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Discovering Rehabilitation trends in Spain: A bibliometric analysis

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Abstract

The main purpose of this study is to offer an overview of the rehabilitation research area in Spain from 1970 to 2018 through a bibliometric analysis. Analysis of performance and a co-word science mapping analysis were conducted to highlight the topics covered. The software tool SciMAT was used to analyse the themes concerning their performance and impact measures. A total of 3,564 documents from the Web of Science were retrieved. *Univ Deusto*, *Univ Rey Juan Carlos* and *Basque Foundation for Science* are the institutions with highest relative priority. The most important research themes are *Intellectual-Disability*, *Neck-Pain* and *Pain*.

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1. Introduction

A different kind of professionals compounds rehabilitation as a therapeutical discipline. It brings together different areas to recover the physical function, find strategies to supply the lost function and increase the patients' quality of life. Then, the main goals of a rehabilitation program are: i) to increase strength, endurance and mobility, ii) improve ability to perform activities of daily living, and iii) improve communication and thinking skills [1].

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Furthermore, the rehabilitation understood as a process enrolls a team of professionals works with a patient and family employing education programs, different treatments and practical experiences to reach the best level of autonomy conceivable. Thus, the rehabilitation research field is composed of different research topics that have a high impact on the general population well-being. For this reason, it could be interesting to analyse the rehabilitation trends through bibliometrics [2].

In this sense, bibliometric provides several methods to explore the impact and evolution of several themes and topics over time, facilitating the understanding and evaluation of the study output in a particular field [3]. Research output used to be evaluated using this sort of measurements [4], using them for practical research [2]. Therefore, the Science Mapping Analysis (SMA) [5, 6] is applied in the present paper. SMA combines with the evaluation of co-word networks, enables the most important terms or keywords of papers to be used to identify a study field structure [7]. Besides, the relative priority index (RPI) [8, 9] is used to discover the different institutions' effort in the development of Spanish rehabilitation research production.

During the last years, some bibliometrics studies were published analysing some aspects of the rehabilitation research area. Huang et al. [10] offered an overview of the research production of rehabilitation using virtual reality for the period 1996-2015. Franchignoni et al. [11] compared and commented about some different bibliometric indicators related to the most relevant journals in rehabilitation. Decullier et al. [12] shown a perspective on the development of evidence-based medicine in 6 rehabilitation professions. Liu et al. [13] performed a quantitative and qualitative analysis of the research on spinal cord injury rehabilitation from 1997 to 2016. Niehaus et al. [14] and Moral-Munoz et al. [15] performed Altmetrics-based analysis to highlight the social attention of rehabilitation production. In that way, to our knowledge, no documents are currently available evaluating the rehabilitation research field trends in Spain.

In views of this background, the primary aim of the present study was to offer a bibliometric overview of the rehabilitation research area in Spain from 1970 to 2018. Four different subgoals were established: 1) to know the Top 20 journals of the rehabilitation category where the Spanish researchers publish, 2) to know the Top 20 Spanish institutions that publish in rehabilitation category, 3) to analyse the RPI of the Top 20 Spanish institutions, and 4) to discover the main themes of Spanish production in rehabilitation by means of SMA.

The structure of the rest of the paper is the following: i) Section 2 present the methodology used to obtain the dataset and to carry out the performance and SMA analyses, ii) Section 3 shows the results obtained, iii) Section 4 discuss the most relevant findings according to the analysis, and iv) Section 5 details the main conclusions are drawn therefrom.

2. Methodology

2.1. Dataset

The nucleus of publications that compound the rehabilitation category of the journal citation report (JCR-2018) was defined to carry out the bibliometric study. According to the research literature, JCR has been suggested to index the most important articles in the various fields of study; it is also used as a condition in certain professional decisions, such as academic engagement [16, 17].

The document collection of 65 journals registered in the Science Citation Index Expanded (SCI-Expanded) and 69 journals published in the Social Sciences Citation Index (SSCI) in the rehabilitation section of the JCR-2018 was thus obtained from the Web of Science (WoS) database.. The information corresponds to July 2019. A total of 3,564 documents were obtained, limiting the search to Spain and taking into account the period 1970-2018. The following metadata was obtained to perform the analysis: title, year of publication, authors, affiliations, abstract, keywords, citations, and sources.

2.2. Performance analysis and Relative Priority Index

First, a quantitative analysis of the Top 20 journals and institutions was performed. Information about the number of documents and the percentage compared to total (3,564) is presented. Furthermore, the Relative Priority Index (RPI) [8, 9] or relative specialization index [18], was employed to identify the scientific effort of the Spanish institutions in the development of the rehabilitation research field. This index is used to show an institution's comparative output according to the Spanish rehabilitation publications.

It is defined as $RPI = \frac{(a/b)}{(c/d)} \times 100$, where:

- a = No. publications of the institution I in rehabilitation;
- b = No. publications of the institution I in all fields;
- c = No. publications of all institutions in rehabilitation;
- d = No. publications of Spain in all fields.

A RPI of 100 reflects that an institution's research priority in a given field is on average with respect to the rest of the institutions. If the RPI is above 100, the priority is above the average; if it is below 100, the priority is below the average. The results of this analysis are shown in a radar chart.

2.3. Science Mapping Analysis

Moreover, a co-word assessment was conducted for the period 1970–2018 using the SciMAT software [19]. First, several procedures have been employed to the keywords of the papers: I) Concept identification: Through a de-duplication method, synonymous and plural/singular are united to be displayed only by a unique word; the keywords of the authors have been manually reviewed using the specific software module. II) Deletion of irrelevant keywords: certain keywords do not add to the field understanding, such as stop words or general concepts (e.g., system, study, etc.). The following stages were implemented to achieve the co-word analysis [19]:

- a) Detection of themes: The clusters obtained in this phase are related to points of interest and/or scientific problems attracting the attention of the research community.
- b) Low dimensional space layout of the themes identified. For the plotting of each detected cluster, a two-dimensional strategic diagram is used to obtain a spatial layout of research themes [20]. Then, themes can be categorised into four groups [21], based on the quadrant: 1) Basic and transversal themes (lower-right quadrant): they are essential for a research area, but they are not highly developed. 2) Motor themes (upper-right quadrant): well-developed and significant for the composition of the area structure. 3) Highly developed and isolated themes (upper-left quadrant): well established but irrelevant for the area. 4) Emerging or declining (lower-left quadrant): weakly and poorly developed.
- c) Analysis of performance. To find the relative contribution of the identified themes to the entire study area, a quantitative and qualitative analysis is conducted. Through these analyses, it is possible to highlight the most relevant, productive and highest impact topics. Several bibliometric indexes could be combined with these themes and thematic areas to enable us this type of analysis, such as the total of documents published, the total number of citations received, and h-index [22–24].

A strategic diagram is constructed using this method in order to analyse the most important themes for the rehabilitation research area. The volume of the spheres represents the document count of each theme. Furthermore, in brackets appear the number of citations reached by each theme.

3. Results

First, Table 1 shows the Top 20 journals where the Spanish researchers published their studies. *Brain Injury*, *Revista Espanola de Discapacidad (REDIS)* and *Supportive Care in Cancer* are the journals with the highest

number of documents. Furthermore, Table 2 shows the Top 20 Spanish institutions publishing in rehabilitation journals, being *Univ Rey Juan Carlos*, *Univ Barcelona* and *Univ Complutense Madrid* the most productive.

Furthermore, Figure 1 shows the RPI of the Top 20 institutions. *Univ Deusto*, *Univ Rey Juan Carlos* and *Basque Foundation for Science* are the institutions with the highest RPI, which means that they are specialized or make an effort in research in this area.

Finally, in order to analyse the most remarkable themes of the Spanish rehabilitation production, a strategic diagram is shown for the whole period 1970–2018. According to the diagram shown in Figure 2, there are 16 themes in which the Spanish researchers have been working: *Intellectual-Disability*, *Neck-Pain*, *Pain*, *Disability*, *Art-Therapy*, *Stroke*, *Spinal-Cord-Injury*, *Traumatic-Brain-Injury*, *Reliability*, *Low-Back-Pain*, *Down-Syndrome*, *Depression*, *Osteoarthritis*, *Cough*, *International-Classification-of-Functioning* and *Granulocyte-Colony-Stimulating-Factors*. Some insights about these themes will be reported in the Discussion section.

Table 1. Top 20 Spanish production in the journals of rehabilitation research from 1970 to 2018.

	Record Count	JIF	Documents	Percentage
	Brain Injury	1.278	175	4.91%
	Revista Espanola de Discapacidad (REDIS)	-	159	4.46%
	Supportive Care in Cancer	2.754	133	3.73%
	Journal of Intellectual Disability Research	1.941	129	3.62%
	Research in Developmental Disabilities	1.872	113	3.17%
	Archives of Physical Medicine and Rehabilitation	2.697	111	3.11%
	Journal of Applied Research in Intellectual Disabilities	1.769	107	3.00%
	Journal of Manipulative and Physiological Therapeutics	1.274	94	2.64%
	Neurorehabilitation	1.197	92	2.58%
	Spinal Cord	1.898	92	2.58%
	Disability and Rehabilitation	2.054	91	2.55%
	American Journal of Physical Medicine Rehabilitation	1.908	76	2.13%
	European Journal of Cancer Care	2.421	67	1.88%
	Journal of Neuroengineering and Rehabilitation	3.582	67	1.88%
	Clinical Rehabilitation	2.738	65	1.82%
	European Journal of Physical and Rehabilitation Medicine	2.101	58	1.63%
	Journal of Electromyography and Kinesiology	1.753	56	1.57%
	Kinesiology	1.383	54	1.52%
	Journal of Orthopaedic Sports Physical Therapy	3.058	53	1.48%
	IEEE Transactions on Neural Systems and Rehabilitation Engineering	3.478	48	1.35%

4. Discussion

In this bibliometric study, the results of publication on the rehabilitation area by Spanish researchers indexed in WoS from 1970 to 2018 are presented. In that sense, some aspects need to be discussed concerning the obtained findings.

First, taking into account the percentages of publications in the different journals, approximately the 25% of the production is centred on 6 journals: *Brain Injury*, *Revista Espanola de Discapacidad (REDIS)*, *Supportive Care in Cancer*, *Journal of Intellectual Disability Research*, *Research in Developmental Disabilities* and *Journal of Applied Research in Intellectual Disabilities*. From this set of journals, only *Supportive Care in Cancer* is ranked into the 1Q. In that way, although authors should select the journal better matching the nature and potential readership of the research [11], this rank is important in some academic decisions. Therefore, at a glance, it is needed that Spanish researchers make an effort in publish in journals ranked Q1. Nevertheless, further insight into the evolution of these publications is needed.

Regarding the institutions, the most important producers are *Univ Rey Juan Carlos*, *Univ Barcelona* and *Univ Complutense Madrid*. Considering the production of these three institutions, they cover almost 20% of Spanish production. Nonetheless, although the number of documents is important information, we performed an analysis using the RPI.

Table 2. Top 20 Spanish institutions in rehabilitation research from 1970 to 2018.

Institution	Documents	Percentage
Univ Rey Juan Carlos	241	6.76%
Univ Barcelona	215	6.03%
Univ Complutense Madrid	206	5.78%
Univ Granada	203	5.70%
Univ Salamanca	201	5.64%
Univ Valencia	184	5.16%
Univ Autonoma Barcelona	168	4.71%
Univ Sevilla	150	4.21%
Univ Malaga	148	4.15%
Univ Autonoma Madrid	122	3.42%
Ciber: Centro Investigacion Biomedica en Red	105	2.95%
Consejo Superior Investigaciones Cientificas (CSIC)	105	2.95%
Basque Foundation for Science	95	2.67%
Univ Murcia	95	2.67%
Univ Deusto	92	2.58%
Univ Zaragoza	83	2.33%
Univ Basque Country	80	2.25%
Univ Miguel Hernandez Elche	73	2.05%
Univ Ramon Llull	71	1.99%
Univ Coruña	68	1.91%

Univ Rey Juan Carlos is the institution with a high number of documents and RPI, the rest of the top producers institutions do not have this similar relation between indicators. The lowest RPI is obtained by the Consejo Superior de Investigaciones Cientificas (CSIC), but this institution covers a high number of topics among their research. Thus, these findings have to be considered as information about the priority of an institution in research in a determined topic, but the number of other topics is not considered. Nonetheless, this finding meets the purpose of offering an overview of the rehabilitation research in Spain.

Finally, it is important to discuss the themes covered by the documents published by Spanish institutions during the period 1970-2018. As stated above, there are 16 themes in which the Spanish researchers have been working: *Intellectual-Disability*, *Neck-Pain*, *Pain*, *Disability*, *Art-Therapy*, *Stroke*, *Spinal-Cord-Injury*, *Traumatic-Brain-Injury*, *Reliability*, *Low-Back-Pain*, *Down-Syndrome*, *Depression*, *Osteoarthritis*, *Cough*, *International-Classification-of-Functioning* and *Granulocyte-Colony-Stimulating-Factors*. The basic and transversal theme *Pain* is one of the themes with the highest production and impact. In rehabilitation, pain is a subjective experience that guides the recovery process. The research about pain is increasing along the last years, and it is due to the high prevalence of chronic pain [25]. Furthermore, there are two motor themes, *Intellectual-Disability* and *Neck-Pain*, that are attracting the scientific community attention.



Fig. 1. Relative Priority Index of the Top 20 Spanish institutions.

The population with intellectual disabilities can benefit of the different rehabilitation professional work, such as occupational therapy, physiotherapy or speech therapy, to improve their quality of life [12]. Furthermore, the neck pain together with low back pain are the two main causes of disability worldwide [27] and the rehabilitation is the main management of this conditions in order to address obstacles to recovery and barriers to return to work [28]. Moreover, it is important to highlight the presence of three themes related to neurological diseases, *Stroke*, *Spinal-Cord-Injury* and *Traumatic-Brain-Injury*. This kind of conditions evolves a long recovery supported by rehabilitation, leading to the appearance of a subspecialty known as Neurorehabilitation [29].

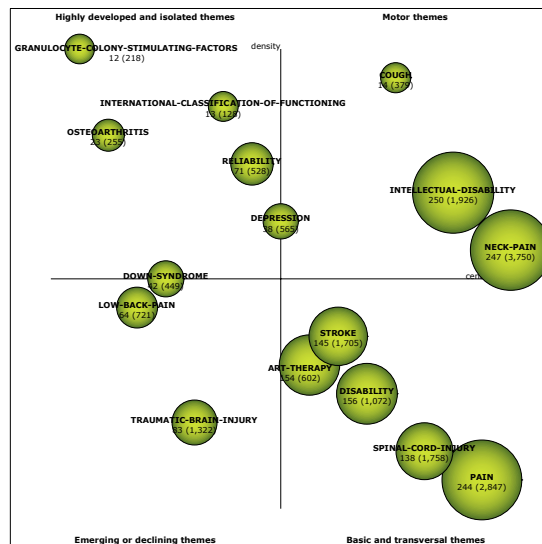


Fig. 2. Strategic diagram of the main topics discovered in the rehabilitation research area in Spain for the period 1970-2018. The number of documents and number of cites (in brackets) appear below the theme name. The size of the spheres is related to the number of documents.

While this research gives an interesting summary of the development of Spanish rehabilitation, some issues need to be covered. First, WoS use implies that only the document viewpoint indexed in this database has been analyzed. In addition, the paper was focused on the WoS category of rehabilitation, and some documents could be indexed in others. Not all the documents published by rehabilitation professionals are indexed in this category. Finally, in the RPI analysis, the foundation date and the variety of research themes covered by the institutions could be influencing these results. In that way, a further analysis considering these drawbacks will be performed.

5. Conclusions

In the present study, a bibliometric analysis, employing performance analysis and SMA, was carried out to present an overview of the Spanish rehabilitation production from 1970 to 2018. Concerning the results obtained, the following considerations could be made:

- *Brain Injury*, *Revista Espanola de Discapacidad (REDIS)* and *Supportive Care in Cancer* are the journals with the highest number of documents.
- *Univ Rey Juan Carlos*, *Univ Barcelona* and *Univ Complutense Madrid* are the institutions with the highest production. Nevertheless, *Univ Deusto*, *Univ Rey Juan Carlos* and *Basque Foundation for Science* are the institutions with the highest RPI.
- The motor themes *Intellectual-Disability* and *Neck-Pain* and the basic or transversal theme *Pain* are those with the highest number of documents and impact measures. They are attracting the interest of the scientific community.

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