation Reports* (JCR)® that compiles the journals by subjects and puts them into hierarchical order according to the impact factor were used. Specifically, the *Journal Citation Reports* (JCR)® *Science Edition,* available at the address www.isinet.com, was used.

The sample was limited to 11 journals: 8 in general psychiatry, 1 child psychiatry, 1 of addictions and 1 internal medicine. The last one served to compare the evolution of the investigation in biomedicine in general with psychiatric research; inclusion of the journals having greater impact factor of child psychiatry and addictions was justified by the thematic content regarding specific areas of psychiatry. The journals finally included are shown in table 1.

Origin of article

The national origin of the author responsible for the communication was found by observing the field Address. Articles corresponding to the six EU countries were included for this analysis: Germany, France, Spain, Holland, Italy and Sweden. The articles of multinational authorship (works in collaboration), in which the principal author was identified as coming from an institution existing in any of the countries included in the search, were exclusively assigned to the production of said country.

A total of 72.7 % of the journals were published in the USA and 27.3 % in the United Kingdom. The United Kingdom was excluded from the countries selected as it is English speaking and the publishing country of 27.3 % of the journals analyzed, which could introduce a publication bias in the study as the editors would have greater predilection for English-speaking authors. The selection of the USA was also excluded for the same reasons and in order to limit the study to the European Union.

Type of article

All articles classified as Clinical trial, Randomized controlled trial and Metaanalysis were included, since they were

Table 1 Journals included in the study

Journals	Speciality	Publishing country	IF
New England Journal of Medicine	Internal medicine	USA	28,857
Archives of General Psychiatry	Psychiatry	USA	11,981
American Journal of Psychiatry	Psychiatry	USA	6,913
Molecular Psychiatry	Psychiatry	U. K.	6,250
Biological Psychiatry	Psychiatry	USA	5,505
Journal of Clinical Psychiatry	Psychiatry	USA	4,735
British Journal of Psychiatry	Psychiatry	U.K.	4,143
Schizophrenia Bulletin	Psychiatry	USA	4,040
Journal of Clinical Psychopharmacology	Psychiatry	USA	4,013
Journal of American Academy of Child and Adolescent Psychiatry	Infant-child psychiatry	USA	3,608
Addiction	Psychiatry addictions	U.K.	2,399

IF: impact factor of the year 2001.

those providing the greatest degree of scientific evidence[4]. Any article classified as Letter and those published in special supplements or non-ordinary monographic numbers were discarded.

Statistical processing

The statistical analysis was performed with the SPSS version 10.0 for Windows. «Number of publications of each country» was analyzed as continuous variable and «Time period» as categorical variable (1993-1997 vs 1998-2002). The statistical programs Mann-Whitney U test and Student's *t* test were used based on the normality criteria of the samples. Von Ferroni's correction was applied to the multiple comparisons.

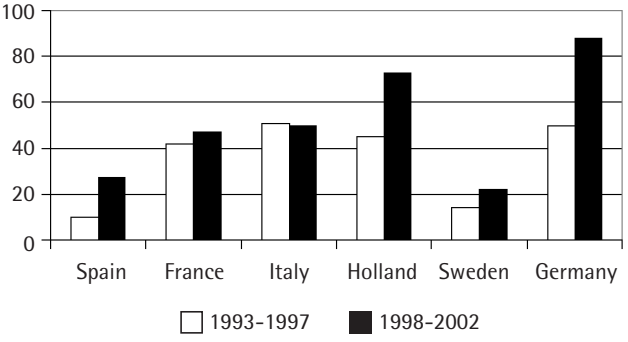

Figure 1 *Scientific production according to the number of articles published in the journals analyzed, distributed in the periods 1993-1997 and 1998-2002.*

Obtaining economic data

Even with the procedure limitations, the study linked scientific products with economic indicators, as a way to approach the profitability of the investment of each country in research. Gross Domestic Product (GDP) per capita dedicated to health care and the GDP per capita dedicated to R + D, referring to the year 2000, were used[5]. The monitory values are indicated in year 2,000 euros. The population data were also obtained from international statistics[5].

RESULTS

Scientific production in psychiatry during the last decade. Spanish publications and those of countries around us in journals of greater impact factor. Relationship with the economic indicators of the study countries

The total number of articles published in the 11 journals analyzed was 4,158, 1,885 corresponding to the period 1993-1997 and 2,273 to the period 1998-2002. In the first five-year period, 212 original articles whose principal author figured as coming from one of the 6 European countries analyzed were identified (11.2 % of the articles published in the period studied). In the 1997-2002 period, 307 articles (13.5 % of the articles published in the period studied) were identified. Figure 1 shows the total number of articles published in the journals and in the study periods. The number of articles published by journals and countries are summarized in table 2. Spain is represented in all the publications chosen, except for *Molecular Psychiatry.*

The relationship between the number of articles published per country and the total number of articles published in the two five-year periods is shown in table 3, which shows the specific weight of each country regarding the total number of publications and its evolution in the two periods. Figure 2 shows the scientific production represented by each country. Globally, the countries analyzed have increased their scientific product internationally, going from 11.2 % to 13.5 % of the total publications in the journals analyzed.

When the two periods are analyzed separately, it is seen that although Spain occupies a place that lags behind, it has duplicated its scientific product (from 0.5 to 1.1 %), going from being in the last place to the second to last one, exceeding Sweden. France (2.2 to 2 %) and Italy (2.7 to 2 %) decreased their representation slightly in the journals studied. The contributions of Sweden (0.7 to 0.9%) and specifically Holland (2.3 to 3.2 %) and Germany (2.6 to 3.8 %) have increased in the last five-year period regarding the prior one.

Tables 4 and 5 show the relationship between the scientific production of the 6 European countries in the last five-year period with the economic indicators: population, GDB, expense in health care and R + D. The publication rate of Holland (3.2 %) stands out. It is a country with almost 16 million inhabitants compared to the 39.5 million inhabitants of Spain and it assigns 0.7 % of its GDP, versus 0.6 % of Spain, to its R + D. France would be on the other extreme, with 59.5 million inhabitants and a relatively low publication rate (2.0 %) if its GDP percentage (0.9 %) assigned to R + D is considered. This translated into 219 euros yearly per capita in R + D, the highest rate, but it is widely exceeded by Holland, with less population and lower cost in R + D. The worst position is occupied by Sweden, with the lowest publication rate (0.9 %), having an elevated cost in R + D (0.7 %).

Thus, in our study, apparently Holland and Italy have more profitability in their production in terms of investment, with a lower mean cost per article published than the others (tables 4 and 5). Spain would be moderately profitable in cost-production terms: it is the one having the lowest health care cost and the one making the lowest investments in R + D, however the cost of its scientific production, which is scarce, would not be sufficiently profitable in comparison with the other countries. Germany has a very high health

Table 2 Number of articles published in each journal per each period

	Spain		France		Italy		Holland		Sweden		Germany		Total
	1993-1997	1998-2002	1993-1997	1998-2002	1993-1997	1998-2002	1993-1997	1998-2002	1993-1997	1998-2002	1993-1997	1998-2002	
New England Journal of Medicine	3	3	20	22	19	10	14	18	6	5	13	22	135
Archives of General Psychiatry	0	1	1	0	0	1	1	1	1	2	1	1	10
American Journal of Psychiatry	1	1	2	8	6	3	3	5	0	1	4	9	43
Molecular Psychiatry	0	0	0	0	0	3	0	1	0	0	0	1	5
Biological Psychiatry	0	4	8	7	11	7	12	17	4	3	20	21	98
Journal of Clinical Psychiatry	1	9	2	3	3	16	1	11	1	1	2	12	62
British Journal of Psychiatry	1	1	5	2	3	2	6	3	0	2	0	1	26
Schizophrenia Bulletin	0	1	0	0	0	0	1	2	0	0	1	2	7
Journal of Clinical Psychopharmacology	1	5	3	4	8	7	4	12	1	7	9	19	80
Journal of American Academy of Child and Adolescent Psychiatry	1	0	0	0	0	1	2	1	0	0	0	0	5
Addiction	2	2	1	1	1	3	0	2	0	1	0	0	13
Total	10	27	42	47	51	50	45	73	11	22	50	88	

care cost in comparison with the others, however it is more profitable in terms of R + D. Sweden is, in appearance, the country that makes the most investments per article published.

Scientific production in psychiatry during the last decade. Evolution and comparative analysis between the last two five-year periods: Spain and countries of its surroundings.

Table 3 Scientific production according to number of articles published in the periods analyzed (1993-1997 and 1998-2002) in the journals chosen, distributed according to the author's origin

	1993-1997		1998-2002	
	No. of publications	%/total	No. of publications	%/total
Spain	10	0.53	27	1.19
France	42	2.23	47	2.06
Italy	51	2.70	50	2.20
Holland	45	2.39	73	3.21
Sweden	14	0.74	22	0.97
Germany	50	2.65	88	3.87
Total	212	11.25	307	13.5

%/total: no. of articles for each 100 articles of all the nationalities.

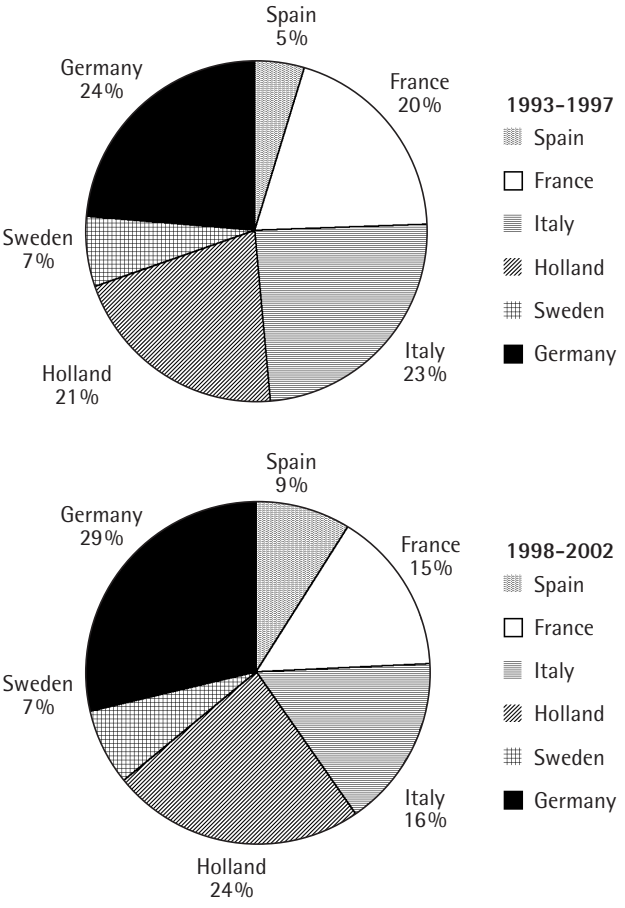

Figure 2 *Proportion of each country in relationship with the global publications of the six countries.*

Table 4 Scientific production (1993-2002) of the six european countries in the sample of 11 journals selected. Relationship with cost in health care

	Spain	France	Italy	Holland	Sweden	Germany
% GDP in health	5.4	7.2	6.1	5.5	6.6	8
Cost in health care *per capita*	832	1,699	1,228	1,380	1,832	1,971
Cost in health care *per capita* per article	22.49	19.09	12.16	11.69	50.89	14.28

Cost is health care *per capita:* calculated according to the adjusted GDP percentage *per capita* (PPP *[purchasing power parity]* in euros) dedicated to health care. The results are expressed in year 2000 euros. Cost inhealth care *per capita* per article: expressed in euros.

In the comparative analysis, we have tried to find out if there are differences that are statistically significant between the two periods analyzed for each country, among the six countries, comparing them two by two, and for the six countries as a whole. With these comparisons, we have tried to establish the evolution of the scientific production in the last decade.

Table 5 Scientific production (1993-2002) of the six European countries in the sample of 11 journals selected. Relationship with population (GDP) and cost in research and development (R + D)

	Spain	France	Italy	Holland	Sweden	Germany
Population	39.490	59.521	57.884	15.983	8.883	82.193
GDP	608.787	1.404.775	1.165.677	401.089	246.619	2.025.534
Total articles published	37	89	101	118	36	138
% GDP in R + D	0.69	0.93	0.58	0.74	0.76	0.80
Cost in R + D	4,200	13,064	6,760	2,968	1,874	16,204
Cost in R + D *per capita*	106	219	116	185	210	197
Cost in R + D *per capita* per article	2.86	2.46	1.14	1.56	5.83	1.42

Population: in thousands of inhabitans; GDP: in thousands of millions of euros; cost in R+D: in thousands of euros; cost in I + D *per capita*: calculated according to the adjusted percentage of GDP *per capita* (PPP [purchasing power parity], in euros) dedicated to R + D. The results are expressed in year 2,000 euros; cost in R + D *per capita* per article: expressed in euros.

When analyzing the evolution of the scientific production in the last two five-year periods of each country separately with the statistical tests chosen, we observe that there is no country in which there has been a statistically significant change in this volume of publications. No differences were observed when we compared the different countries two by two. And, if we consider all the countries as a whole, the evolution of the number of publications does not change significantly.

DISCUSSION

The validity of this initial study has methodological limitations that must be considered. In the first place, to establish the origin of the article, in the case of works in collaboration, we have limited the nationality of the institution to that of the main author. This means there is a bias, as the contribution of the authors of multiple nationalities is not considered. The intellectual property and authorship of the multicenter studies are a debatable aspect and difficult to solve, so that it is not rare that the biomedical journals themselves freely establish their policy regarding the authorship of the group. The present tendency, advocated by several journals of prestige, among which *The Lancet* and *British Medical Journal*[6-8] are included, establishes the figure of the «guarantor», that would be responsible for the project integrity before and after the publication. In our study, we assimilate this figure as the main responsible person for the work and, thus, we assigned his/her nationality to the study.

In the second place, not all the articles that are published in journals of a certain speciality correspond to original research studies of the speciality. The *Journal Citation Reports* (JCR)®, in addition to the *Science Edition,* compile the *Social Sciences Citation Index* (SSCI), that includes publications of the psychology area. These publications are given a greater impact factor as they are aimed at a more extended public, so that some authors may try to publish the results of their original studies in these journals.

In the third place, the selection of the journals analyzed was done considering the SCI classification, which may sometimes not respond exactly to the group of journals in which certain investigators preferably try to publish their results. The distribution, due to the large number of journals presently published, makes it possible for original research articles to be published in journals that are not included in this classification.

On the other hand, the panorama of international publications of impact is biased when powers such as the USA, Canada or United Kingdom are excluded due to the reasons given in this study's methodology. The comparative analysis has been limited to six countries of the EU, including, together with three of the largest European powers (Germany, France and Italy) Sweden and Holland, two countries that have sometimes been used as reference for Spain in terms of R + D.

In the last place, the decision to confine the analysis to 11 journals also influences in the study's validity, which does not aim to be exhaustive, but only to provide the closest possible view to the Spanish scientific production in a sample of highly competitive journals with elevated impact factor. A review of the tendencies of international publication in psychiatry by Spanish authors manifests that the clinical journals that are published in the most are *Schizophrenia Research* (FI: 3,506), *Acta Psychiatrica Scandinavica* (FI: 1,774), *European Psychiatry* (FI: 4,45) and *Journal of Clinical Psychiatry* (FI: 4,45). Of these, only the latter has been included in our study[9].

With all, it can be verified that biomedical research has improved in Spain in recent years. The present challenge is to maintain or increase our progression, as is occurring in other areas of the Spanish science, such as molecular biology, cancer or paleontology, for example.

Included among the measures mentioned by Vieta[10] and other authors[11-16] are: increasing public funds for research and creating mechanisms to give incentive to health care and research personnel by scholarships and stays in national and foreign centers of renown prestige; introducing objective evaluation systems of the research projects presented for public financing; evaluating and providing accounts of the programs of public cost in research in a usual, systematized and comparable way; facilitating the circulation of a research culture that overcomes the resistance or insecurity of many good clinicians; better integrating clinical research with the basic one: although clinical research is the one to be developed in hospitals, it is necessary for centers to exist in which both types of research exist. In the university setting, the employment policy should be modified, facilitating access to young investigators. Training in research methodology, biostatics and languages, basic tools for research, must be improved. Publication of the most relevant studies in international journals of maximum impact should be promoted. In addition, in our setting, an effort should be made to concentrate studies of good quality in a single Spanish psychiatry journal, which makes it possible to incorporate it into the bibliometric indexes and facilities its access and projection to the international scientific community.

CONCLUSIONS

Research in psychiatry in Spain is represented in the publications of greater impact factor of the speciality and is comparable in volume to that of the countries of our surroundings. Outside of the biases derived from the editorial process, Spanish scientific production would need greater efforts in investment, research culture and in incentivating the most productive groups in the hospital and university settings.

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