anales de psicología / annals of psychology
2025, vol. 41, nº 1 (january), 118-128
https://doi.org/10.6018/analesps.616671

ISSN online: 1695-2294.
https://revistas.um.es/analesps

Bibliometric analysis of Spanish scientific collaboration between Psychology and other health areas between 1980 and 2019

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Título: Análisis bibliométrico de la colaboración científica española entre la Psicología y otras áreas de la salud entre 1980 y 2019.
Resumen: Conocer la colaboración entre investigadores de diferentes áreas es una forma de determinar la evolución de un área epistemológica hacia un estatus científico propio. El objetivo del presente trabajo es analizar la colaboración entre la psicología y las ciencias de la salud a través del análisis de la producción científica según diferentes indicadores bibliométricos. Se analizaron 4.295 artículos publicados entre 1980 y 2019 en revistas incluidas en la Web of Science (WoS), en los que había colaboración interdisciplinar entre un autor perteneciente a una institución española en el área de la psicología y un investigador perteneciente a otras áreas de las ciencias de la salud. Los resultados muestran un aumento de la colaboración entre la psicología y las ciencias de la salud a lo largo del tiempo, con especial relevancia entre la psicología clínica y la psiquiatría y las neurociencias a través del estudio de la salud mental. Esta colaboración se concreta a través de tres ejes, las universidades, los hospitales y los institutos de investigación, con especial relevancia de los grupos CIBERSAM, haciendo de nexo entre profesión e investigación.
Palabras clave: Psicología. Bibliometría. Colaboración científica. Ciencias de la salud; Sociología de la ciencia. España.

Abstract: Knowing the collaboration between researchers from different areas is a way of determining the evolution of an epistemological area towards its own scientific status. The aim of this paper is to analyse the collaboration between psychology and health sciences through the analysis of scientific production according to different bibliometric indicators. We analysed 4.295 articles published between 1980 and 2019 in Web of Science journals (WoS), in which there was interdisciplinary collaboration between an author belonging to a Spanish institution in the area of psychology and a researcher belonging to other areas of the health sciences. The results show an increase in collaboration between psychology and health sciences throughout the years, with special relevance between clinical psychology and psychiatry and Neurosciences through the study of mental health. This collaboration is materialised through three axes, universities, hospitals and research institutes, with special relevance of the CIBERSAM groups, acting as a link between profession and research.
Keywords: Psychology. Bibliometry. Scientific collaboration. Health sciences. Sociology of science. Spain.

Introduction

Knowing the evolution of scientific collaboration between different areas of knowledge not only provides a historical perspective, but also allows us to identify affinities between the areas through this collaboration. Another relevant information is to know historically how this evolution has taken place and to identify events in the social, political, academic or professional context that may have influenced an increase in interdisciplinary collaboration. In this sense, sociobibliometrics (Carpintero, 1980, 1983; Carpintero & Peiró, 1983; Klappenbach & Arrigoni, 2011) can be used as a working methodology to address these issues.

The History of science and the Sociology of science have analysed the study of scientific collaboration (Beaver, 2001), highlighting the increase in informal collaboration between scientists or 'invisible colleges' (Price, 1963). Scientific collaboration has been related to increased productivity and research groups (Lotka, 1926; Price & Beaver, 1966), in what Price (1963) called Big Science, and to greater visibility of work (Katz & Hicks, 1997; Persson et al., 2004). However, this can be approached from different objects of study such as the field of interdisciplinarity, which has been the subject of analysis in different works, such as those carried out by Morillo et al. (2003) or Rafols and Meyer (2007 and 2010) or González-Sala et al. (2024), among others.

Based on the Australian Research Council's (2019) and the National Science Foundation's (2020) conceptualisation of interdisciplinary collaboration, it can be deduced that for this to occur, a series of characteristics must be present, such as: researchers from different areas of knowledge or scientific disciplines; a common objective aimed at solving problems; the generation of knowledge through scientific evidence that facilitates the solution of the problems addressed; and an integration of theories and methodologies from different areas. All this is justified by taking into account the multidimensionality of the complex problems that researchers have to face and that require, as Barthel and Seidl (2017) point out, solutions from different methodologies. In fact, this type of research is highly valued by the European Commission itself, Directorate-General for Research and Innovation et al. (2020).

In the case of psychology, it has originally been closely linked to medicine, if we take into account the relevance of physiology in its origin, mainly in the development of scientific psychology through the physiology professor Wilhelm Wundt. In Spain it has also been closely linked to great names in medicine, and the role played by medical and psychiatric journals in the dissemination of works of a psychological nature (Sos Peña & Roig Ballester, 2009). This raises the question of the role played by the collaboration between

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(Article received: 24-5-2024; revised: 3-7-2024; accepted: 24-8-2024)

psychology and the health sciences in achieving the current status of psychology at a scientific and professional level. In this sense, Carpintero (2006) also reflects the influence of psychiatry on Spanish psychology after the Civil War. In the same line, Pérez-Delgado et al. (1981) point out the contribution to the development of psychology of different researchers, among whom 26.07% were doctors of medicine, 26.89% doctors of psychology, 3.28% doctors of physiology and 13.55% doctors of philosophy.

In the study of collaboration between psychology and other health sciences, it is necessary to point out the role of psychology not only in the scientific field, but also in the development of the profession, enabling collaboration with other areas of health. It is worth highlighting, in this sense, aspects such as the inclusion of psychology studies in the area of experimental and health sciences in 2006, or the creation of the PIR (Psychologist in Residence) to carry out their functions in hospitals, introduced in 1983 in Asturias and Andalusia, and in 1993 at national level. Legislation such as Royal Decree 2490/1998, of 20 November, creating and regulating the official title of Specialist Psychologist in clinical psychology, Law 44/2003, 21 November, on the organisation of health professions by considering psychology graduates as health professionals, Royal Decree 183/2008, of 8 February, which determines and classifies the specialities in health sciences and develops certain aspects of the specialised health training system, including the speciality in clinical psychology, and Law 33/2011, of 4 October, General Law on Public Health, which in its seventh additional provision, regulates psychology in the health field.

The aim of this study is to find out, by means of different bibliometric indicators, the particularities of scientific collaboration between psychology and other health sciences through the analysis of scientific articles in which there was the presence of an author from a Spanish institution between 1980 and 2019.

In this sense, the bibliometric analysis will allow the following hypotheses to be tested:

1. It is expected to find over the years an increase in scientific collaboration between Psychology and other disciplines of the health sciences.
2. Among the areas of Psychology included in the JCR, a greater number of articles with interdisciplinary collaboration are expected to be found in journals belonging to the categories of clinical psychology and multidisciplinary psychology.
3. There will be greater interdisciplinary collaboration between Psychology, especially clinical psychology, and Psychiatry, mainly if we take into account: the thematic area of the scientific journals where the articles have been published and the collaboration between researchers according to research groups related to the study of health.

Method

Materials and procedure

For the development of the present study, the criteria established from the PRISMA methodology (Page et al., 2021) were followed in order to proceed from a systematic protocol to identify those works where there was interdisciplinary collaboration between Psychology and other health sciences.

The number of documents analysed was 8,477, of which a total of 4,295 were included in the present study after applying the inclusion and exclusion criteria related to the objective of this work.

The search was carried out in the Web of Science Main Collection (WoS) in March 2020, including as search terms in the field ADDRESS: (hosp* OR dep* OR inst* OR sch* OR fac* OR univ* OR fdn* OR univ* OR fdn* OR serv* OR cent* OR ctr*) AND ADDRESS: (health* OR hlth* OR med* OR salud OR nurs* OR odontol* OR neuros* OR phisiothe*) AND ADDRESS: (Spain) AND ADDRESS: (psychol*).

The data were downloaded into an Excel spreadsheet by selecting the variables that were the object of this study. The data were then standardised, mainly in the sections on authors and institutions of origin.

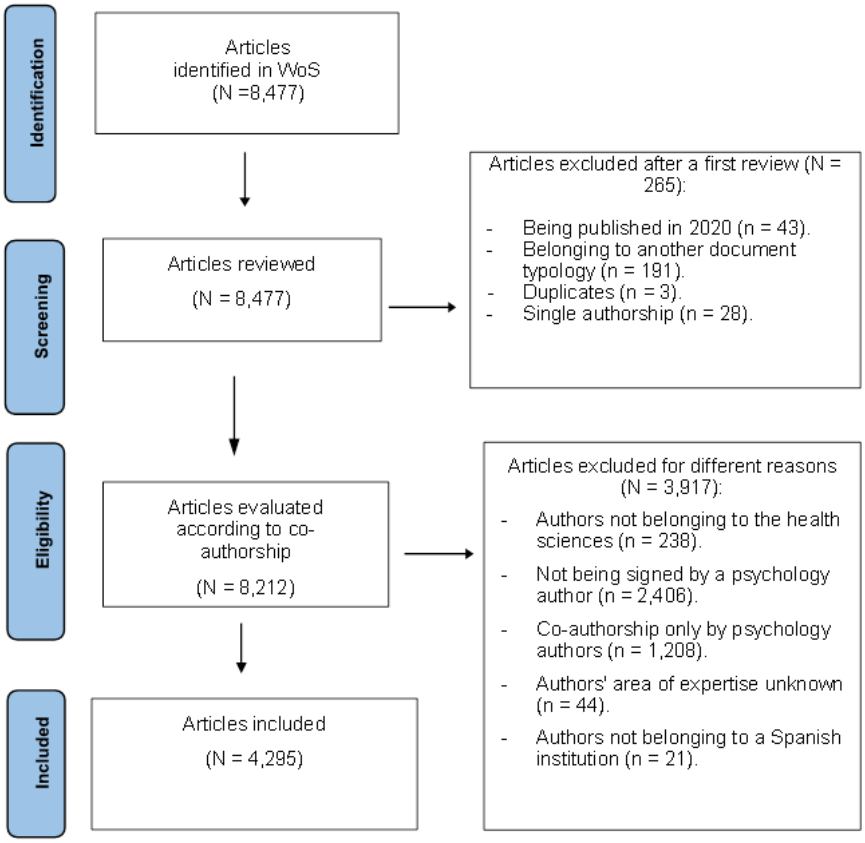
The inclusion criteria were established as scientific articles in which there was inter-institutional collaboration between the authors, with the presence of at least one Spanish author with a degree or doctorate in psychology or who was attached to a psychology centre and who signed the article with another author from another area of the health sciences. This type of collaboration also includes researchers who carry out their scientific or academic work in an area other than the one in which they were trained (Jacobs & Frickel, 2009), such as medical graduates who carry out their research work in a Psychology department, and those who have training in both Psychology and other areas of the health sciences.

Exclusion criteria included: other types of documents such as books, book chapters and conference proceedings, among others, as well as articles in which all signatories were psychologists or where they signed the work with authors from areas of knowledge other than the health sciences, and articles in which there was not at least one author from the field of psychology or single-authored articles.

Once these criteria had been applied, the papers were retrieved. A total of 8,477 articles were obtained, of which a total of 265 were eliminated for different reasons (Figure 1). The analysis of co-authorship was carried out on the 8,212 articles selected. Of these, 44 were eliminated because the training of the authors could not be determined, 21 because all the authors did not come from a Spanish institution, 238 because they did not belong to the health sciences, 2,406 because they were signed by authors not belonging to the field of psychology and 1,208 because they were signed only by

authors belonging to the field of psychology. The number of papers included in the present study was 4,295.

Figure 1
Flow chart of the different phases carried out in the research.



Variables

The variables analysed were: number of articles in interdisciplinary collaboration by year of publication; journals and JCR subject areas in which the journals in which the papers were published are classified; number of papers per journal, differentiating the following categories (30 or more articles, between 20-29 articles, 10-19 articles, 2-9 articles and a single article); total number of signatures; authors with the highest production and institution of origin; institutions with the highest scientific production according to the number of articles and collaboration between research groups.

Data analysis

Frequencies were counted and percentages calculated. With regard to the study of collaboration between institutions, social network analysis (SNA) was carried out using the UCINET programme and by creating graphs using Netdraw software (Borgatti, 2002; Borgatti et al., 2013) and counting frequencies. The size of the nodes indicates the total number of articles signed by authors belonging to an institution, the larger the size of the nodes the greater the number of articles produced. The links indicate which institutions have co-signed articles and the thickness of the lines indicates the number of articles jointly signed between two institutions.

Results

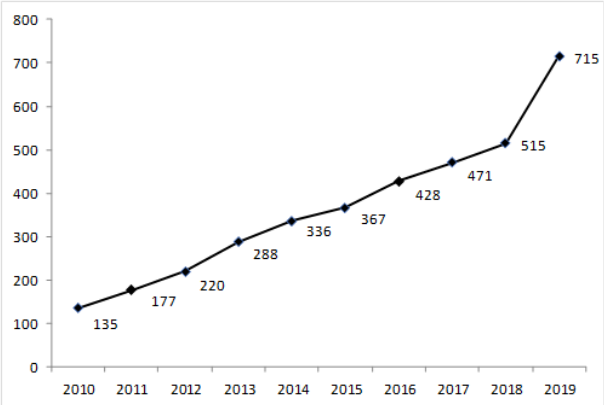
Analysis of scientific articles signed in collaboration between psychology and other areas of health sciences (1980-2019)

Analysis according to years of publication

The data show an increase over the years in Spanish scientific collaboration between psychology and other areas of health, especially in the decade 2010-2019, with a total of 3,652 articles, compared to 18 in the decade 1980-1989, 105 in the decade 1990-1999 and 520 in the decade 2000-2009. As can be seen in Figure 2, there is a constant increase in the number of articles per year, being in 2019 where this increase

is greater than in the rest of the years, with a total of 715 articles compared to 515 in 2018.

Figure 2
Number of articles signed in collaboration per year in the decade 2010-2019



Journal-based analysis

The 4,295 articles analysed are published in a total of 1,123 journals. Table 1 shows the list of the 20 journals with the highest number of articles published during the period studied. It can be seen that the journal PloS One, included in the Multidisciplinary Sciences category (SSCI), has the highest number of articles published, with a total of 141. The journals indexed in the thematic categories of Neurosciences, Psychiatry and Clinical Psychology stand out.

Among the Spanish journals where the largest number of papers have been published are the European Journal of Psychiatry with 22 papers, included in the category of Psychiatry (SSCI), Anales de Psicología with 17 papers, included in the categories of Psychology (SSCI), Psychology Multidisciplinary (SCIE) and Actas Españolas de Psiquiatría with 16 papers, included in the category of Psychiatry and Neurosciences (SSCI).

Table 1
Journals with the highest number of articles in interdisciplinary collaboration

Journal	Nº artícles	JCR categories
Plos One	141	Multidisciplinary Sciences
Psychiatry Research	89	Psychiatry
Frontiers in Psychology	74	Psychology, Multidisciplinary
Schizophrenia Research	63	Psychiatry
Neuroimage	62	Neurosciences; Neuroimaging; Radiology, Nuclear Medicine & Medical Imaging
Journal of Affective Disorders	50	Clinical Neurology; Psychiatry
Scientific Reports	47	Multidisciplinary Sciences
International Journal of Environmental Research and Public Health	39	Environmental Sciences; Public, Environmental & Occupational Health
Journal of Alzheimers Disease	34	Neurosciences
European Eating Disorders Review	33	Psychology, Clinical
Behavioural Brain Research	32	Behavioral Sciences; Neurosciences
Bmc Psychiatry	31	Psychiatry
Physiology & Behavior	30	Psychology, Biological; Behavioral Sciences
Psychological Medicine	30	Psychology, Clinical; Psychiatry; Psychology
Neurorehabilitation	28	Clinical Neurology; Rehabilitation
European Psychiatry	27	Psychiatry
Journal of Neuroscience	26	Neurosciences
Neuropsychologia	26	Behavioral Sciences; Neurosciences; Psychology, Experimental
Neuroscience Letters	26	Neurosciences
Personality And Individual Differences	26	Psychology, Social

Table 2 shows that 28.3% of the articles are published in 34 journals if we take into account those that have published 20 or more papers, which represent 3% of the total. Only 13.1% of the articles are published in occasional journals, i.e. those that have only published a single paper per journal, which represent almost half of the journals analysed.

The 1,123 scientific journals analysed are classified thematically into a total of 138 different categories. Table 3 shows the list of categories that include 20 or more journals. Specifically, the areas of Psychiatry, Neurosciences, Clinical Neurology and Psychology Clinical have the highest number of journals in which Spanish authors belonging to the field of psychology have published articles co-authored with other authors belonging to other areas of health.

Table 2
Number of articles distributed by journals

Nº articles	Nº journals	% journals	Total articles	% articles
30 or more	14	1.2%	755	17.6%
Between 20-29	20	1.8%	459	10.7%
Between 10-19	56	5.0%	764	17.8%
Between 2-9	469	41.7%	1752	40.8%
1 article	565	50.3%	565	13.1%
Total	1124	100%	4295	100%

With regard to the number of articles published by subject category, Psychiatry has the highest number of articles (1,154), which corresponds to 26.9% of the total production. The next categories with the highest number of articles are

Neurosciences (907; 21.1%), Clinical Neurology (489, 11.4%), Psychology, Clinical (347, 8.1%) and Psychology (311, 7.2%). Approximately 75% of the articles analysed are published in journals belonging to these five categories.

Table 3
Number of journals and number of articles by journal indexation category in the JCR

JCR category	Nº. journals	% journals in the category	Nº. artícles	% articles in the category
Psychiatry	151	13.4%	1,154	26.9%
Neurosciences	149	13.3%	907	21.1%
Clinical Neurology	110	9.8%	489	11.4%
Psychology, Clinical	73	6.5%	347	8.1%
Public, Environmental & Occupational Health	69	6.1%	228	5.3%
Psychology, Multidisciplinary	58	5.2%	232	5.4%
Rehabilitation	54	4.8%	147	3.4%
Psychology	52	4.6%	311	7.2%
Pharmacology & Pharmacy	41	3.6%	183	4.3%
Nursing	40	3.6%	94	2.2%
Psychology, Experimental	39	3.5%	168	3.9%
Health Care Sciences & Services	38	3.4%	120	2.8%
Psychology, Developmental	35	3.1%	124	2.9%
Pediatrics	34	3.0%	110	2.6%
Sport Sciences	32	2.8%	61	1.4%
Geriatrics & Gerontology	31	2.8%	130	3.0%
Behavioral Sciences	30	2.7%	227	5.3%
Surgery	29	2.6%	87	2.0%
Substance Abuse	28	2.5%	128	3.0%
Endocrinology & Metabolism	26	2.3%	50	1.2%
Medicine, General & Internal	26	2.3%	100	2.3%
Genetics & Heredity	25	2.2%	75	1.7%
Health Policy & Services	25	2.2%	84	1.9%
Nutrition & Dietetics	25	2.2%	77	1.8%
Oncology	24	2.1%	48	1.1%
Dentistry, Oral Surgery & Medicine	21	1.9%	36	0.8%
Education & Educational Research	20	1.8%	27	0.6%

Authors and number of signatures

The total number of author signatures of the 4,295 articles analysed is 47,810. Among the authors from a Spanish institution that stand out for having a greater presence in the signature of collaborative articles are Josefina Castro Fornieles, José Manuel Menchón Magriña and Eduard Vieta with more than 100 articles in interdisciplinary collaboration between psychology and other health sciences. A total of 28 authors have published 50 or more articles in interdisciplinary collaboration, of which 9 are women and 19 are men. Of these, 15 are psychiatrists while 13 authors have a degree or doctorate in psychology. It should also be noted that 18 of them (64.3%) belong to a CIBER research group, either in relation to mental health (CIBERSAM) or mainly related to Physiopathology of Obesity and Nutrition (CIBEROBN). All these data can be consulted in Table 4.

Table 4
Spanish authors with the highest number of papers signed in collaboration

Author	Nº. articles	Institution and Knowledge area
Castro-Formieles, Josefina	111	CIBERSAM. Instituto de Neurociencias. Hospital Clínic de Barcelona; IDIBAPS; UB Psychiatry
Menchón Magriña, José Manuel	103	CIBERSAM, Hospital Univ. Bellvitge; UB. IBIDELL Psychiatry
Vieta, Eduard	102	CIBERSAM; Hospital Clínic i Provincial de Barcelona; UB. Psychiatry
Fernández-Aranda, Fernando	92	Hospital Univ. Bellvitge. Instituto Salud Carlos III; CIBER-OBN; UB. Psychology (Clinical Psychology)
Tobeña, Adolf	83	UAB. Instituto de Neurociencias, Psychiatry
González-Pinto, Ana	82	CIBERSAM. Hosp. Univ Alava. BIOARABA; Univ. País Vasco. Psychiatry
Fernández Teruel, Alberto	81	UAB. Instituto de Neurociencias. Psychology
Soriano-Mas, Carles	81	CIBERSAM; IDIBELL. Hosp. Univ. Bellvitge. UAB Psychology (Clinical Neuropsychology)
Rodríguez-Fornells, Antonio	78	UB. IDIBELL. Psychology (Basic Psychology)

Author	Nº. articles	Institution and Knowledge area
Baeza Pertegaz, Inmaculada	75	Hosp. Clínic de Barcelona. IDIBAPS. CIBERSAM. Psychiatry
Maestu Unturbe, Fernando	76	UCM. Centro de Neurociencia Cognitiva y Computacional (C3N). CIBER-BBN Psychology (Psychobiology)
Jiménez-Murcia, Susana	73	Hosp Univ. Bellvitge; IDIBELL; CIBER-OBN; UB. Psychiatry
Verdejo-García, Antonio	69	UGR; Monash Univ (Australia) Monash Institute of Cognitive and Clinical Neuroscience Pssychology. Psychiatry
Arango-Lasprilla, Juan Carlos	68	Hosp. Univ. de Cruces; UPN, Univ País Vasco. IKERBASQUE Basque Foundation for Science Psychology (Clinical and Health Psychology) (Neuropsychology)
Pujol, Jesús	67	Hosp. del Mar de Barcelona, CIBERSAM.
Botella Arbona, Cristina	62	CIBER-OBN; Univ Jaume I. Psichology (Clinical Psychology)
Granero Pérez, Roser	60	UAB. CIBER-OBN. Hospital Universitario de Bellvitge Psichology
Arango López, Celso	59	CIBERSAM; UCM, Hosp. General Univ. Gregorio Marañón. Servicio Madrileño de Salud.
Deus Yela, Joan	58	UAB. Hospital del Mar. CIBERSAM. Guttmann Neurorehabil Inst. Psychology (Neuropsychology and Clinical Psychology).
García Campayo, José Javier	58	Univ Zaragoza. Hosp Miguel Servet Psychiatry
Faraone, Stephen Vincent	57	SUNY Upstate Medical University (USA) Psychology (Clinical Psychology)
de la Serna, Elena	56	Hospital Clinic de Barcelona. CIBERSAM. IDIBAPS Psychology
Parellada, Mara	55	Hosp Gen Univ Gregorio Maranón. CIBERSAM. Psychiatry
Buitelaar, Jan K.	54	University Center, Nijmegen (Netherlands) Psychiatry
Bernardo Arroyo, Miguel	53	UB. CIBERSAM. IDIBAPS. Hosp Clin i Provincial.Inst Neurociencias. Psychiatry
Asherson, Philip	53	Kings Coll London (England) Psychiary
Baños Rivera, Rosa María	52	UV. CIBER-OBN Psychology (Clinical Psychology)
Gill, Michael	50	Trinity Center Health Science (Ireland)

Nota: CIBER (Centro de Investigación Biomédica en Red). CIBERSAM (Salud Mental. CIBEROBN (Fisiopatología de la Obesidad y Nutrición); CIBER-BBN (Bioingeniería, Biomateriales y Nanomedicina). IDIBAPS (Instituto de Investigaciones Biomédicas August Pi i Sunyer); IDIBELL (Instituto de Investigación Biomédica de Bellvitge); IKERBASQUE (Basque Foundation for Science); BIORABA (Instituto de Investigación Sanitaria Bioaraba); UCM (Universidad Complutense de Madrid); UB (Universitat de Barcelona); UAB (Universitat Autònoma de Barcelona); UGR (Universidad de Granada); UPN (Universidad Pública de Navarra); UV (Universitat de València).

In relation to the institutions from which the signing authors come (Table 5), the papers signed by authors from a CIBER research group stand out, with a total of 1,058 papers signed, representing 24.6% of the total number of articles included in this study, of which 695 (16.2%) are signed by a CIBERSAM research group.

Among the universities, the University of Barcelona (933 papers, 21.7%), the Autonomous University of Barcelona, followed by the University of Granada and the University of Valencia stand out. Among the foreign centres, King's College London (241 papers), Vrij University (150 papers) and Karolinska Institutet (126 papers) stand out.

Among the institutes, IDIBAPS (August Pi i Sunyer Biomedical Research Institute) has a greater presence, which is present in 327 articles, representing 7.6% of the total number of articles. This institute is made up of the University of Barcelona, specifically the Faculty of Medicine, the Hospital Clínic de Barcelona and the CSIC, and forms part of the CIBER network. The Instituto de Salud Carlos III, which has given rise to the CIBER network. As well as the Institut Hospital del Mar d'Investigacions Mèdiques (IMIM), of which, in addition to the Hospital del Mar and the IMIM Foundation, the Autonomous University of Barcelona and the Pompeu Fabra University form part. The IDIBELL Institute, which includes the University of Barcelona, Bellvitge University Hospital, Viladecans Hospital and the Catalan Institute of Oncology.

Finally, the presence of hospitals whose researchers sign papers is also important, highlighting the Hospital Clínic de Barcelona (246 papers), the Bellvitge University Hospittal (244), the Hospital del Mar and the Hospital General Gregorio Marañón.

Table 5

Centres with a greater presence of authors signing articles in interdisciplinary collaboration

Centre and country	N	%
CIBER Centro de Investigación Biomédica en Red (Spain)	1,058	24.6
University of Barcelona (Spain)	933	21.7
CIBERSAM (Spain)	695	16.2
Autonomous University of Barcelona (Spain)	685	15.9
Universidad of Granada (Spain)	370	8.6
University of Valencia (Spain)	354	8.2
IDIBAPS (Spain)	327	7.6
Complutense University of Madrid (Spain)	281	6.5
Autonomous University of Madrid (Spain)	265	6.1
Hospital Clínic de Barcelona (Spain)	246	5.7
Hospital Universitario de Bellvitge (Spain)	244	5.7
Kings College London (England)	241	5.6
Universidad of the Basque Country (Spain)	195	4.5
University of Oviedo (Spain)	188	4.4
University of Zaragoza (Spain)	181	4.2
Pompeu Fabra University (Spain)	171	4.0
Institut Hosp. del Mar d'Investigacions Mediques (IMIM) (Spain)	166	3.9
IDIBELL (Spain)	163	3.8
Virgili i Rovira University (Spain)	160	3.7
Vrij University (Netherlands)	150	3.5
University of Santiago de Compostela (Spain)	142	3.3

Centre and country	N	%
CIBER-OBN (Spain)	138	3.2
ICREA (Spain)	134	3.1
University of Murcia (Spain)	129	3.0
Hospital General Gregorio Marañón (Spain)	126	2.9
Karolinska Institutet (Sweden)	126	2.9
University Jaume I (Spain)	123	2.9
University of Malaga (Spain)	121	2.8
University of Deusto (Spain)	119	2.8
University Illes Balears (Spain)	117	2.7
University of Seville (Spain)	115	2.7
University of Salamanca (Spain)	110	2.6
University of Melbourne (Australia)	110	2.6
Hospital Vall d'Hebron (Spain)	104	2.4

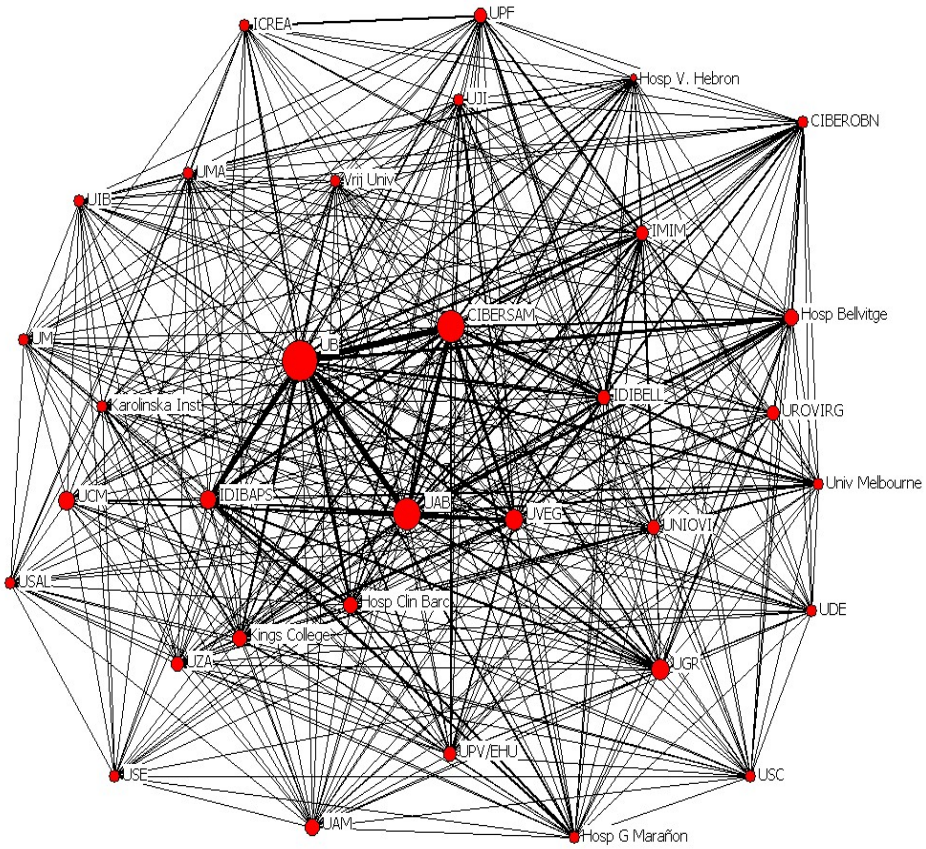
Note: CIBER (Centro de Investigación Biomédica en Red). CIBERSAM (Salud Mental. CIBEROBN (Fisiopatología de la Obesidad y Nutrición); IDIBAPS (Instituto de Investigaciones Biomédicas August Pi i Sunyer); IDIBELL (Instituto de Investigación Biomédica de Bellvitge), ICREA (Institución Catalana de Investigación y Estudios Avanzados).

Analysis of scientific collaboration between institutions according to the scientific articles signed in collaboration between psychology and other areas of the health sciences (1980-2019)

Collaboration between institutions according to authors' affiliation

Figure 3 shows the collaboration between the institutions that have carried out the work. The figure shows a strong relationship between authors belonging to three institutions or groups such as the University of Barcelona, CIBERSAM and the Autonomous University of Barcelona. In turn, there is an important relationship between these three institutions and IDIBAPS and IDIBELL. All these institutions share publications with other Catalan hospitals such as Hospital Clínic de Barcelona, Hospital de Universitari de Bellvitge, Hospital Vall d'Hebron and Hospital del Mar Research Institute. Also noteworthy are the relationships between researchers from the University of Valencia with the Autonomous University of Barcelona and the CIBERSAM group.

Figure 3
Collaboration network between institutions



Nota: UCM (Universidad Complutense de Madrid); UB (Universitat de Barcelona); UAB (Universitat Autònoma de Barcelona); UGR (Universidad de Granada); UVEG (Universitat de València); UPF (Universitat Pompeu Fabra); UM (Universidad de Murcia); USAL (Universidad de Salamanca); UPV/EHV (Universidad del País Vasco); USE (Universidad de Sevilla); USC (Universidad de Santiago de Compostela); UROVIRG (Universidad Rovira i Virgili); UZA (Universidad de Zaragoza); UIB (Universitat Illes Baleares); UMA (Universidad de Málaga); UJI (Universitat Jaume I); UNIOVI (Universidad de Oviedo); UDE (Universidad de Deusto); IMIM (Instituto de Investigación Hospital del Mar).

Discussion

The aim of this study was to analyse the collaboration between psychology and other health sciences through the analysis of articles co-authored by researchers from both areas. The results found point to an increase in collaborative scientific production over the years, mainly in the last decade, between 2010 and 2019, fulfilling the first hypothesis of the study, which pointed to an increase in scientific collaboration between psychology and other areas of the health sciences over the years. This trend has already been noted in the study by De Filippo et al. (2014) when analysing inter-university collaboration in Spanish universities between 2002 and 2011 in the field of health sciences, and more specifically from the studies in the area of psychology and clinical psychology by González-Sala et al. (2021), González-Sala and Osca-Lluch (2022) and González-Sala et al. (2024).

Specifically, the collaboration between psychology and other health sciences, as can be seen from the results of this study, is materialised through the publication of 4,295 papers published in 1,123 journals. The publication of these papers, according to the categories of psychology in the JCR (SSCI), mainly takes place in the categories of clinical psychology and experimental psychology. These results confirm the second hypothesis of the study, which advocated a greater use of these categories when publishing papers in interdisciplinary collaboration, which can be explained by the subject matter of the papers, specific to health psychology, and the interdisciplinary nature of the authors who signed the papers.

If we take into account all the thematic categories of the JCR (SSCI and SCIE) in which the journals in which articles are published in interdisciplinary collaboration are indexed, the categories of Psychiatry, Neurosciences, Clinical Neurology and Psychology Clinical stand out, with 67.5% of the articles analysed in this study being published in these four categories, which are also the categories in which the journals with the highest number of published papers are indexed. These results confirm the third hypothesis of the study, which was based on the existence of greater interdisciplinary collaboration between psychology, mainly clinical psychology, and other health areas such as psychiatry or neuroscience. In addition, the training of researchers with a greater number of published works in interdisciplinary collaboration should also be taken into account, highlighting those with a specialisation mainly in clinical psychology or psychiatry.

These results can be related to certain events which have marked not only the development of psychology since 1980, the year in which the creation of the Faculties of Psychology (BOE of 5 July 1979) and the Professional Psychology Colleges (BOE of 8 January 1980) was approved, but also, as pointed out by González-Sala et al. (2024), the approval in 1986 of the General Health Law (BOE of 29 April 1986), which recognised the clinical psychologist as a health professional. It is from this law that the Instituto de Salud Carlos III was created, giving rise to the Centro de Investigación Biomédica en Red CIBER. On the other hand, the decade of the 1990s and the first decade of the 2000s gave rise to the implementation of the PIR at state level (1993), which meant, among other aspects, a boost for the promotion of professional and scientific collaboration between psychology and medicine, mainly with psychiatry professionals. Years later, different institutes were created with the joint participation of universities and hospitals, such as the Institute of Neurosciences at the Autonomous University of Barcelona in 2003, the Bellvitge Biomedical Research Institute (IDIBELL) in 2004, with the participation of Bellvitge University Hospital, Viladecans Hospital (Catalan Institute of Health), the Catalan Institute of Oncology (Duran i Reynals Hospital), the University of Barcelona and the City Council of Hospitalet de Llobregat.

In 2007, CIBERSAM was set up, made up of different research groups spread throughout Spain, including universities such as the Autonomous University of Barcelona, the University of Barcelona, the University of Valencia, the University of Oviedo, the Complutense University of Madrid and the Autonomous University of Madrid, the University of the Basque Country and the Rovira i Virgili University, among others. These universities are joined by hospitals such as Hospital Gregorio Marañón and Hospital Ramón y Cajal of the Madrid Health Service, Hospital Clínico y Provincial de Barcelona, Hospital Universitario de Bellvitge, Hospital Universitari Vall d'Hebron, Hospital del Mar, all of them in Catalonia, Hospital Virgen del Rocío in Seville or Hospital Universitario de Álava belonging to the Basque Health Service. This union between universities and hospitals has given rise to the creation of different institutes, such as the Bellvitge Biomedical Research Institute - IDIBELL, the August Pi i Sunyer Biomedical Research Institute - IDIBAPS, the Hospital del Mar Medical Research Institute - IMIM, the Basque Foundation for Science - IKERBASQUE or the Bioaraba Health Research Institute - BIOARABA, among others. All of these institutions have a strong presence in the scientific production of articles in collaboration between the area of psychology and the area of health sciences.

In this sense, we should highlight the presence of researchers from a CIBER group, present in almost 25% of the articles analysed, with special relevance of researchers belonging to a mental health research group (CIBERSAM) in 16.2%, and CIBEROBN (Centro de Investigación Biomédica en Red de la Fisiopatología de la Obesidad y Nutrición) in 3.2% of the articles analysed in this study. The universities of Barcelona and Autonomous of Barcelona have the highest production of articles, 21.7% and 15.9% respectively. Similar results can also be observed in the case of theses directed in interdisciplinary collaboration between psychology and health sciences (González-Sala et al., 2024).

The network analysis clearly represents the existing connection between researchers from different Catalan universities, hospitals and research institutes, such as the University of Barcelona, the Autonomous University of Barcelona, ID-

IBAPS, IDIBELL and CIBERSAM groups, with a greater number of groups in Catalonia, 11 groups of the 24 groups included in the CIBERSAM report of 2019 (Salagre et al., 2019). These relationships are facilitated by the presence of researchers attached to different institutions, as is the case of those with the largest number of articles. Among these, Josefina Castro Fornieles and Eduard Vieta stand out, signing their papers with affiliation to the University of Barcelona, the Hospital Clínic de Barcelona or José Manuel Menchón Magriña attached to the University of Barcelona and the University Hospital of Bellvitge.

The analysis of networks and the greater presence of researchers attached to a university institution reveals the fundamental role played by these institutions, with the University of Barcelona, the Autonomous University of Barcelona, the University of Valencia and the University of Granada being the most represented, the first three being the ones with the greatest production in the area of health between 2002 and 2011, together with the Autonomous University of Madrid (De Filippo et al., 2014).

This interdisciplinary collaboration between psychology and health sciences can be explained from different perspectives. On the one hand, Engel's biopsychosocial model of health (1977) and the conceptualisation of health according to the WHO (1946), by explicitly pointing out the relationship between contextual, physical and psychological factors with respect to the state of health and well-being, which requires an interdisciplinary approach (Ledford, 2015).

On the other hand, the creation of the Carlos III Health Institute in 1986 following the approval of the General Health Law in 1986, on which the Consortium of Networked Biomedical Research Centres (CIBER) and, at the regional level, the creation of the August Pí i Sunyer Biomedical Research Institute (IDIBAPS) in 1993, which are benchmarks in health research, depend, among others, and have endowed psychology with greater modernity and experimentalism by approaching the study of mental health from different interdisciplinary perspectives, generating banks of instruments, clinical and biological data and methodologies and clinical and biological data, aspects that characterise scientific psychology as pointed out by Pastor et al. (2000). These groups are a clear reflection of collaborative structures between researchers from different disciplines that have great stability, and which unite researchers from different countries and centres, being an example of what Price (1963) called Big Science, and which in turn, through the study of collaborative networks, makes it possible to identify the 'invisible colleges', a term introduced by Robert Boyle between 1646 and 1647, and to which Crane (1972) referred in relation to informal collaboration between scientists when sharing scientific knowledge and projects.

Institutional support is another aspect that may be behind the increase in interdisciplinary collaboration. This support can be expressed at both the political and institutional level if we take into account the participation of city councils, such as the case of the Hospitalet de Llobregat City Council as part of the Bellvitge Biomedical Research Institute (IDIBELL), of the Generalitat de Catalunya as an entity that forms part of the August Pi i Sunyer Biomedical Research Institute (IDIBAPS), as well as grants from the Ministry of Science, Innovation and Universities and the European Union for the development of research projects and the formation of international consortia, as in the case of the CIBERSAM groups.

Future studies should look more deeply into other aspects of collaboration, such as the composition of the collaboration groups in relation to the training of the signatories, analysis from a gender perspective, analysis of collaboration networks, or in identifying emerging topics where collaboration between psychology and other health sciences could occur, such as in the treatment of oncology patients, the development of interventions aimed at preventing and slowing down the effects of Alzheimer's disease, or in the approach to studies aimed at rare diseases, which can benefit from studies carried out in interdisciplinary collaboration.

The limitations of this study include the fact that only scientific articles were analysed, ruling out other types of documents. Furthermore, only journals included in WoS were considered, so the study could be extended to include publications indexed in other databases such as Scopus, Scielo, Psicodoc or Latindex, among others.

Conclusion

Based on the bibliometric indicators analysed in this study, it can be concluded that the consolidation of interdisciplinary collaboration between psychology and other health sciences is a reality today. This collaboration is mainly between clinical psychology and psychiatry, and the creation of research groups and institutes, which are mainly formed by universities and hospitals, as well as the recognition of the psychologist within the health field by different laws, has had a great relevance in this field. These groups, in turn, are a link between the profession and research if we take into account those professionals who, in addition to practising their profession in hospitals, mainly form part of the university and large research groups. However, when it comes to understanding the increase in scientific production and collaboration between psychology and health sciences, other factors of a political, economic and social nature must be taken into account, under the conception of science as a social activity Bucchi (2004) and Knorr-Cetina and Mulkay (1983).

In the Spanish context, as Carulla et al. (2020) point out, it was following the Report of the Ministerial Commission for Psychiatric Reform in 1985 that a real change in mental health took place. In the last decade, mental health has been considered a priority public health issue. This has led to the development of strategic action plans at regional, national and European level, aimed at designing policies aimed at prioritising actions in terms of prevention, intervention and research in this area of health (Elfeddali et al., 2014; Haro et al. 2014). Such is the case that in 2013, the CIBER-

SAM groups, together with other institutions, formed part of the ROAMER project (Roadmap for mental health research in Europe), the aim of which was to specify the main lines of research in relation to mental health and increase its funding within the European Horizon 2020 programme (Haro et al. 2014; Hazo et al. 2019). This increase in economic funding, in turn, is related to an increase in scientific productivity (Páez et al. 2012; Schofer, 2004), which plays an important role in obtaining funding in competitive projects.

This funding mainly depends on public funds (Osuna, 2009), and it is here where the participation of public administrations, such as city councils and regional councils, play a relevant role in what Leydesdorff and Sun (2009) and Park and Leydesdorff (2010) called the 'Triple Helix', which allows us to understand the model of networking between Catalan institutions, universities and hospitals, which, and in the specific case of this study, has also contributed to the increase in interdisciplinary production between psychology and health sciences.

Conflict of interest.- The authors of this article declare that they have no conflict of interest.
Funding.- No funding.

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