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## ORIGINAL ARTICLE

# A Map of Clinical Dermatology Research Centers in Spain: Results of the MaIND Study<sup>☆</sup>



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### KEYWORDS

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### Abstract

**Background and objective:** Bibliometric indicators and analyses of clinical research articles can help to quantify the scientific production of hospitals and institutions and identify their main areas of research. The aim of this study was to draw up a bibliometric map of clinical research in dermatology by Spanish hospitals and institutions through an analysis of quantitative, qualitative, and topic-based variables.

**Material and method:** Bibliometric study of clinical research articles that met the inclusion criteria and had a definitive publication date between 2005 and 2014 in PubMed or Embase in which the corresponding author's affiliation was a Spanish dermatology department or institution.

**Results:** Barcelona and Madrid were the provinces with the highest number of articles and citations. The centers with the most articles and citations were Hospital Clínic and Instituto Valenciano de Oncología. Those 2 hospitals also produced the highest number of articles on the most common research topic identified: melanoma. Because the articles were selected on the basis of the affiliation of the corresponding author to a Spanish dermatology center, this analysis does not include collaborative studies or clinical research studies led by nondermatology centers.

**Conclusions:** We have created a bibliometric map of clinical dermatology research in Spain that shows the distribution of scientific production and the main areas of research by province and hospital/institution. This map could be useful for education and research purposes.

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**PALABRAS CLAVE**

Bibliometría;  
Investigación  
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Dermatología;  
Española;  
Evidencia científica

## Mapa de centros de investigación clínica dermatológica española: resultados del estudio MaIND

**Resumen**

**Antecedentes y objetivo:** Los artículos de investigación clínica y los indicadores bibliométricos que de ellos derivan pueden ser útiles para cuantificar la productividad científica de centros e instituciones e identificar las líneas o temas de investigación de estos centros. El objetivo de este estudio es realizar un mapa bibliométrico de investigación clínica de centros e instituciones de dermatología españolas analizando variables cuantitativas, cualitativas y temáticas.

**Material y método:** Estudio bibliométrico de los artículos de investigación clínica con fecha definitiva de publicación entre el año 2005 a 2014, ambos inclusive, en las bases de datos Pubmed o Embase, en cuya dirección de autor de correspondencia figure un centro o institución de dermatología española y que cumplan los criterios de investigación clínica en dermatología.

**Resultados:** Las provincias que presentaron un mayor número de artículos y de citas acumuladas fueron Barcelona y Madrid. Los centros que presentaron un mayor número de artículos y citas acumuladas fueron el Hospital Clinic y el Instituto Valenciano de Oncología. Estos centros fueron también los que presentaron más publicaciones sobre el tema de investigación más frecuente, el melanoma. El criterio para atribuir una publicación científica a una institución dermatológica española en función de la dirección del autor de correspondencia hace que estudios dirigidos por instituciones no dermatológicas o estudios colaborativos no sean incluidos.

**Conclusiones:** Los resultados de este estudio permiten trazar un mapa tanto provincial e institucional de investigación clínica en dermatología que puede ser de utilidad con fines docentes y de investigación.

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**Introduction**

Bibliometric studies analyze indicators derived from statistics for journal articles and cites; examples are the raw number of articles, their subject matter, or their impact.<sup>1</sup> The point of reference for indicators can be subjects, research centers, provinces, or countries. They can also be analyzed by specialty or subspecialty to identify trends that describe topics of interest, researchers, or leading research centers. The knowledge generated through bibliometric studies can help researchers share information about highly complex clinical problems and identify potential partners for research collaboration.

The scientific output of Spanish researchers overall has been analyzed by such groups as Camí et al.<sup>2</sup> and Mendez-Vasquez et al.<sup>3</sup> Research on specific specialties, diseases, and techniques has also been done. For example, Ramos et al.<sup>4</sup> analyzed output on infectious diseases and microbiology; Iñigo et al.<sup>5</sup> studied the specialties of gastroenterology and hepatology; Miguel-Dasit et al.,<sup>6</sup> publications on magnetic resonance imaging in radiology; and Alonso-Arroyo et al.,<sup>7</sup> pediatrics. Dermatology has been looked at from several perspectives. Some bibliometricians have described work from different research centers published in Spanish journals<sup>8</sup> or in a single journal such as *Actas Dermo-Sifiliográficas*.<sup>9–11</sup> Others have analyzed papers published in international journals by authors affiliated with Spanish dermatology centers<sup>12</sup> or the level of scientific evidence in articles from Spain in specific journals in comparison with papers from other countries.<sup>13,14</sup>

The strengths of our study in comparison with the literature to date include 1) our identification and inclusion of

only research articles in clinical medicine, excluding papers providing only a low level of evidence and those not focused on clinical problems; 2) the inclusion of all journals indexed in MEDLINE and Embase; 3) coverage of an extended time period; 4) topic analysis; and 5) the use of results to map the scientific output of Spanish dermatology.

Our aim was to use quantitative variables and data reflecting article quality and topic to map the research output of hospitals with dermatology departments and other clinical research centers in our specialty.

**Materials and Methods****Design**

This bibliometric study covered publications from 2005 through 2014.

**Article Inclusion and Exclusion Criteria**

Three inclusion criteria were stipulated. First, articles had to be indexed in MEDLINE or Embase, and the field for the corresponding author had to include mention of a Spanish hospital or other research center with specialists in dermatology or venereology. The affiliations of coauthors were not taken into account given that this information was not consistently included by the databases we used or by all journals during the study period. Second, articles had to have a publication date between 2005 and 2014, inclusive. This time frame was chosen to coincide with the full-year indexing of *Actas Dermo-Sifiliográficas*, which publishes a

large percentage of the dermatology papers from Spanish centers. Third, articles had to meet the 3 sets of criteria that define clinical research<sup>13</sup> as follows: 1) the study was performed in patients, other persons, or health care systems or was based on clinical or laboratory findings (including samples from biopsies obtained from patients or healthy controls, dermoscopic images, laboratory results, etc.); 2) the study or systematic review answered a question that might be asked in clinical practice to solve a problem about patient management (including research on etiology, diagnosis, prognosis, treatment, prevention, disease prevalence, costs, and health care systems); and 3) the study provided at least level 4 evidence according to the criteria of the Centre for Evidence-Based Medicine (CEBM) of the University of Oxford.<sup>15</sup> Thus, we excluded case reports; expert opinion articles not designed to test an explicit hypothesis (which would have meant the review was a systematic one); and articles on physiology, laboratory techniques, or basic sciences.<sup>15</sup> One author (A. M. L.) read the title and abstract of all articles to evaluate the level of evidence; the full text was also read if the abstract provided insufficient information. If doubt remained about the study's level of evidence after this evaluation, another author (I. G. D. or M. D.) also assessed it and consensus was reached.

The exclusion criteria were as follows: 1) articles on topics clearly unrelated to dermatology, and 2) articles without definitive publication dates (ie, those posted online ahead of print).

### Variables of Interest

The main variables of interest were grouped according to type. The main quantitative variables were the numbers of articles per center and per province. Publication quality was reflected by the number of cites per center and per province. Research topics were studied based on author-provided keywords referring to dermatologic diseases. Terms referring to diagnostic techniques and treatments were excluded. Each of the 2352 keywords from the 1104 included articles were examined. Keywords not referring to dermatologic diseases were excluded. This approach yielded 875 keywords, which were then homogenized with OpenRefine software.<sup>16</sup> Keywords for which we found few cases or in highly heterogeneous groups were recorded in accordance with higher level categories until we were left with 73 topics distributed in 5 categories: skin tumors, inflammatory skin conditions, autoimmune skin diseases, pediatric skin diseases, and other. Each category encompassed 10 specific topics (the ones that yielded higher numbers of cases, plus 1 topic labeled "other" to receive the remaining keyword topics). When interpreting our results for topics it is important to remember that keywords were the units of evaluation, not articles. Not all articles contained published keywords provided by authors, and some articles included several keywords referring to dermatologic diseases.

### Search Strategy

Titles were harvested from the Scopus database because it includes all articles indexed in both MEDLINE and Embase and provides information on cites received by each article.

The search was undertaken on November 6, 2015 using the following strategy: (AFFILCOUNTRY (spain OR espana OR spanien OR espagne OR espanha) AND AFFILORG (dermat\*)) AND PUBYEAR > 2004 AND PUBYEAR < 2015.

## Results

The search returned 8617 titles, 1104 of which (12.8%) met the inclusion criteria to be considered clinical research in dermatology after elimination of articles according to exclusion criteria (Fig. 1).

### Map of Research Output and Cites by Provinces

Figure 2 is a map of the absolute numbers of clinical research articles and cites according to Spanish province. Data tables are provided in the online supplement. Researchers in Barcelona and Madrid published the largest number of articles and accumulated the most cites. The map also facilitates comparison of the number of published articles and cites per article between provinces by means of circle circumferences: the greater the difference between the circumference of the darker circle, reflecting the number of cites, and the lighter circle, reflecting the number of articles, the larger the number of cites per publication on average. For example, researchers in Malaga published more articles (55) than researchers in Seville (42). However, of the articles from Seville made a greater impact in terms of the number of cites they received (486 vs 287 for the articles from Malaga). The mean (SD) number of cites per article was about 2-fold greater for Seville than for Malaga (11.6 [16.9] vs 5.2 [5.2]). Tables with mean values are provided in the online supplement.

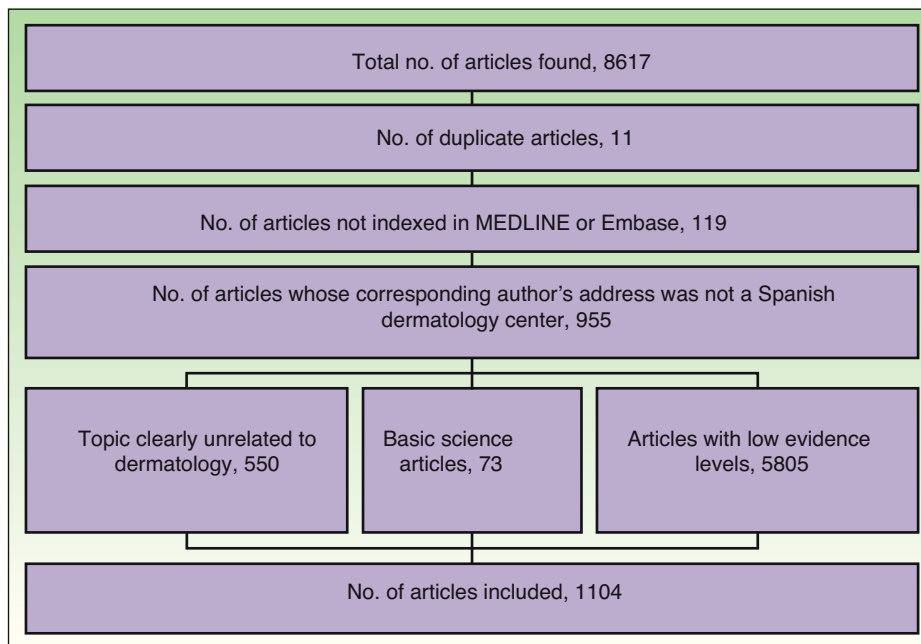
### Research Output and Cites by Hospital or Other Center

Data tables for mapping relationships between hospitals or other research centers and their output in volume of clinical research publications, number of cites, average number of cites per article, and level of evidence according to CEBM categories are provided in the online supplement. The 3 hospitals with the most publications were Hospital Clínic de Barcelona, Instituto Valenciano de Oncología, and Hospital del Mar.

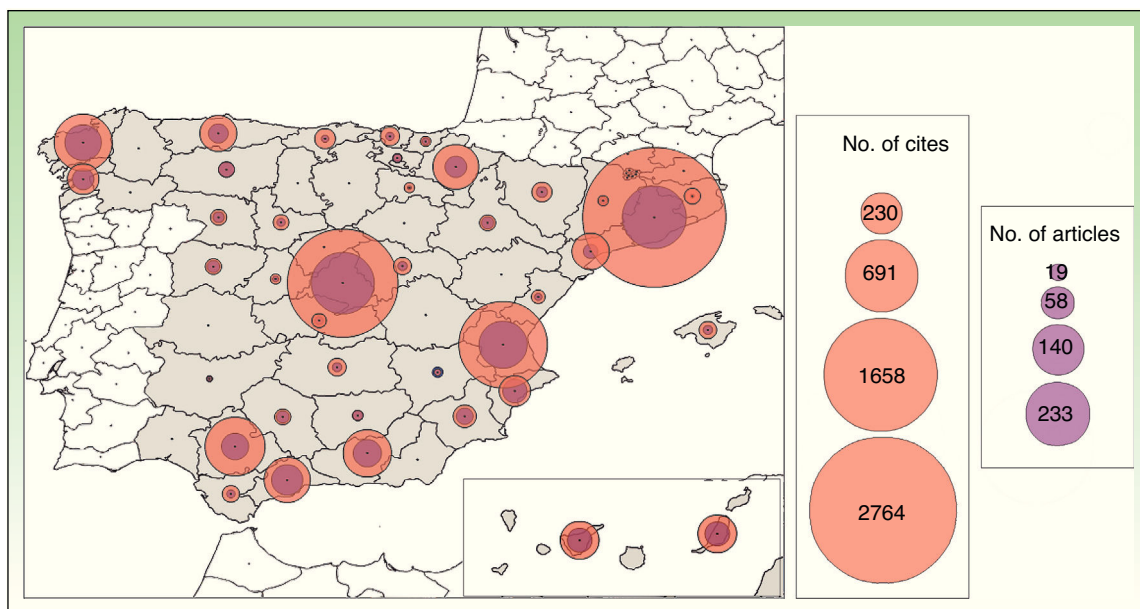
These centers were also the ones that received more cites overall (see online supplement).

Clínica Plató, Hospital de Sant Pau i Santa Tecla, and Hospital Marqués de Valdecilla were the centers with the most cites per article among those publishing more than a single article during the period (see online supplement).

Centers with the most publications with CEBM evidence levels of 4 or better were Instituto Valenciano de Oncología, Hospital Clínic de Barcelona, and Hospital de La Princesa. Clínica Plató was the center with the largest number of publications categorized in CEBM evidence level 1 a (see online supplement).



**Figure 1** Flow chart of the process of including and excluding articles for the study.



**Figure 2** Map of scientific output and impact of research in clinical medicine in dermatology according to Spanish provinces. The numbers of publications and cites accumulated are represented by proportional concentric circles.

### Research Topics by Center

The most common research topics were melanoma, psoriasis, and dermatitis/eczema. Hospital Clínic de Barcelona, Instituto Valenciano de Oncología, and Hospital Gregorio Marañón published the most articles specifying melanoma as a keyword. Hospital Sagrado Corazón, Hospital Central de Asturias, and Hospital San Cecilio published the most articles referring to psoriasis. Finally, Hospital General de Alicante, Hospital General de Valencia, and Hospital de

Santiago de Compostela were the centers with the most articles specifying dermatitis/eczema among the keywords.

To identify specialized research centers focusing on certain questions we grouped keyword topics into 5 categories: skin tumors, inflammatory skin conditions, autoimmune skin diseases, pediatric skin diseases, and other (see online supplement). The research centers with the largest numbers of articles on skin tumors were Instituto Valenciano de Oncología, Hospital Clínic de Barcelona, and Hospital del Mar. The most common disease topics in this category

were melanoma, benign skin tumors, and malignant skin tumors (see online supplement). Hospital General de Valencia, Hospital Gregorio Marañón, and Hospital Juan Canalejo published the most articles on inflammatory skin diseases. The most common topics in this category were dermatitis/eczema and blistering diseases (see online supplement). Hospital Costa del Sol, Hospital La Paz, and Hospital de Santiago de Compostela published the largest number of articles on infectious diseases. The most common topics in this category were fungal infections, human papillomavirus infections, and mycobacterial infections (see online supplement). Hospital Arquitecto Marcide, Hospital Juan Canalejo, and Hospital La Paz produced the largest amount of published research in pediatric dermatology. The dermatologic processes most often studied in this category were genetic diseases, vascular malformations, and acne (see online supplement). Finally, the research centers whose output most often fell into the category of other topics were Hospital Virgen de la Macarena, Hospital San Cecilio, and Hospital General de Valencia. The most common topics in this group were forms of alopecia, skin diseases caused by toxic agents, and nail disorders.

## Discussion

Our data describe clinical research activity in dermatology and venereology published from hospitals and other research centers in Spain, analyzed according to province and main topic areas.

A large number of articles were excluded because they did not provide the required level of evidence for inclusion. Another analysis of publications from Spanish centers in 1992, 1996, 2000, 2004, and 2008 reported that on average 69.3% of the titles had to be excluded,<sup>13</sup> consistent with our findings. Most of the articles published by Spanish dermatologists in this period were reports of single cases or narrative reviews by experts.

Analysis by provinces showed that the most productive ones contain the largest cities: Madrid, Barcelona, Valencia, and La Coruña head the list. These provinces have more hospitals and other research centers affiliated with universities, explaining their large research output. These findings, in combination with the number of cites attracted by the publications from these centers, reflect their scientific impact and provide a frame of reference for understanding the importance of their output. We believe that the absolute number of cites is the best indicator of scientific productivity over time. Although the mean number of cites per article is also important, it must be interpreted in context and not be used for direct comparisons given that there are centers that may attract many cites with only 2 or 3 articles. In fact, this statistic provides information about the scientific impact of the publications themselves.

The research centers at the top of the list of total number of publications are in the provinces that also lead in terms of number of cites per article. It is interesting to note the great difference between the absolute citation counts for publications from Hospital Clínic de Barcelona and Instituto Valenciano de Oncología and the rest of the Spanish research centers. Each of these 2 centers' publications attracted over twice as many cites as any other on the list, even though the

next highest ranked center published only 11 articles fewer than the Instituto Valenciano. Most publications from these top 2 centers treated various aspects of melanoma, possibly accounting for their markedly higher level of impact. The top position of Clínica Plató for mean number of cites per article merits discussion. This center published only 3 articles, but they were all systematic reviews within the Cochrane Collaboration. Therefore, their CEBM classification was 1a, accounting for the many (185) cites received. In contrast, the evidence level of most of the other published articles we located was 4.

The topic category with the largest number of articles was skin tumors, and melanoma was the most common topic in this category. Psoriasis and dermatitis/eczema were the diseases that were most often mentioned in keywords overall. Our study identified the research centers with the most clinical research publications on these and other dermatologic conditions of interest.

Certain limitations affect the interpretation of our results. First, we relied on the corresponding author's affiliation to identify the location of a research center responsible for an article. This approach can lead to lack of recognition for the centers of other participating dermatologists. Hospitals participating in multicenter studies would likewise not be reflected and their contributions underestimated unless they provided the corresponding author. We chose to use this approach because databases record more complete information about corresponding authors. Affiliation indexing is not homogeneous over time and comparisons between periods cannot be made. Second, we did not have keywords available for all the articles found. Therefore, the output of some centers on topics corresponding to some keywords may have been underestimated. On the other hand, other centers' topic output may have been inflated if their articles listed various keywords to describe a single article. Notwithstanding these limitations, we believe that this approach to identifying topic range is valid because our previous research showed that title words referring to dermatologic diseases and keywords provided by authors and journals are correlated.<sup>17</sup>

We hope the results of this analysis serve to encourage clinical research in dermatology in Spain and that they provide a point of reference for hospitals, departments, and individual researchers seeking partners for training and research projects.

## Ethical Disclosures

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this investigation.

## Data protection

The authors declare that no private patient data are disclosed in this article.

**Right to privacy and informed consent.** The authors declare that no patient data appear in this article.

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## Conflicts of Interest

The authors declare that they have no conflicts of interest.

## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.ad.2017.05.006](https://doi.org/10.1016/j.ad.2017.05.006).

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