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Original Research

Investigating the Status of Intra-Disciplinary and Extra-Disciplinary Relationships of the Physiotherapy Articles of Iran Indexed In the Web of Science during 2013-2017

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Abstract

Physiotherapy is an interdisciplinary field. Accordingly, to grow and develop itself, in addition to intra-disciplinary relationships, it needs significant extra-disciplinary relationships. The present study investigates intra-disciplinary and extra-disciplinary relationships in physiotherapy articles of Iran indexed on the Web of Science (WoS) from 2013 to 2017. In this study, to answer the research questions, the methods of content analysis, citation analysis, and scientometric approach were used. The statistical population included 210 articles on Iran in physiotherapy indexed on the WoS from 2013 to 2017. The trend of publishing 210 articles on Iran in physiotherapy has been growing from 2013 to 2017, with some neglect. Out of 7058 references in the 210 articles, the share of intra-disciplinary and extra-disciplinary references is 75% and 46%, respectively. The examined articles have been cited in 758 articles, of which 81.14% were extra-disciplinary citations, and 18.86% were intra-disciplinary citations. During the research period, physiotherapy articles of Iran in the research period have benefited from intra-disciplinary relationships more than extra-disciplinary ones. Relationships between articles citing the examined articles were more than in other scientific fields and extra-disciplinary.

Keywords: Extra-disciplinary Relationships, Intra-disciplinary Relationships, Physiotherapy, Rehabilitation Sciences, Scientometrics, Web of Science, Iran.

Introduction

Scientific relationships are essential for the growth and development of science. Scientific advances always occur in an interactive context between different fields and disciplines, just

as no scientific discipline alone can solve its problems (Bergmann, Dale, Sattari, Heit & Bhat, 2017; Ghanavizchian, Horri & Ghaebi, 2006). Scientific and research articles have a collective nature, and each article is enclosed in a circle of thematic texts before being done (Horri & Shahbodaghi, 2015). It can be said that the various sciences that are the basis for the production of these articles have a collective nature and are the product of interaction with each other. Sometimes these relationships are the product of interaction in the domestic space of the same scientific field, and sometimes the product of interaction with other scientific fields. As Mukherjee has been asserted in his book entitled "Librarianship, its philosophy, and history", the study of intra-disciplinary and extra-disciplinary relationships is part of the philosophy of any scientific field (Jamali Mahmuei, 2000), and knowledge of it can provide a transparent approach to the philosophy of that field.

Various terms have been used in the literature for an intra-disciplinary relationship, such as disciplinary (Fazeli & Koushki, 2017), Intra-disciplinary (Haji Hosein, Khabbaz Shahbodaghi & Shekoufteh, 2021; Schary & Cardinal, 2015; Tarafdar & Davison, 2018). Furthermore, different terms for the concept of extra-disciplinary relationship have been found in the literature, including transdisciplinary (Ebrahimy & Jafari, 2019; UNESCO, 1998), interdisciplinary (Aboelela et al., 2007; Boon & Van Baalen, 2019; Chen, Arsenault, Gingras & Larivière, 2015; Ebrahimy & Jafari, 2019; Schary & Cardinal, 2015) and extra-disciplinary (Haji Hosein Khabbaz et al., 2021; Moser, 2021; Sedighi, 2013) Regardless of the differences in terminology, the intra-disciplinary relationship is a single discourse in the allocated space of a specific domain (Fazeli & Koushki, 2017). In an intra-disciplinary approach, researchers in each field utilize their field's capabilities, tools, and methods to solve scientific problems and expand the boundaries of knowledge. Following the mentioned definition, in this study, "interdisciplinary relationship", was considered an exchange of citations in the allocated space to a specific scientific field. Sometimes the capacities within a scientific field do not meet the needs of that field. In these cases, often using the capacities of other scientific fields is helpful and supportive. Therefore, researchers resort to extra-disciplinary relationships. In our study, "extra-disciplinary relationship" has been considered to cite publications of other scientific disciplines or receive citations from those domains.

Physiotherapy is a sub-disciplinary of rehabilitation sciences. Therefore, it can be said that it has an interdisciplinary nature like its predecessor (Department of Rehabilitation Medicine, 2019; Institute of Medicine, 1997). The specialists in this profession in different countries are called by different names, such as Physical therapists, physiotherapists, and kinesiologists. Despite this difference in the naming of this field, all these terms represent a common concept that refers to providing services to maintain and sustain the maximum functional and motor skills of human beings (World Confederation for Physical Therapy, 2019). The physiotherapy profession focuses on developing and facilitating the recovery and empowerment processes of injured, sick, or disabled people, so its goal is to bring these individuals back into the workplace and help them maintain as much independence as possible (CSP, 2019). Although exercise in improving a healthy lifestyle has a long history, modern physiotherapy in Europe began in the 19th century and in the United States and Canada in the 20th century (Campbell, 2017; Cleather, 2008). In Canada, the outbreak of war, the spread of disease, and the increase in accidents made the growth and development of physiotherapy a growing social demand in the early 20th century. As a result, in 1921, the American Women's Physical Therapeutic Association became the first professional

association in this area. Therefore, from that date until now, we have witnessed the increasing expansion of this profession as an academic discipline worldwide (Campbell, 2017; Casarotto, de Andrade, Tanaka, Lancman & Oliver, 2016; Cleather, 2008). In Iran, a professional view of physiotherapy began in 1971 (Pormomeni, 2012). Rehabilitation schools currently offer physiotherapy programs for undergraduate and postgraduate students.

The field of physiotherapy, like other sciences, needs intra-disciplinary and extra-disciplinary relationships to enrich and broaden its boundaries. Studying intra-disciplinary and extra-disciplinary relationships of physiotherapy scientific products can lead to valuable information about this area's internal and external scientific interactions. Therefore, this study aims to investigate intra-disciplinary and extra-disciplinary relationships in physiotherapy articles of researchers of Iran on the Web of Science (WOS) from the period 2013 to 2017.

According to investigations conducted by researchers, some studies have looked into the intradisciplinary /interdisciplinary relationships of scientific products in a variety of domains, including Basic Science fields (Ebrahimy & Jafari, 2019), Information Systems (Tarafdar & Davison, 2018), Cognitive Science (Bergmann et al., 2017), Cybernetics (Hosseini & Baradar, 2017), Nanotechnology, Biotechnology, Information and Cognitive articles (Azadi Ahmadabadi & Nourmohammadi 2020), Biochemistry and Molecular Biology (Chen et al., 2015), Library and Information Science (Yousefi, Taherian & Osareh., 2013), Science and Technology (Sedighi, 2013), etc. In another study, the researchers of the present study have examined interdisciplinary and extra-disciplinary relationships in scientific products in the field of rehabilitation sciences in Iran (Haji Hosein Khabbaz et al., 2021). However, in this article, researchers have not specifically examined the intra-disciplinary and extra-disciplinary relationships of physiotherapy articles in Iran. Some studies focused on the scientometric study of physiotherapy articles (Benton & Benton, 2018; Wiles, Matricciani, Williams & Olds, 2012) and did not examine their intra-disciplinary and extra-disciplinary relationships. Therefore, in this study, an attempt has been made to provide a clear picture of intra-disciplinary and extra-disciplinary relationships in the physiotherapy articles of researchers of Iran.

The results of this study can provide appropriate information to policymakers and planners in the physiotherapy field by providing a clear picture of the situation of intra-disciplinary and extra-disciplinary relationships in the scientific productions related to this field in Iran. In addition, it can provide thoughtful decision-making in the adoption of educational, research, and planning policies and provide a roadmap for science production in physiotherapy.

Materials and Methods

In this study, content analysis, citation analysis, and scientometric approaches have been used to determine the status of intra-disciplinary and extra-disciplinary relationships of physiotherapy articles in Iran from 2013 to 2017. It should be noted that intra-disciplinary and extra-disciplinary relationships have been studied based on two-ways relationships. This means that these relationships were examined both in the references and in the citations to these articles. The statistical population of the present study included 210 original articles published by researchers of Iran in the period 2013 to 2017 in journals or conferences indexed in the WoS. The WoS was chosen because it is the world’s oldest, most widely used, and authoritative database of research publications and citations (Birkle, Pendlebury, Schnell &

Adams, 2020). Also, according to the need of our research, it was offered the ability to search through the Rehabilitation category.

Extraction of all articles included in the research community from 25 to 30 October 2018 has been done through the advanced search on the WOS. Thus, the keyword Iran was combined with the CU label related to the country field, with the AND operator with the term rehabilitation using the WC label, which is related to the Web of Science category of the WOS. The results were then refined into an article and proceedings paper from 2013 to 2017. A total of 467 articles were found. By examining the content of the titles, abstracts, and full text of these articles, 210 original articles related to the field of physiotherapy were identified, and in order to further analyze and answer some of the research questions, they were entered into Endnote and Excel software. In order to investigate intra-disciplinary and extra-disciplinary relationships, a list of 210 physiotherapy articles was extracted and entered into Excel software separately. Then, the references of each article were analyzed one by one, based on the title, abstract, and in some cases, the full text, the thematic scope of the journals or conferences in which they were published. Thus, the area or thematic areas of each source were carefully identified. According to the area or thematic areas, the references of each article were classified into two categories of intra-disciplinary (physiotherapy) and extra-disciplinary references. It should be noted that some references were placed in both categories due to being interdisciplinary.

To determine the use of articles in other fields of science from 210 articles in physiotherapy, citations to these articles were identified on the WOS. Thus, 210 physiotherapy articles were selected, and through the citation report tool of WOS, the articles citing these articles were identified and entered into Excel software. In the next step, by thematic analysis of the titles and abstracts of the citing articles, and in some cases, the full text, with the thematic area in which they were published, the thematic area of the citing articles was determined. The citing articles were then categorized into intra-disciplinary and extra-disciplinary citations according to their field or thematic areas.

Results

According to the findings presented in Figure 1, publishing 210 physiotherapy articles in Iran from 2013 to 2017 has been a growing trend with a bit of condescension.

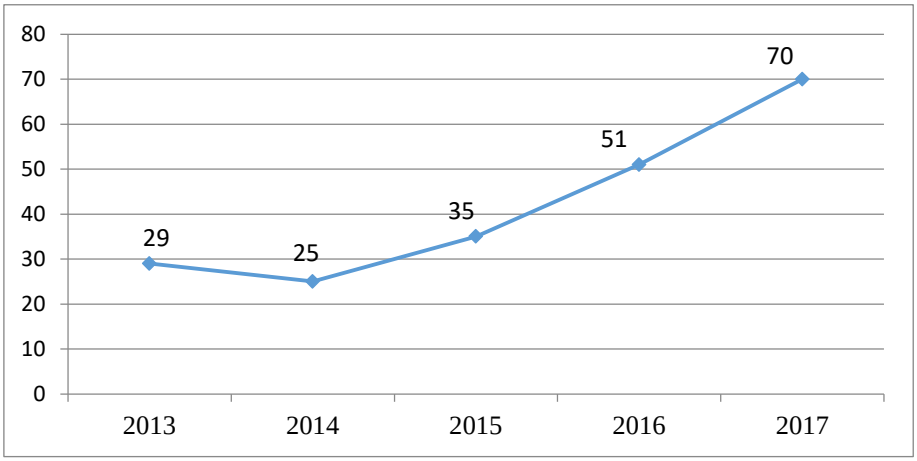

Figure 1: The Frequency Distribution of the Physiotherapy Articles of Iran Based on the Year of Publication

In terms of intra-disciplinary and extra-disciplinary relationships in the references of physiotherapy articles of Iran indexed on the WoS from 2013 to 2017, findings showed that out of 7058 references, the share of intra-disciplinary references (physiotherapy) is 75%, and the share of extra-disciplinary references is 46%. Also, some references, in addition to the scientific field of physiotherapy, had extra-disciplinary thematic areas, so these references were classified in both categories. In general, as shown in Figure 2, the share of intra-disciplinary references in the list of references of physiotherapy articles in Iran is more than the share of extra-disciplinary references.

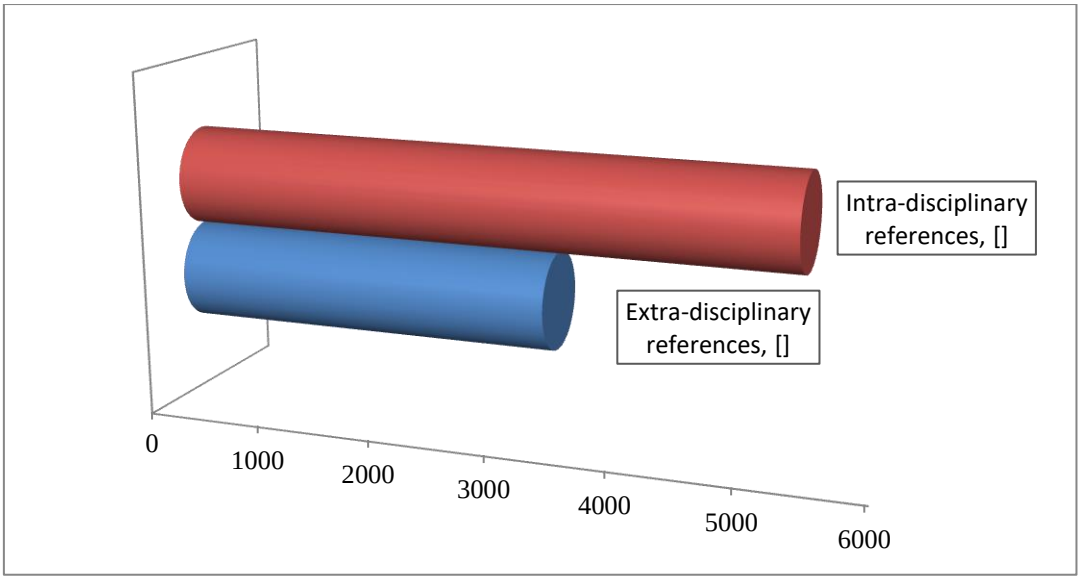

Figure 2: The Share of Intra-Disciplinary and Extra-Disciplinary References of the Physiotherapy Articles of Iran

Further analysis of extra-disciplinary references of physiotherapy articles showed that out of 3249 extra-disciplinary references, the largest share, i.e., 37.03%, belongs to orthotics and prosthetics. After orthotics and prosthetics, the most extra-disciplinary references related to neuroscience (23.51%). Table 1 shows the frequency distribution of extra-disciplinary references of the studied articles by their scientific fields.

Table 1

The frequency distribution of the extra-disciplinary references of the physiotherapy articles of Iran based on their scientific fields

Scientific fields	Record count	Percentage
Orthotics and prosthetics	1203	37.03%
Neuroscience	764	23.51%
Biomechanics	184	5.66%
Psychology	172	5.29%
Physiology	164	5.05%
Kinesiology	132	4.06%
Biomedicine	123	3. 79%
Rheumatology	118	3.63%
Occupational therapy	99	3.04%

Scientific fields	Record count	Percentage
Psychiatry	72	2.22%
Biology	48	1.48%
Ergonomics	37	1.14%
Radiology	33	1.02%
Audiology	28	0.86%
Biochemistry	21	0.65%
Epidemiology	20	0.62%
Nursing	14	0.43%
Immunology	11	0.34%
Pharmacology	6	0.18%
Total	3249	100%

Findings of the study have shown that 210 articles have been cited in 758 articles. The average number of citations received per article is 3.61. According to the findings, 81.14% of citations were extra-disciplinary, and 18.86% were intra-disciplinary related to physiotherapy. It should be noted that the thematic area of none of the citations was such that it was placed in both intra-disciplinary and extra-disciplinary categories.

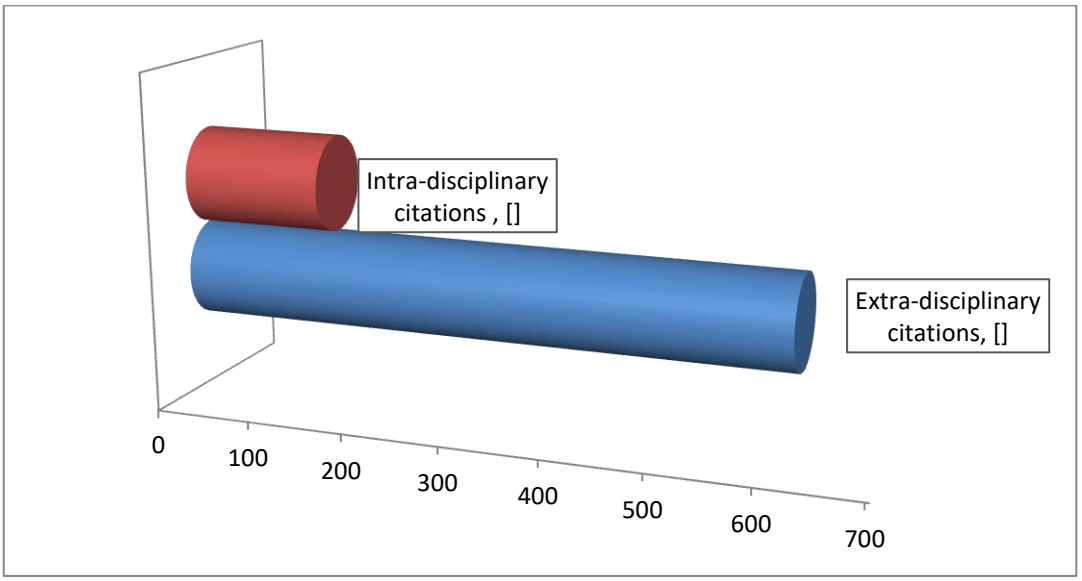

Figure 3*: The Share of Intra-Disciplinary and Extra-Disciplinary Citations to the Physiotherapy Articles of Iran*

Table 2 shows the frequency distribution of extra-disciplinary citations to physiotherapy articles of Iran by their scientific fields. According to the findings of this study, the highest rate of extra-disciplinary citations is related to the sports sciences with 19.67%, followed by neuroscience with 16.58%.

Table 2
The frequency distribution of the extra-disciplinary citations based on their scientific fields

Scientific fields	Number of citing article	Percentage
Sport science	121	19.67%
Neuroscience	102	16.58%
Orthopedics	77	12.52%
Medicine	70	11.38%
Clinical neurology	61	9.92%
Biomedicine	56	9.11%
Rehabilitation science (except physiotherapy)	56	9.11%
Other sciences	72	11.71%
-	615	100%

Discussion

Between 2013 and 2017, 210 articles in the field of physiotherapy were retrieved in the WOS, of which at least one of the authors of those articles belongs to Iran. Further studies indicated that the trend of publishing articles on physiotherapy in Iran in the period under review, with slight condescension, has been growing. This result is in line with the results of some international studies. In the study of Bentons and Benton (2018) and Wiles et al. (2012) in different periods, the growth trend of scientific products in physiotherapy has been reported to be a growing trend. According to the findings of this part of the research and the cited research results, it can be considered the growing trend of scientific productions in physiotherapy due to the increasing human awareness of the importance of this profession in human health, especially from the 20th century onwards (Campbell, 2017; Cleather, 2008). The spread of unhealthy lifestyles in today's societies and the increase in diseases caused by unhealthy lifestyles, including musculoskeletal problems (Burniston, Eftekhari, Hrabi, Worsley & Dean, 2012; Farhud, 2015) can also be evidence of this claim. Therefore, it may be possible to predict a growing future for scientific outputs in the physiotherapy area, both nationally and internationally.

On the other hand, the growing trend of physiotherapy scientific products of Iran in the WOS is in line with many studies that have examined Iranian scientific products in various fields. These include research in the field of nursing (Mousavi Chalak, Yaminfirooz & Riahi, 2018), medical education (Okhovati, Sadeghi & Shojaei, 2013), endocrinology and metabolism (Mohammadi, Shekofteh & Kazerani, 2020), and health literacy (Asadzandi, Shahbodaghi, Sajjadi, Kamkarhaghighi & Hemmat, 2013). These results seem to be due to the Ministry of Health and Medical Education's incentive policies to encourage researchers to participate in the production of science in the national and international arenas.

Further research by researchers demonstrated that 210 articles in the field of physiotherapy have 7058 references, of which 5298 references are related to the physiotherapy area, and 3249 references are related to other fields of science. Out of 3249 extra-disciplinary references, the first field with which the scientific products of physiotherapy have established extra-disciplinary relationships is orthotics and prosthetics. This can be because both areas are under the rehabilitation sciences and the similarity of the goals of the two areas in human motor empowerment (Alberta Health Services, 2012; Pormomeni, 2012; World Health Organization, 2011). Besides the second field to which most

of the references of the researched articles belong in the neuroscience area. This may be due to the importance of neuroscience in physiotherapy (Cohen, 1999).

In general, the results of this study revealed that the references of the examined articles are 75% intra-disciplinary and 46% extra-disciplinary. These results indicate that physiotherapy has benefited from interdisciplinary relationships more than extra-disciplinary relationships, indicating physiotherapy has benefited from intra-disciplinary relationships more than extra-disciplinary relationships. Suppose we accept that extra-disciplinary relationships expand the boundaries of scientific fields (Van den Besselaar & Heimeriks, 2001), and intra-disciplinary relationships help deepen the field's topics. In that case, we can say that in the Iran's scientific productions of the physiotherapy field during the research period, the most effort is spent to deepen the field and use the internal capacities of the field to solve its problems and answer its questions.

The research on rehabilitation articles of Iran also showed that in 89.6% of cases, the references of the articles have intra- disciplinary nature (Haji Hosein Khabbaz et al., 2021). Also, a study conducted on information systems articles indicates that the predominant types of knowledge contribution are intra-disciplinary (Tarafdar & Davison, 2018). Moreover, in other research in basic sciences, researchers showed that chemistry has an interdisciplinary nature (Ebrahimy & Jafari, 2019).

It is worth noting that the more significant share of intra-disciplinary relationships than extra-disciplinary relationships is not an unexpected result because researchers in different fields of science usually try to answer the questions of the field by using the capacities within the atmosphere of the same field. If these capacities are not convincing, they will look at the capacities and capabilities of other scientific fields. This does not mean that extra-disciplinary relationships are not essential. The importance of extra-disciplinary relationships is such that it has been a significant issue in science policy-making for more than 20 years (Larivière Haustein & Börner, 2015). However, higher rates of intra-disciplinary relationships than extra-disciplinary relationships are normal, but this should not have originated from a lack of knowledge of the potential and capacity of other sciences in solving internal problems in this field, lack of a proper context for the discourse of researchers in various fields of science, disciplinary biases and prejudices, and other communication barriers. Schary & Cardinal (2015) also emphasize the importance of understanding and benefiting from interdisciplinary relationships in kinesiology, which is very close to physiotherapy (Bindal, 2018). Perhaps, this is because today, rehabilitation services are beyond the scope of one field and require group work and expertise (Momsen, Rasmussen, Nielsen, Iversen & Lund, 2012; World Health Organization. Therefore, the study results need more analysis and etiology to be able to comment on the need for appropriate policies to guide researchers to make more use of extra-disciplinary relationships.

Researchers' studies indicated that 210 articles received 758 citations, an average of 3.61 citations per article. In their study, Hariri and Shokfteh (2013) have shown that 36 articles in the field of rehabilitation sciences in the Science Citation Index (SCI) in the period 2003 to 2007 have succeeded in obtaining 175 citations almost eight times over the past ten years. However, the average citation per article in this study (3.57) has decreased compared to the study of the mentioned researchers (4.86). Studies have shown that the largest share of extra-disciplinary citations in physiotherapy has been from the sport sciences and neuroscience areas. According to the findings of this study, the largest share of relationships established

between citation articles and articles receiving citations was the extra-disciplinary type. This confirms that the reviewed articles have an excellent potential to answer questions and solve problems in other fields of science and have been able to play a role in the production of articles in other sciences. Sedighi (2013) has also shown in his study that in nanotechnology, extra-disciplinary citations are more than intra-discipline, but in sociology and nuclear physics, the amount of intra-disciplinary citations are more than extra-disciplinary. She pointed out that extra-disciplinary and intra-disciplinary citations vary depending on the subject area. Chen et al. (2015) have also shown in research an increasing tendency of Biochemistry and Molecular Biology researchers to cite literature from other disciplines. Yousefi et al. (2013) have also shown that articles on library and information science have cited more to scientific publications of other scientific fields than to be cited in other fields. However, due to the variety of citation motivations and the complexities of citation behavior(Garfield, 1989a, 1989b; Vinkler, 1998), more study is needed to analyze this part of the findings.

Conclusion

Overall, the findings obtained from the research period show a growing trend in the publication of articles by researchers of Iran in physiotherapy. The articles under study used intra-disciplinary relationships more than extra-disciplinary relationships, but the number of citations they received compared to other articles was significantly out of the related field. The reviewed articles interacted with orthotics, prosthetics, and neuroscience more than any other field and received the most citations from sports sciences and neuroscience. Although the present study's findings clarified the status of interdisciplinary and extracurricular relationships in physiotherapy articles of researchers of Iran in the defined time, due to the limited research community, the results cannot be generalized to all articles in the field of physiotherapy. In order to have a more comprehensive and deeper understanding of intra-disciplinary and extra-disciplinary relationships in scientific productions in the physiotherapy field, it is necessary to conduct research with a wider geographical range over a more extended time.

Acknowledgment

Current research has been approved by the ethics committee of Shahid Beheshti University of Medical Sciences (ethics code: IR.SBMU.RETECH.REC.1398.389)

Conflict of interests

The authors declare no conflict of interest.

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