

Bibliometric and academic network analysis of Spanish theses on drug dependence in the TESEO database

Análisis de redes sociales y bibliométrico de las tesis españolas sobre drogodependencias en la base de datos TESEO

LOURDES CASTELLÓ I COGOLLOS*, FRANCISCO JESÚS BUENO CAÑIGRAL**, JUAN CARLOS VALDERRAMA ZURIÁN***.

* Departament de Sociologia i Antropologia Social. Universitat de València; UISYS, Unidad Mixta de Investigación, CSIC, Universitat de València, Valencia, España. ** Plan Municipal de Drogodependencias; UPCCA Valencia. Concejalía de Sanidad, Salud y Deportes (Ayuntamiento de Valencia), Valencia, España. *** Instituto de Documentación y Tecnologías de la Información. INDOTEI. Universidad Católica de Valencia San Vicente Mártir, Valencia, España.

Abstract

The present study aims to reveal the structure of positions in the field of addiction through the analysis of doctoral theses read in Spain. The source consulted for the selection of the theses was TESEO. Searching for the keywords drug abuse, alcoholism, drug effects and drug addiction treatment during the period 1976-2017 produced 728 theses. The most productive period is 2013-2017, with 208 (28.6%) doctoral theses. The overall rate of publication is increasing, but in the period 2003-2007 output decreased significantly to 5.2% of the total. The university contributing the most theses is the University of Valencia. The academic who has supervised the most theses is Alfonso Velasco Martín, and Emilio Ambrosio Flores is the researcher who has participated most on examining committees. The analysis of the participants in the doctoral thesis process shows a gradual increase of women in authorship, in thesis supervision and as examiners. In terms of subject, the most frequently treated aspects are those related to psychology, pharmacology and medical sciences.

The analysis of doctoral theses on substance abuse provides an overview of the structure and the most influential participants in this area. Increasing public concern and the creation of specific groups and research units are reflected in the growth of scientific output.

Keywords: Academic Dissertations; Gender identity; Substance-Related Disorders; Bibliometrics; Social network analysis; Gender analysis.

Resumen

El presente trabajo tiene por objeto desvelar la estructura de posiciones del campo de las adicciones a partir del análisis de las tesis doctorales defendidas en España. La fuente consultada para la selección de las tesis fue TESEO. La búsqueda se limitó al período 1976-2017 y se utilizaron los descriptores abuso de drogas, alcoholismo, efecto de las drogas y tratamiento de la drogadicción. Se obtuvieron 728 tesis, siendo el quinquenio más productivo el 2013-2017 con 208 (28,6%) tesis doctorales. La evolución de las publicaciones es ascendente, excepto en el quinquenio 2003-2007 en el que la producción baja a un 5,2% del total. La universidad que aporta más tesis es la Universitat de València. El académico que más tesis ha dirigido es Alfonso Velasco Martín y Emilio Ambrosio Flores es el investigador que más ha participado en los tribunales. El análisis de los actores participantes en las tesis doctorales muestra un incremento de presencia de las mujeres como autoras, directoras de tesis y miembros de tribunales. En relación a la temática, los temas más abordados han sido los relacionados con la psicología, la farmacología y las ciencias médicas. El análisis de las tesis doctorales sobre drogodependencias ha dado una visión de su estructura y de las personas más influyentes de la misma. El aumento de la preocupación social en esta área y la creación de grupos y unidades de investigación específicos ha ocasionado un incremento de la producción científica.

Palabras clave: Tesis académicas; Trastornos relacionados con sustancias; Bibliometría; Análisis de redes sociales; Análisis de género.

Received: March 2018; Accepted: September 2018.

Send correspondence to:

Juan Carlos Valderrama Zurián. Instituto de Documentación y Tecnologías de la Información (INDOTEI). Universidad Católica de Valencia. San Vicente Mártir C/Quevedo 2, 46001 Valencia. E mail: jc.valderrama@ucv.es.

The annual reports of the European Monitoring Centre for Drugs and Drug Addiction (2018) show that Spain is one of the European Union countries with the highest rates of cocaine and cannabis use. This fact has stimulated an increase in research into the problem, which has become a priority area for agencies and institutions (González-Alcaide et al., 2008; Melero-Fuentes, 2016; Vidal-Infer, 2010). The consolidation of this research area has led in turn to growing scientific output (Osca-Lluch, 2016) and has promoted the generation of bibliometric studies that characterize this area by subject, substance, sex of the authors or geographical area (Bramness, Henriksen, Person & Mann, 2014; González, Fernandes, Pinto & Agulló, 2015; González-Alcaide et al., 2007; Khalili et al., 2018; Osca-Lluch, 2012, 2016). Nevertheless, these studies have focused only on the analysis of journal articles, while it has been shown that the production of doctoral theses is proportional to scientific articles indexed in international databases, both in their growth over time, as in their distribution across universities (Sánchez, Blázquez, Montesi & Botezan, 2017).

The doctorate the highest degree that can be attained at university level (Curiel-Marín & Fernández-Cano, 2015; Curiel-Marín, Passoni, Olmedo-Moreno & Fernández-Cano, 2018), and the defense of the doctoral thesis is the culminating activity of the doctoral program (MacLennan, Piña & Gibbons, 2018). By developing and writing their theses, doctoral students acquire the methodological knowledge and analytical skills necessary to produce and disseminate the results of their research (Davis, Wladkowski & Mirick, 2017), to establish a career in academia (Piña, MacLennan, Moran & Hafford, 2016) and to become highly qualified workers and competent researchers in different academic fields (Caparrós-Ruiz, 2018).

The number of doctoral theses supervised is an indicator of a successful doctorate (Buela, 2005) and influences the prestige of professors and their academic careers. In fact, the assessment criteria used for the accreditation of teachers in the Academia program, overseen by Spain's National Agency for the Evaluation of Quality and Accreditation (ANECA), both in terms of research and teaching activities, include having been a doctoral thesis supervisor (ANECA, 2017). It should be noted that doctoral theses are one of the indicators of the report "Spanish universities in figures" published by the Conference of Spanish University Rectors (CRUE, 2017), and the titles of doctorates awarded are also used as assessment criteria in various university rankings such as the RUR World University Ranking (Round University Ranking, 2018), THE World University Ranking (Times Higher Education, 2018) or the U-Multirank. Universities Compared. Your way (U-Multirank, 2018).

The analysis of doctoral theses is thus a good indicator of the lines of research and research trends in a given field of science and provides an outline of the social structure of

the discipline since the thesis writing and assessment process involves academic professionals with established roles, such as authors, supervisors, reviewers and members of the examining committee (Arguimbau-Vivó & Fuentes-Pujol, 2009; Delgado, Torres-Salinas, Jiménez-Contreras & Ruiz-Pérez, 2006; Repiso, Torres & Delgado, 2011a).

The present study aims to reveal the structure of academic posts in the field of addiction by combining bibliometrics with an analysis of the academic networks of people involved in supervising and examining doctoral theses defended in Spain, as registered in the TESEO database (<https://www.educacion.gob.es/teseo/irGestionarConsulta.do>). This will provide information complementary to the results obtained in the bibliometric analysis of scientific articles concerning addiction. To this end, the defended theses, their authors, supervisors and examiners, the sex of the participants involved and the subject of the theses are taken for reference.

While a preview of the study (Castelló-Cogollos, Bueno & Aleixandre, 2016) was published as a brief note in the "Current Issues" section of the CendocBogani center for documentation on addiction, this article features a broader and more in-depth analysis of the data obtained for the note in question.

Method

The source consulted for the selection of theses was the TESEO database of the Spanish Ministry of Education, Culture and Sport, which has registered information on theses defended in Spain since 1976, classified according to the codes of the UNESCO thesaurus (<https://en.unesco.org/>).

The search equation for the recovery of doctoral theses on addiction included the keywords: "drug abuse", "alcoholism", "drug effects" and "treatment of drug addiction". Independent searches were conducted with each of the descriptors, and for each academic year from 1976 to 2017. The last academic year included in the search equation was 2017/2018, from which the doctoral theses defended in 2017 were selected. In total, 832 records were downloaded and included for the present study in an "ad hoc" relational database using Microsoft Access which included the title of the thesis, descriptors, author, institution where the thesis was defended, thesis supervisor(s), and members of the examining committee, specifying their role on the committee.

Since records might contain two or more of the keywords used in the search, duplicates were detected when performing individual searches for each of the keywords. The final sample, once duplicates were eliminated, comprised 728 theses. Next, the institutional affiliations, signatures of the authors, supervisors and members of the tribunal and the keywords were homogenized. The sex of each participant in writing and defending the thesis was also noted.

The bibliometric analysis was divided into five major blocks: a) authorship analysis, involving calculations regarding thesis authorship; b) analysis of the supervisors, either as sole supervisor or co-supervisor, including a co-supervision index (number of theses supervised divided by total theses); c) analysis of examining committees, presenting examiner data; d) comparison by sex of the three participant levels (authors, supervisors and examiners), and e) thematic analysis, analyzing the frequency of the keywords found in the theses and the relationships between them.

The Pajek program (<http://mrvar.fdv.uni-lj.si/pajek/>) was used to create and graphically display the networks of keywords, committees and the combination of supervisor and examiner. The size of the vertices is proportional to the number of occurrences. The thickness of the lines connecting two vertices are proportional to the number of times the two terms appear simultaneously in the total number of theses. For inclusion in the graphic representation of keywords, the co-occurrence of three or more keywords in the same doctoral thesis was required, and involvement in three or more doctoral theses was deemed necessary for the network of examiners.

The supervisor-examiner invitation network provides a closer view of the existence of close connections among academics since it represents the number of times that a supervisor invites, recommends or asks for the presence of an academic to participate as an examiner on the committee of a doctoral thesis that he or she has supervised. The invitation by the thesis supervisor to different academics to sit on the examining committee understood as the establishment of a relationship. This has been done following the regulations governing submission, assessment and defense of the thesis of various universities, including the Complutense University of Madrid and the University of Valencia, which require alongside the thesis submission a list of six experts for its assessment. While ten experts were previously required, this was modified with the publication of Royal Decree 99/2011, January 28, 2011, regulating the official doctoral education (Royal Decree 99/2011, 2011). This stipulates that the selection of academics for the thesis examining committee is carried out by its supervisor(s) and therefore reveals a relationship between supervisors and examiners. Inclusion criterion for this network was sitting on three examining committees or more.

Results

Global data

The first doctoral thesis on drug addiction to be included in TESEO is “*Psychological and evaluative aspects of the alcoholic personality*” by Flora Paniagua Cárdenas, defended in 1978 at the Complutense Universidad of Madrid. The most productive five-year period is 2013-2017, with 208 (28.6%)

doctoral theses (Figure 1). Although doctoral thesis output is increasing overall, it slowed significantly to 5.2% of the total during the quinquennium 2003-2007, 11.4 percentage points less than in the previous five years (16.6%). It can be noted that 11.7% of thesis authors also participate later as supervisors or examiners, and that 22 have been author, supervisor and examiner.

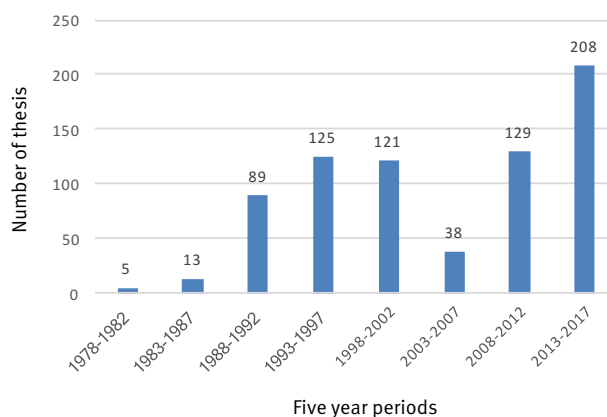


Figure 1. Development over five-year periods of doctoral thesis output in Spain on the subject of drug addiction.

The largest number of doctoral theses have been defended in Catalonia (16.8%), followed by Madrid and the Community of Valencia (15.7% and 15.4%, respectively), while Andalusia registered 13.9%. The theses were defended at 51 universities. Valencia University has contributed most to the study (n = 69), followed by Autònoma University of Barcelona (n = 57) and the University of Valladolid with 51 theses; the Complutense University of Madrid is also in the top positions with 46 theses. Table 1 shows the universities where 10 or more theses have been defended.

Analysis of thesis supervisors

The analysis of thesis supervisors yields 664 different supervisors or co-supervisors. This analysis was carried out with those theses which included the relevant information in the TESEO database registry (n = 663, 91.1% of total theses). The co-supervision index is 1.54 supervisors. The academic supervising the most theses is Alfonso Velasco Martín (n = 26), professor of pharmacology at Valladolid University; followed at a significant distance by Emilio González Reimers, professor of internal medicine at La Laguna University, who supervised 11 theses. Of the total number of supervisors, 75.9% have overseen only one thesis, 20% between two and four theses and 4.1% five or more theses. Table 2 presents the academics who have supervised five or more doctoral theses.

The supervisor-examiner network shows that 106 academics participated and 22 groups were created, with the

Table 1. *Distribution of Spanish doctoral theses on drug addiction by university (\geq of 10 theses ordered by number of theses defended).*

University in which defended	Nº of theses	%
Universitat de València (Estudi General)	69	9.5%
Universidad Autónoma de Barcelona	57	7.8%
Universidad de Valladolid	51	7.0%
Universidad Complutense de Madrid	46	6.3%
Universidad de Santiago de Compostela	38	5.2%
Universidad de Barcelona	36	4.9%
Universidad de Granada	34	4.7%
Universidad de Murcia	29	4.0%
Universidad del País Vasco/ Euskal Herriko Unibertsitatea	29	4.0%
Universidad Autónoma de Madrid	25	3.4%
Universidad de La Laguna	24	3.3%
Universidad de Salamanca	23	3.2%
Universidad de Sevilla	23	3.2%
Universidad de Málaga	19	2.6%
Universidad Miguel Hernández de Elche	18	2.5%
Universidad de Zaragoza	17	2.3%
Universidad Pompeu Fabra	17	2.3%
Universidad Nacional de Educación a Distancia	15	2.1%
Universidad de Cádiz	13	1.8%
Universidad de Oviedo	12	1.6%
Universidad de Navarra	10	1.4%
Universidad Jaume I de Castellón	10	1.4%

largest group consisting of 28 people (Figure 2). It shows that there is no reciprocity when recommending supervisors to other academics for examining committees, but there is a conspicuous relationship around Alfonso Velasco Martín, who on 11 occasions recommends that Luis San Román del Barrio (Salamanca University) and Fernando Fernández de la Gandara (Complutense University of Madrid) sit on the examining committees in which he is supervisor. The relationships around Pedro Sánchez García (Autonomous University of Madrid) or Antonio Dueñas Laita (Valladolid University) also stand out, and the figure shows vertices (academics) that act as a link with other academics such as, for example, Cecilio Álamo González (Alcalá de Henares University) or Francisco Javier Álvarez González (Valladolid University).

Figure 3 shows four groups of six or seven components, where reciprocity is observed in the relationship formed by Emilio González Reimers and Francisco Javier Santolaria Fernández of La Laguna University, who invite each other to sit on examining committees when they are supervisors. There is a similar reciprocity in the relationship

Table 2. *Distribution of supervisors of Spanish doctoral theses on drug addiction (\geq of 5 theses supervised, ordered by number of theses directed and alphabetically).*

Name	Supervisor	Co-supervisor	Nº of theses supervised
Velasco Martín, Alfonso	25	1	26
Gonzalez Reimers, Emilio	10	1	11
Bermejo Barrera, Ana María	8	1	9
Luna Maldonado, Aurelio	8	1	9
Miñarro López, José	6	3	9
Álvarez González, Javier	8		8
Farré Albaladejo, Magí	6	2	8
Romero Gómez, Francisco Javier	7	1	8
Santolaria Fernández, Francisco Javier	7	1	8
de la Torre Fornell, Rafael	3	3	7
García Del Castillo Rodríguez, José Antonio	6	1	7
Ambrosio Flores, Emilio	5	1	6
Cadaveira Mahía, Fernando	4	2	6
Fernández Gómez, Purificación	3	3	6
García Algar, Oscar	4	2	6
Maldonado López, Rafael	1	5	6
Pérez García, Miguel	4	2	6
Rodríguez Arias, Marta	3	3	6
Domingo Salvany, Antònia	4	1	5
Espada Sánchez, José Pedro	5		5
Espí Martínez, Fernando	5		5
González Aragón, Carlos Manuel	4	1	5
Graña Gómez, José Luis	4	1	5
Luengo Martín, María Ángeles	4	1	5
Miquel Salgado-Araujo, Marta Asunta	3	2	5
Tabernero Duque, María Jesús	2	3	5
Torrens Melich, Marta	4	1	5

between José Antonio García del Castillo Rodríguez and José Pedro Espada Sánchez of the Miguel Hernández University in Elche.

Analysis of examining committees

We found that 2,055 different doctors have participated as examiners. Table 3 shows that Emilio Ambrosio Flores is the researcher who has sat on committees most frequently, 20 times in total, (five times as chair, once as secretary and 14 times as member), followed by Miguel Sánchez Turet, on 17 committees (eight as chair and nine as member).

Taking into account that the capacity in which one sits on an examining committee can differ in importance, it is notable that Francesc Jané (n = 10) has participated most

often as committee chair, followed by Vicente Simón Pérez (n = 9) and Miguel Sánchez Turet (n = 8). The majority of academics who sit on committees do so only once (74%), with only 22 (1.1%) sitting on 10 or more committees (Table 3).

The network analysis of examiners yields a network formed of 67 committee members and 21 groups. The largest group consists of 16 members (Figure 4) and shows how Luis San Román del Barrio (University of Salamanca) is the academic who most frequently coincides with other

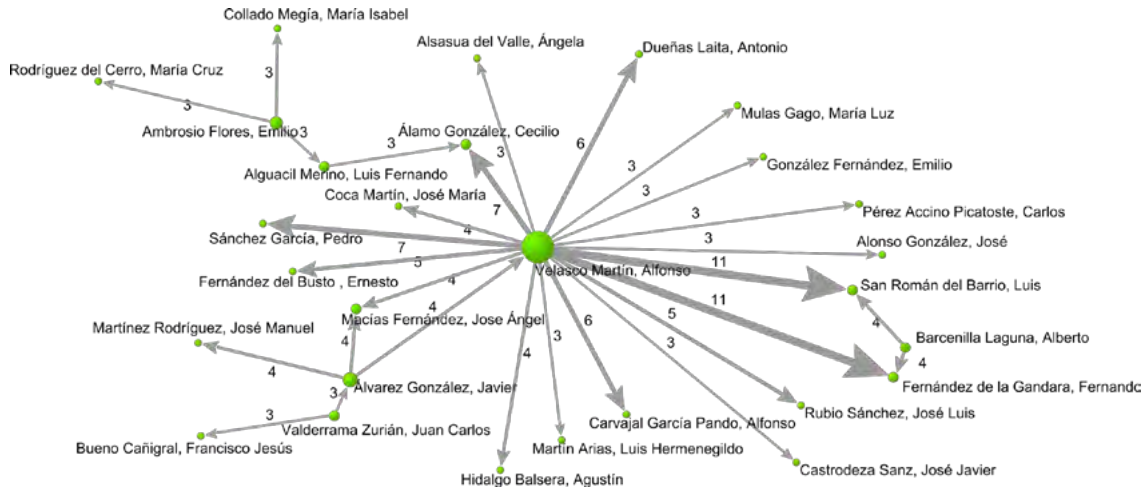


Figure 2. Supervisor-examiner invitation network in Spanish doctoral theses on drug addiction (group of 28 members).

Note. The vertices represent academics acting as supervisors or examiners. The size of the vertices reflects the direct connections with other vertices. The thickness of the arrows represents the total number of times a supervisor has invited an academic to participate in a thesis.

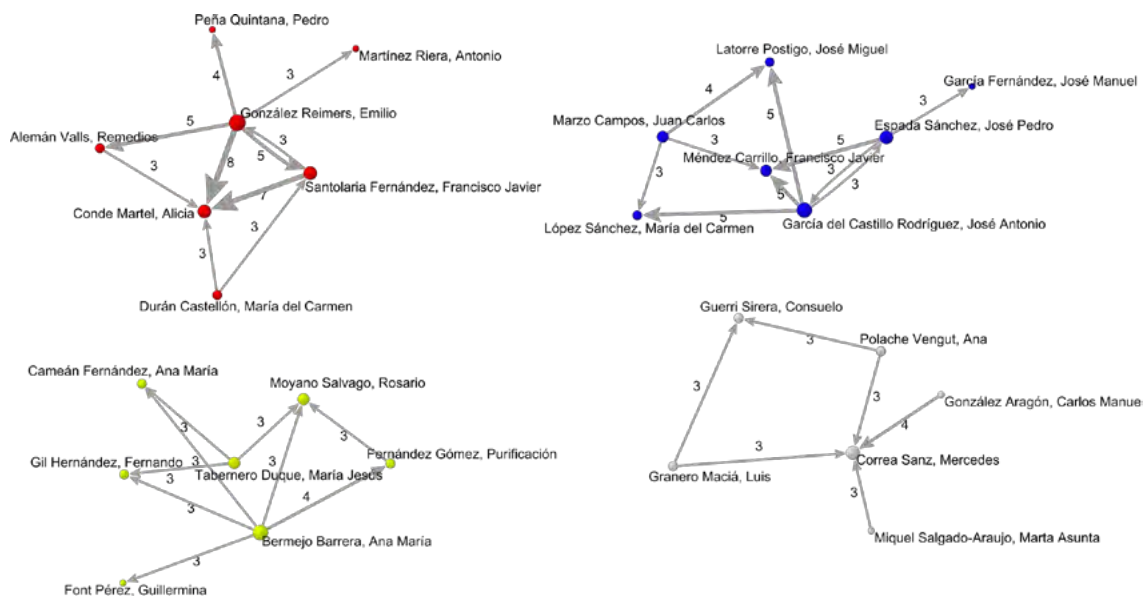


Figure 3. Chair-examination committee invitation network in Spanish doctoral theses on drug addiction (groups of 7-6 members).

Note. The vertices represent academics acting as chair or examiner. The size of the vertices determines the direct connections with other vertices. The thickness of the arrows reflects the total number of times the chairperson has asked an academic to participate in a thesis.

Table 3. Distribution of the committees examining Spanish doctoral theses on drug addiction (\geq of 10 appearances on committees ordered by number of appearances and alphabetically).

Name	Chair	Secretary	Member	Nº of committee appearances	Place of work
Ambrosio Flores, Emilio	5	1	14	20	Universidad Nacional de Educación a Distancia
Sánchez Turet, Miguel	8		9	17	Universitat de Barcelona
Becoña Iglesias, Elisardo	4		12	16	Universidad de Santiago de Compostela
Casas Brugue, Miquel	4	3	9	16	Fundación Hospital Universitario Vall d'Hebron
Conde Martel, Alicia	1		13	14	Universidad de Las Palmas de Gran Canaria
Alguacil Merino, Luis Fernando	4		9	13	Universidad San Pau CEU
San Román Del Barrio, Luis	2		11	13	Universidad de Salamanca
Torrens Melich, Marta	4	3	6	13	Institut Hospital del Mar d'Investigacions Mèdiques
Álamo González, Cecilio	4	1	7	12	Universidad de Alcalá de Henares
Beneit Montesinos, Juan Vicente	3	1	8	12	Universidad Complutense de Madrid
Collado Megía, María Isabel	2	2	8	12	Universidad Complutense de Madrid
Fernández De La Gandara, Fernando	5		7	12	Universidad Complutense de Madrid
Simón Pérez, Vicente	9	1	2	12	Universidad de Valencia
Valverde Granados, Olga	4	3	5	12	Universitat Pompeu Fabra
Álvarez González, Javier	2	3	6	11	Universidad de Valladolid
Dueñas Laita, Antonio		2	9	11	Universidad de Valladolid
Jané Carrenca, Francesc	10		1	11	Universitat Autònoma de Barcelona
Leal Cercós, Carmen	3		8	11	Universitat de València
Mendez Carrillo, Francisco Javier	7		4	11	Universidad de Murcia
Vega Fuente, Amando	3		8	11	Universidad del País Vasco
Echeburua Odriozola, Enrique	7		3	10	Universidad del País Vasco
Velasco Martín, Alfonso	6	2	2	10	Universidad de Valladolid

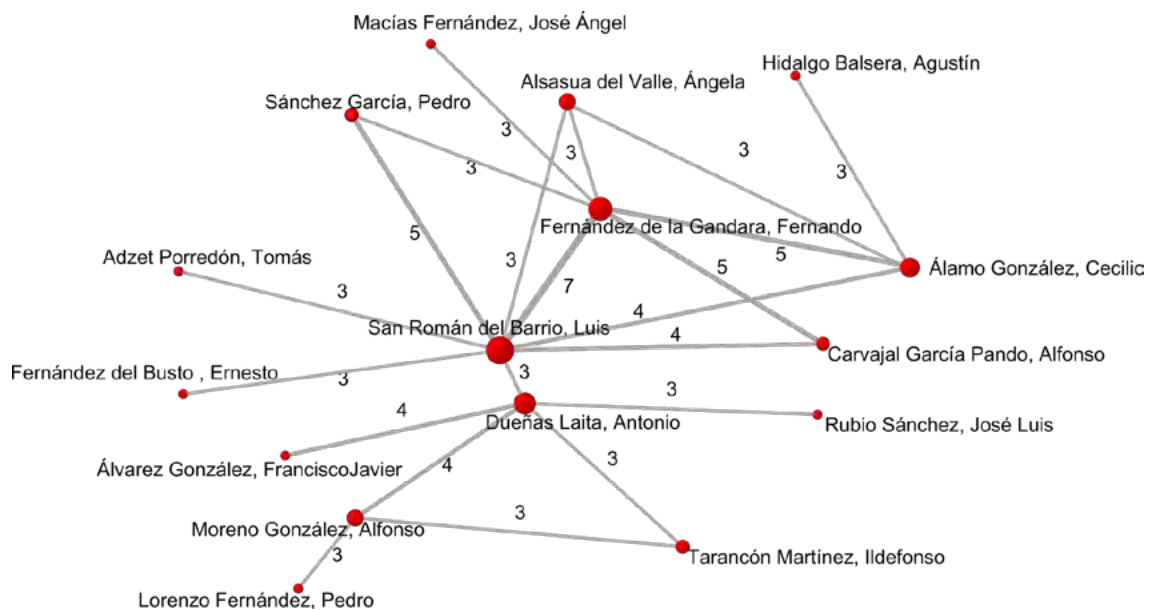


Figure 4. Network of committees examining Spanish doctoral theses on drug addiction (group of 16 members).

Note. The vertices represent the academics who act as chairs or examiners. The size of the vertices determines the direct connections with other vertices. The thickness of the lines represents the total number of times that two committees co-occur in the same thesis.

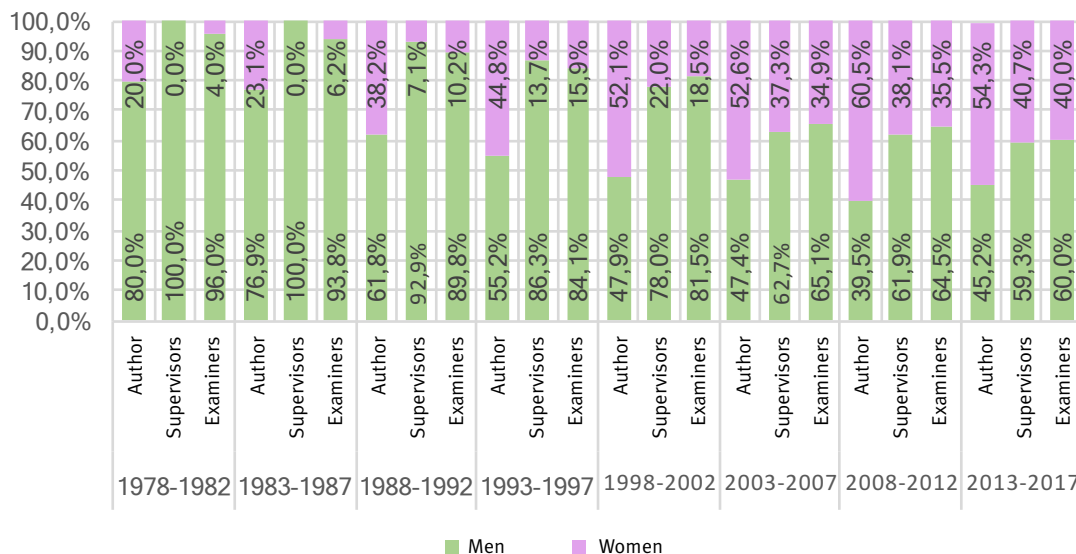


Figure 5. Comparison by sex of participants in doctoral theses on drug addiction

academics on examining committees. Moreover, this co-occurs more often on the committees with Fernando Fernández de Gandara (Complutense University of Madrid) and they, in turn, form two triangles of co-occurrence with Cecilio Álamo González (Alcalá de Henares University) and Alfonso Carvajal García Pando (Valladolid University).

Comparison by sex of thesis process participants

Men comprised 49.5% of authors and women 50.5%. In the first four five-year periods, men make up the greater proportion of authors, while from the five-year period 1998-2002 the situation reverses to women submitting the most theses, with the most significant difference occurring in the period 2008-2012, when women’s output makes up 60.5% (Figure 5) of the total.

With respect to supervisors, 68.2% are men and 31.8% are women. Figure 5 shows that there is a constant and gradual growth in the participation of women as doctoral thesis supervisors, rising from zero in the first and second quinquennia to 40.7% in the last five years.

In the case of examining committees, men make up 74.4% of members and women 25.6%, with a growing trend in the percentage of women sitting on committees being observable. During the first two decades, the percentage of women sitting on committees was greater than the percentage of theses supervised by women, with values of 4% and 6.2% as committee members and zero as supervisors. These differences are steadily disappearing, with the percentage of women supervisors already exceeding the percentage of women examiners in the five-year period 1998-2002.

Thematic analysis of theses

In general, the subjects dealt with in the doctoral theses are psychology, pharmacology and medical sciences. Within the field of psychology, the following subjects stand out: psychopharmacology (n = 385) and psychology (n = 379), psychopathology (n = 31), experimental psychology (n = 23) and clinical and social psychology, with 21 theses each. In the medical sciences, the keyword medical sciences (n = 223), psychiatry (n = 52), internal medicine (n = 37) and public health (n = 35) are prominent. The specific keywords related to addiction are drug abuse (n = 304), followed by alcoholism (n = 200), drug effects (n = 196) and drug addiction treatment (n = 126). Table 4 shows keywords appearing in more than 10 doctoral theses.

Figure 6 shows the six most frequent keywords in each five-year period. It can be observed that in the first five-year period, doctoral theses focus on aspects related to psychology, peaking in the two central quinquennia from 1993 through 2002, while in the subsequent five-year periods it undergoes a very significant decline until it almost disappears. Drug effects emerges strongly in the years from 1998 to 2002, and although they subsequently decline slightly, in the last five years it becomes the most researched aspect alongside drug abuse, thus reflecting the greatest concern, together with alcoholism.

Figures 7 and 8 show the relationships between keywords occurring jointly in the same thesis in the periods 1978-1997 and 1998-2017. The network of the first period (1978-1997) shows that psychology and psychopharmacology appear more often in theses with other keywords. These, in turn, are frequently found alongside drug abuse, alcoholism and medical sciences. Keywords such as the drug

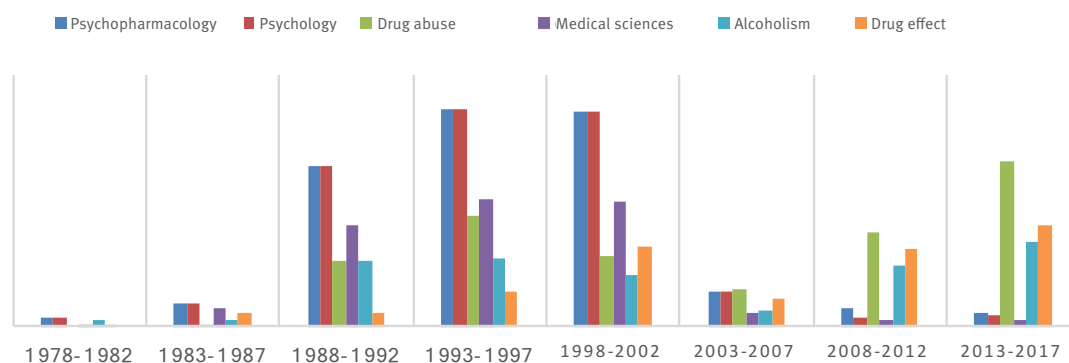


Figure 6. Changes by five-year period in the six most used keywords in doctoral theses on drug addiction

Table 4. Frequency of keywords in Spanish doctoral theses on drug addiction (>10 theses).

Keyword	Frequency	%
Psychopharmacology	385	12.6%
Psychology	379	12.4%
Drug abuse	304	9.9%
Medical sciences	223	7.3%
Alcoholism	200	6.5%
Effect of drugs	196	6.4%
Drug addiction treatment	126	4.1%
Psychiatry	52	1.7%
Pharmacodynamics	42	1.4%
Pharmacology	40	1.3%
Internal medicine	37	1.2%
Public health	35	1.1%
Mechanisms of drug action	33	1.1%
Psychopathology	31	1.0%
Epidemiology	28	0.9%
Neurosciences	27	0.9%
Psychotropic drugs	27	0.9%
Toxicology	26	0.8%
Experimental psychology	23	0.8%
Clinical psychology	21	0.7%
Social psychology	21	0.7%
Psychology of children and adolescents	20	0.7%
Preventive medicine	19	0.6%
Clinical sciences	18	0.6%
Personality	18	0.6%
Life sciences	17	0.6%
Psychology of abnormality	16	0.5%
Physiological psychology	16	0.5%
Evaluation and diagnosis in psychology	13	0.4%
Behavioral responses	13	0.4%
Pathology	13	0.4%
Sociology	13	0.4%
Action of drugs	11	0.4%
Neurology	11	0.4%

effects, pharmacodynamics or psychiatry are very closely connected, while keywords related to behavior, law or sociology, among others, are found on the network's periphery.

In the network of the second period (1998-2017), drug abuse becomes the keyword that is most strongly linked to other drugs, followed by psychology and psychopharmacology. It is observed that the keyword drug effects becomes more relevant in this second period, since it grows in co-occurrence with a variety of other keywords and in the frequency of their connections. The treatment of drug addiction and alcoholism continues to be of importance in this network. In this second network and the period covered, the keyword acquired immunodeficiency syndrome disappears and new terms appear, such as occupational health, neurosciences, clinical genetics, emotion, motivation, neurochemistry and personality measurement.

Discussion

The most substantial limitation of this work is due to the shortcomings of the TESEO database itself; although it features the most complete level of thesis coding, it should be noted that the data records for thesis registration are completed by the doctoral candidates or in the faculty or department office (Delgado et al., 2006). For this reason, the records sometimes contain errors and lack relevant information, such as, for example, examining committee or supervisor. In addition, there are deficiencies in terms of completeness, quality or the complete text, among others (Fuentes & Arguimbau, 2010). A further limitation of the study involves the fact that, although all the UNESCO keywords on drug abuse have been used, it should be noted that there may be biases, since it is possible that there are theses dealing with addiction which have not have been indexed with these keywords, or that theses from another field of study were included. Such aspects of deficient coding make it difficult to recover valuable information

provides an overview of its structure and the most influential academics working in it; students often seek to have their theses supervised by the most prestigious or powerful academics in the field, aiming to link the prestige of the academic to their work, since “the simple number of theses supervised is sufficient to distinguish the great promoters in the different disciplines” (Bourdieu, 2008).

Thesis output in the field of addiction during the period studied is similar to that found in most areas of science, with the trend of sustained growth in the number of defended theses only broken by a drop during the academic year 2004/2005 (Fuentes & Arguimbau, 2010). This decrease in almost all fields can be explained by a weakness in TESEO in relation to keyword labelling: during the period 2001-2005 there are numerous records with no keywords assigned (Sánchez et al., 2017), resulting in a loss of records when running searches in the affected field, as is our case. However, in other fields, such as sociology, the growth in the number of doctoral theses defended is constant (Castelló-Cogollos, 2016). Where our subject does resemble sociology is in the exponential growth over the most recent five-year periods, a phenomenon that does not occur in other fields such as, for example, otolaryngology (Diego & Prim, 2008), psychology (Agudelo et al., 2003; Oscala-Lluch, Haba, Fonseca, Civera & Tortosa, 2013) or the field of radiology (Repiso et al., 2011b). This growth could be due to the evident concern generated by the problem of drug addiction in recent years.

With regard to the authors of the theses, it was found that 11.7% of the total has continued an academic career, subsequently participating as supervisors or examiners; this is 1.6% lower than in the field of sociology, where 13.4% continue their academic careers (Castelló-Cogollos, 2016). One possible explanation can be found in the profile of the successful candidates in this area, since after graduation most doctors and psychologists dedicate themselves to clinical work rather than university teaching or research.

The university producing the most theses on drug addiction is the University of Valencia, probably because it offers several master's degrees in this field, as well as running specific research groups such as the Psychobiology Research Unit of Drug Dependence attached to the Psychology Department, or the Neuropharmacology of Addiction group (NEUROPHARAD) at the Pharmacy Department. The University of Valencia, the University of Valladolid and the University of Santiago de Compostela are among the most productive universities, more so than the top five universities in overall doctoral thesis output in Spain, namely the Complutense University of Madrid, the Autonomous University of Madrid, the University of Barcelona, the Autonomous University of Barcelona and the University of Granada (Sánchez et al., 2017).

With regard to supervision, the noticeably wide range of people who have supervised theses is significant, since

75.9% of supervisors have only overseen a single thesis, a value almost 14 percentage points below that observed in the doctoral theses of women's studies at national level in the period 1976-2002 (Torres & Torres, 2005). However, in areas such as librarianship and documentation, almost 50% of the theses defended in Spain in the period 1992-2006 are led by just six supervisors (Olmeda-Gómez, Perianes-Rodríguez, Ovalle-Perandones & de Moya-Anegón, 2009). This spread may be related to the thematic diversity observed in the field of addiction since substance use affects a multitude of health, family and social aspects and can therefore be analyzed from a variety of methodological and theoretical aspects.

Analyzing the data regarding thesis supervisors and examiners can identify the most important academics in the field of addiction. At the level of supervision, the difference between Alfonso Velasco Martín and other supervisors is clear. Velasco has dedicated his entire career to the study of drugs and poisons at the University of Valladolid, becoming an authority in his field. The woman who has supervised most doctoral theses is Ana María Bermejo Barrera, who has developed her career in the field of toxicology at the University of Santiago de Compostela. The fact that she is the only woman among the top ten supervisors may be a result of gender bias because, as various investigations have shown, women encounter gender-based career obstacles in their professions (Alonso-Arroyo, Bolaños-Pizarro, González-Alcaide, Villamón & Aleixandre-Benavent, 2010; Vicente, 2003; García de Cortázar & García de León, 1997; García, 1990; Gonzalez-Alcaide, Agullo-Calatayud, Valde-rrama-Zurián & Aleixandre-Benavent, 2009; Lluch, 2012).

With regard to sitting on examining committees, substantial differences were found because the same value cannot be assigned to taking part as chair, secretary, or member. The role of chairperson carries more responsibility and prestige and, for this reason, it is customary to appoint a renowned academic in the field. While it is true that this model of chair appointment is the most common, it should be noted that the chair is occasionally chosen according to the age of the committee's members. If these differences in weighting are considered, the positions regarding greatest participation would change; while Emilio Ambrosio is the academic who has sat on most examining committees, this was mostly as a normal member; Francesc Jané Carrencia, on the other hand, almost always sat on committees as chairman, given his long career in medicine and his position as emeritus professor of pharmacology at the Universitat Autònoma de Barcelona.

The study of supervisors and examiners thus shows that, having consolidated or finished their academic career, Alfonso Velasco and Francesc Jané possess greater prestige and capacity for action, which confirms Bourdieu's theory (2008) that the accumulation of academic capital and prestige is directly linked to the number of years in academia

and to age. The names of Miguel Sánchez Turet, a professor in the Department of Psychiatry and Clinical Psychology and founder of the master's degree in drug addiction at Barcelona University, and Elisardo Becoña Iglesias, professor of clinical psychology at the University of Santiago de Compostela also stand out.

Regarding the number of invitations a single academic receives to join a committee, the maximum is eleven, and the maximum reciprocity is five and three petitions, figures which are very similar in the field of sociology, where the maximum number of invitations received by the same academic is ten (Castelló-Cogollos, 2016). These data regarding number of invitations add to the existing spread in the participation on committees and confirms that in the area of drug addiction the level of inbreeding is not particularly high and is similar to that found in sociology. Therefore, we may consider that it is a field of science open to other disciplines and the exchange of theories and methods. Nevertheless, the fact that there are connections between academics could suggest a system of obligations, because "he who invites a colleague to sit on the examining committee of a thesis that he has supervised tacitly agrees to reciprocity and thus enters a cycle of continuous exchanges" (Bourdieu, 2008).

With regard to a comparison of the sex of authors, the proportion of women successfully completing the doctorate is greater than that of men from the quinquennium 1998-2002 onwards. This fact can also be observed in other areas such as experimental sciences and health, in which the percentage ranged from 51% to 56% per year during the quinquennium 2006-2010 (Instituto Nacional de Estadística; INE, 2011) or in psychology, where in the period from 1978 to 2012 women submitted 56.52% of the theses (Osca-Lluch et al., 2013). Also in the field of sociology, in the period 2010-2013 the percentage of women rises to 57.81% (Castelló-Cogollos, 2016).

In the case of supervisors and examiners, however, the percentages change, with men reaching higher quotas throughout the period studied; here, women make up 25.6% of examining committee members and 31.8% of supervisors. These data are similar to those found in other fields such as sociology, where the percentage of women examiners was 26.8% and that of supervisors 17.2% (Castelló-Cogollos, 2016), education, where 32,7% of examiners and 36,4% of supervisors were women (Moreno-Fernández & Moreno-Crespo, 2016), and psychology, with 26% and 30%, respectively (Osca-Lluch et al., 2013).

Although there is a gradual increase in the presence of women as thesis supervisors and examiners, their representation is still 20 percentage points lower than that of men in the last five years. These data confirm that the participation of women in education is progressively increasing and their consolidation as students and graduates is a reality (Barona, 2013; Bermúdez et al., 2011; Lluch,

2012). However, after this stage the academic careers of women slow down and a large number of women abandon an academic trajectory. (Castelló-Cogollos, 2016). In other words, while "the overall educational performance" of women is higher at all educational levels (Manassero & Vázquez, 2003), this advantage is not reflected in the academic positions held by women (Escribano, 2010; Lluch, 2012; Vicente, 2003), and it has been observed that there is a lack of gender equality among the most productive authors in the area of drug addiction (González-Alcaide et al., 2007). Much has been written on the causes of this and different terms have been coined that may explain the situation, such as, for example, "bottleneck", "leaky pipeline", "hysteresis" or "hidden discrimination" (Díaz, 2008; Gonzalez-Alcaide et al., 2009). However, the metaphor most often used to clarify this phenomenon is "glass ceiling", the invisible barriers discriminating against women and difficult to pinpoint since they are not found in any law or clearly identifiable social code (García de Cortázar & García de León, 1997).

Universities must not stop incorporating such highly qualified women, who would contribute to excellence in teaching and research. To improve this situation and to make sure the equality of women is more than a formal and rhetorical goal (Lluch, 2012), some studies (Díaz & Dema, 2013; Lluch, 2012) advocate solutions such as the need to apply general corrective measures (in terms of maternity and affirmative action). An example would be the supervision of appointment procedures, career breaks in tune with the biological clock or the active recruitment of women (Díaz & Dema, 2013), in addition to effectively applying and monitoring laws regarding gender, and projecting them across all public domains (Lluch, 2012).

In terms of collaboration between subjects, the most significant, as expected, is between psychology and psychopharmacology and drug abuse, since historically "the intervention of psychology in drug addiction has developed in parallel to the specialization in this area" (Colegio Oficial de Psicólogos, 1998). While the field of addiction has benefited from psychologists' professionalism and their versatility in interventions, psychology has found an emerging field in which to develop its techniques (Martín González, 2000).

Nevertheless, when attention is turned to the development of research into drug addiction, drastic changes in focus are apparent. Whereas the initial focus is on psychopharmacology and the ability to create drugs to treat the problem of addiction and its effects, since 2000 the trend has changed and research into this question drops completely, while the interest in researching the effect of drugs on the brain and how they affect human behavior gradually increases. This change can be explained by the influence of different entities and institutions such as NIDA (National Institute on Drug Abuse), which, thanks

to Nora Volkow, favored the creation of a model of “brain disease in addiction”. This new model was consolidated in 2007 when NIDA defined addiction as “a chronic brain disease [...] It is considered a brain disease because drugs change the brain: they modify its structure and how it works” (Secades-Villa, García-Rodríguez, Fernández-Hermida & Carballo, 2007) and has led to an increase in research in neuroscience, neurochemistry and clinical genetics.

In conclusion, the results confirm that bibliometric analysis of theses and the related academic networks in terms of supervision and assessment provides an instrument that facilitates an overview of the structure of a specific field of science, as well as of the academics with most influence and the greatest capacity for action (Bourdieu, 2008).

Conclusions

The realization of this study has made it clear that an analysis of the theses of a discipline provides an overview of its structure and the most influential academics involved in it. Likewise, it has been observed that the TESEO database has some limitations, the most significant of which are related to deficiencies in the coding of the data.

Regarding thesis output, it is noted that the increase in social concern over the consequences of addiction and the increase in the creation of groups and research units analyzing this problem is reflected in the growing number of doctoral theses in the field of addiction.

The results indicate that the positions with greatest power of action and academic prestige are occupied by professors such as Alfonso Velasco or Frances Jané, which was to be expected since in some cases they have either finished their teaching career or consolidated it well. Emilio Ambrosio Flores, Miguel Sánchez Turet and Elisardo Becoña Iglesias have also been or still are important academics in the field of drug addiction.

The analysis by institution shows that the leading universities in this field are the University of Valencia, the Autonomía University of Barcelona and the University of Valladolid.

Regarding the study of gender, the promotion of women to positions of great academic responsibility or power is slow since the levels of participation both as supervisors and examiners continues to be lower than that of men. It can thus be said that universities also suffer from a “glass ceiling”, which makes it difficult for women to progress in the workplace, obstructing access to higher positions of responsibility.

Regarding research trends in drug addiction, a change has been observed from an initial focus on psychopharmacology and its effects to a focus on the effects of drugs on the brain. Similarly, the large number of keywords found in this study is an example of the rich diversity of issues that affect drug addiction.

Acknowledgments

This study has been carried out with the aid of the Municipal Drug Addiction Plan of the Department of Health and Sports of the city of Valencia, Spain.

Conflict of interests

The authors of this article declare that there is no conflict of interest.

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