doi.org/10.54141/psbd.1133062

PAMUKKALE JOURNAL OF SPORT SCIENCES
ISSN: 1309-0356 dergipark.org.tr/en/pub/psbd

Pamukkale J Sport Sci, 13(2), 70-82, 2022 Research Article

Impact Assessment of Sports Medicine Studies on Knowledge Production and Development

Fatemeh ZARE[1] Fatemeh MAKKIZADEH[1*] Afsaneh HAZERI[1]

[1]*Department of Social Sciences, Yazd University, Yazd, Iran*

Keywords
Evaluation studies, Knowledge development, Knowledge production, Sport Medicine

Article History
Received 22 June 2022
Revised 24 August 2022
Accepted 25 August 2022
Available Online 29 August 2022

[*] **Corresponding Author**:
Fatemeh Makkizadeh
E-mail Address:
Makkizadeh@yazd.ac.ir

ABSTRACT

In order to justify the investments made in research in the field of sports medicine, the outcomes and impacts of these investments should be assessed. The purpose of this study was to investigate the status and impact of sports medicine studies on the production and development of knowledge. In this descriptive study bibliometric and scientometric methods were used on 1145 scientific productions of sports medicine indexed in the Web of Science database. Data were analyzed through Excel Software, and cooperation maps were drawn using VOSviewer Software. According to the findings, the ratio of citations to the articles on the scientific productions of sports medicine was 23.17, which is higher than the clinical medicine area (6.8). The ratio of citations to the authors was 5.46% and 52 articles (4.54%) of the articles appeared without citations. The average impact factor of journals publishing papers was 3.9. Most of the articles were published with the collaboration of five authors. The results of the present study, based on a selected model and a combination of indicators of the UK's and Canadian Capital Return frameworks (from the production and development dimension), generally highlighted the validity and effectiveness of all indicators, including activity, quality, and development. The results revealed the most significant impact of the number and quality of each of the indicators in sports medicine in this area.

Citation: Zare F., Makkizadeh F., and Hazeri A. (2022). Impact Assessment of Sports Medicine Studies on Knowledge Production and Development. *Pamukkale Journal of Sport Sciences*, 13(2), 70-82. doi.org/10.54141/psbd.1133062

INTRODUCTION

In recent years, the world has witnessed tremendous advances in sciences and technologies, and sports science is no exception, as it has been considered a broad, advanced, and comprehensive science. Sports medicine is an area of medical practice concerned with the treatment of injuries resulting from athletic activities. Sports medicine bridges the gap between science and practice in the promotion of exercise and health and the scientific assessment, study, and understanding of sports performance (Abou Elmagd, 2020).

Research on sports medicine and its achievements has considerable potential to promote the health of the athlete community. On the other hand, the impacts and achievements of these studies should be evaluated according to the investments in sports medicine studies (Guthrie et al., 2013). The research impact refers to any output of research activities that positively impact the scientific community, the health system, patients, and society as a whole (Milat et al., 2015). It means that it includes changes in awareness, knowledge, understanding, ideas, attitudes, policies, and practices resulting from research. Reducing the loss of investment in research and increasing added value for stakeholders justify the great importance of the research impact as well as its assessment and evaluation (Zachariah et al., 2014).

In this regard, various frameworks and models have been presented for impact assessment of research works. These frameworks provide organizations with an overview of management and supervision of their performance, enable them to understand the contribution of the organization's research in local, national, or international communities, and hold them accountable to the government, stakeholders, taxpayers, and the general public for demonstrating the value of research (Newson et al., 2015; Nason et al., 2008).

The UK's Capital Returns Framework is among the most common frameworks of impact assessment of research in the medical area. This model assesses research impact in five dimensions: (i) knowledge production, (ii) targeting research, capacity, and attraction, (iii) information on policy and product development, (iv) health advantages and health section, and (v) more general economic interests. Some indicators, such as the number of articles and citations, are mentioned in the dimension of knowledge production (Jamali, 2012). Another framework is the Canadian Capital Return model, which is based on the UK's Capital Returns Framework. In the Canadian model, indicators are provided for impact assessment of research on knowledge development. The first set of indicators is called activity indicators, which include the number of published scientific-research articles reviewed based on the subject area, year, number of authors, and the number of joint articles. The second set of indicators is

related to the research quality, which includes the impact factor of the journals, the number of citations, the number of highly cited articles, hot papers, and the number of articles published in top journals. The third set of indicators is related to the development of co-authorship networks. Co-authorship is an example of a scientific collaboration in which two or more authors collaborate to create a joint scientific work. Co-authorship analysis allows national and international collaborations to be identified (Canadian Institute of Health Research, 2005). The impact of publicly-funded medical and health research has been interested significantly over the last few years (Abou Elmagd, 2020). Several studies have been carried out to determine the range of theoretical models and approaches to measure of research impact in various fields such as The impact of Cochrane Reviews (Bunn et al., 2015), in health services or public health research (Newson et al., 2018; Manrique et al. 2019), in environmental, agriculture, and education research (Heyeres et al., 2019), A research impact model for work and health (Van Eerd et al., 2021) and Collective health research assessment: (Kork et al., 2022). Reviewing the background shows that the impact assessment and evaluation of the researches have been done mainly in the field of medical sciences and different models have been used. But so far, sports medicine studies have not been studied from this point of view

It is clear that despite the literature on sports science, the impact assessment of research on sports medicine is from the dimension of knowledge production. Development can pave the way for the realization of national and international plans and policies for prevention and treatment. This can assist the implementation sector in macro-planning based on the results of new research and a better perspective for more accurate insight and better performance of managers and policymakers in this area. Therefore, the main objective of this study is to answer the following question: What is the impact assessment status of scientific outputs in the field of sports medicine based on the combination of indicators of the UK's and Canadian Capital Return frameworks?

METHODS

Data Collection

This is descriptive and applied research which was performed based on the scientometrics approaches, and the data were analyzed using an evaluation technique. The statistical population of this study consists of 1145 articles from sports medicine studies from 2010 to 2019, which are indexed on the science website. For data collection, first, the keywords in the articles on sports medicine were searched in the Web of Science, PubMed, and Scopus databases. The following search strategy was used after the detection of the keywords in the

advanced search section of the Web of Science, which resulted in 8114 results: TS = ("sport * medicine*" OR "sports and exercise medicine" OR "exercise medicine")

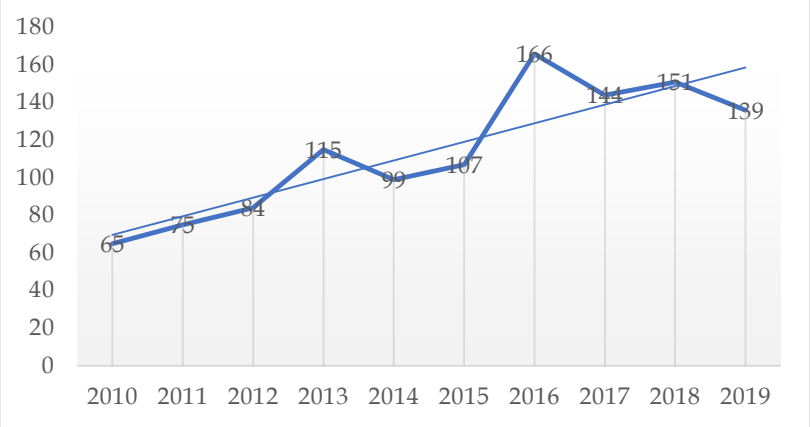
According to the objective of this study, the results were then limited to the type of article and to the period from 2010 to 2019, which resulted in 5009 records. The results were limited to all funding agencies to assess the effectiveness of the allocation of funds in terms of financial resource support, and 1145 records were obtained that were used as the study population.

Three categories of indicators, i.e., activity, quality, and development, were explored in the present study. The information needed to examine these indicators was collected from the Web of Science and the Journal Citation Reports (JCR) database. Finally, the data were calculated and analyzed using Excel and VOSviewer software packages.

RESULTS

In this study, 1145 articles with funding support were studied in the area of sports medicine from the Web of Science from 2010 to 2019. The results revealed that more than 99% of the articles were published in English, and the publication of articles had an ascending trend (Figure 1).

Figure 1. Growth Trend of Sports Medicine Articles During 2010-2019



In the study of quality indicators, it was found that the total number of 1145 retrieved documents have been published in 333 journals, of which 310 titles (93.09%) of these journals have an impact factor in the Journal Citation Reports (JCR)and 23 journals (6.9%) had no impact factor. About a third of the journals were in the first quarter. The results also showed that the articles received 38,710 citations, of which 1,093 articles (95.45%) had citations and only 52 articles (4.54%) did not receive any citations. the citation-to-article ratio is 35.41 (Table 1).

Table 1. Status of Sports Medicine Articles in Terms of Activity and Quality

Indicators	Number	%
Total citations	38701	100
Cited papers	1093	95/45
Papers without citation	52	4.54
Citation ratio to cited papers	35.41	_
Citation ratio to all papers	33.80	_
Journals with impact factor	310	93.09
Journals without impact factor	23	6.90
Total number of journals publishing papers	333	100
Number of articles published in Q1 journals	709	61.92
Number of Q1 journals publishing papers	97	31.29
Number of hot papers	1	0.08
Number of highly cited papers	5	0.43

According to the topical review of articles, it was found that all articles under study have been published in 104 different topic groups. Among them, 41.22% of the articles (472) were published in the sports science group, followed by the orthopedic group with 146 articles (12.75%) and physiology with 70 articles (6.11%). The 20 topic groups in which most sports medicine articles have been published are presented in Table 2. The results indicated that the highest rate of citations among different topic groups was related to the "Public, Environmental & Occupational Health" with a ratio of 36.70 followed by "Geriatric Medicine" (35.06) and "Clinical Neurology" (34.05). On the other hand, the lowest citation rate among the 20 groups was related to the topic group of sports sciences, with a ratio of 12.10 citations per article.

Table 2. Top 20 Topics in Terms of Article Publication Frequency, Number of Citations, and Citation-to-Article Ratio

Topics	Papers	%	Citation	Citation-to-article ratio
Sport Sciences	472	41.22	5712	12/10
Orthopedics	146	12.75	1947	13/33
Physiology	70	6.11	1082	15/45
Rehabilitation	61	5.32	1398	22/91
Public, Environmental & Occupational Health	48	4.19	1762	36/70
Surgery	47	4.1	725	15/42
Medicine, General & Internal	38	3.31	873	22/97
Multidisciplinary Sciences	26	2.27	643	24/73
Rheumatology	25	2.18	361	14/44
Neurosciences	23	2	851	37
Nutrition & Dietetics	22	1.92	587	26/68
Engineering, Biomedical	21	1.83	420	20

Table 2. Continues

Topics	Papers	%	Citation	Citation-to-article ratio
Clinical Neurology	18	1.57	613	34/05
Medicine, Research & Experimental	18	1.57	290	16/11
Geriatrics & Gerontology	16	1.39	561	35/06
Pediatrics	16	1.39	456	28/5
Oncology	15	1.31	374	24/93
Endocrinology & Metabolism	14	1.22	361	25/78
Pharmacology & Pharmacy	12	1.04	170	14/16

The study of impact factor and average impact factor of topic group journals demonstrated that among the top 20 journals, most journals had a higher impact factor than the average impact factor of topic group journals, and one journal, i.e., BRITISH JOURNAL OF SPORTS MEDICINE, had the highest impact factor compared to other journals in the topic group. The top 20 journals have published 681 articles on sports medicine (Table 3).

Table 3. The Top 20 Source Title of Sports Medicine Papers

Journals	Country	Papers	(IF)	(MIF)	(Q)	Citation
Journal of Science and Medicine in Sport	Australia	401	3/607	1/979	Q1	7642
British Journal of Sports Medicine	England	42	12/68	1/979	Q1	23370
American Journal of Sports Medicine	USA	32	5/81	1/979	Q1	34313
Orthopaedic Journal of Sports Medicine	USA	25	2/492	1/979	Q2	2959
Arthroscopy-The Journal of Arthroscopic and Related Surgery	USA	25	4/325	1/979	Q1	16791
Medicine and Science in Sports and Exercise	USA	21	4/029	1/979	Q1	37601
Plos One	USA	21	2/74	1/866	Q2	688786
International Journal of Sports Medicine	Germany	14	2/556	1/979	Q2	8353
Clinical Journal of Sport Medicine	USA	11	3/165	1/979	Q1	4242
BMC Public Health	England	10	2/521	2/104	Q2	40148
BMJ Open	England	9	2/496	1/681	Q2	35626
Sports Medicine	New Zealand	9	8/551	1/979	Q1	18114
Frontiers in Physiology	Swiss	9	3/367	2/456	Q1	21190
International Journal of Behavioral Nutrition and Physical Activity	England	8	6/714	2/937	Q1	11154
Journal of Sports Sciences	England	8	2/597	1/979	Q2	13266
Journal of Strength and Conditioning Research	USA	8	2/973	1/979	Q1	18708
Journal of Physical Activity & Health	USA	8	1/993	2/104	Q2	4924
Pm&R	USA	7	1/821	1/979	Q2	3411
Applied Physiology Nutrition and Metabolism	USA	7	2/522	1/692	Q3	5955
Sports Health-A Multidisciplinary Approach	USA	6	2/866	1/979	Q1	2224

The majority of the articles were co-authored, 17.03% of which were published in collaboration with five authors. A total of 5336 authors contributed to producing 1145 sports medicine articles in the last decade, and on average, each article has been written by three authors. The highest number of co-authors in an article was related to an article with 38 authors. Only 28 articles were written by single authors without scientific participation.

The assessment of international scientific participation in sports medicine indicated that 1145 articles were written by authors from 49 countries, all of which had participated in at least one document. The highest scientific collaboration was with 432 articles by the USA (Figure 2). In this study, in addition to countries, the degree of collaboration of organizations and universities in writing articles has been investigated. The collaboration map of organizations with at least five documents in sports medicine is illustrated in Figure 3.

According to the results of this section, a total of 1400 organizations have had international scientific collaborations in producing sports medicine articles. Among these organizations, the University of Queensland, Deakin University, and Monash University had the most scientific participation with 59, 49, and 39 articles, respectively.

Figure 2. Network Map of Scientific Collaboration Between Countries in Publishing Articles on Sports Medicine

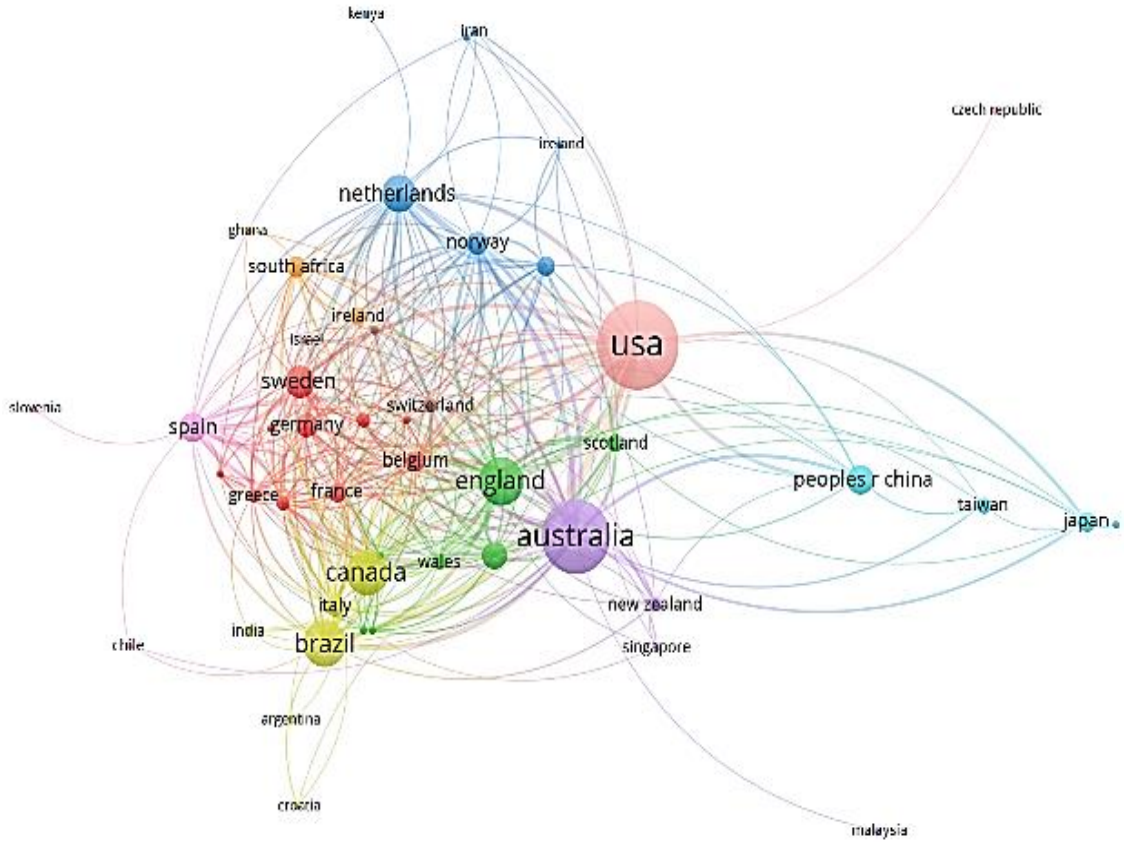
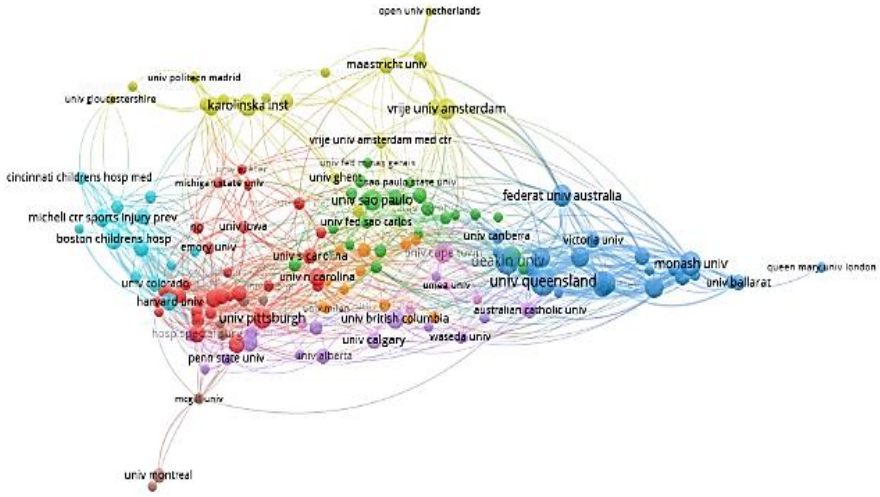


Figure 3. Network Map of International Scientific Collaboration of Organizations Publishing Sports Medicine Articles



DISCUSSION

The present study assessed those sports medicine articles that were funded and indexed on the Web of Science database during 2010-2019. In general, 1145 articles on sports medicine were covered by this database in the 10-year period, which were funded by 1557 organizations. Although research funding in this area has fluctuated over the past decade, an ascending trend has generally been shown. In this regard, it is noteworthy that the tendency to invest in and conduct scientific and medical studies across the world is generally increasing, which can be attributed to the growing tendency of scholars to research in the area of global health (World Health Organization, 2013).

In this study, the indicators of the UK's Capital Return framework and the Canadian Capital Return framework were used for the impact assessment of research on sports medicine from the knowledge production and development dimensions. Multiple studies have employed these two frameworks for impact assessment of research at the national and organizational levels (Hiney & Curran, 2015; Cohen et al., 2015; Donovan et al., 2014; FeyzabadI & Vaziri, 2019).

Studies for impact assessment of research on knowledge production and development have applied various indicators. Some studies have used only the indicators of the number of articles and the number of citations as the criteria for the research impact on knowledge production using the UK Capital Return model (Cohen et al., 2015; FeyzabadI & Vaziri 2019; Wooding et al., 2014; Nason et al., 2008).

Citation is an indicator used to indicate the scientific impact of an article or journal. Therefore, the scholars generally aim to publish articles that, by receiving more citations, affect significantly science (Falagas et al., 2013). Decision-makers commonly use the number of citations to evaluate the scientific performance of scholars, groups, and research organizations (Leimu & Koricheva 2005). According to the results of this study, these articles received a total of 38,710 citations, of which a total of 1093 articles (95.45%) received citations, and only 52 articles (2.54%) did not receive any citations.

Furthermore, for the articles which received citations, the citation-to-article ratio is 35.41, but for all articles this number is equal to 33.8. In addition to the number of articles and the number of citations, several studies have employed the citation-to-article ratio indicator for impact assessment of research on knowledge production and development (Agarwal et al., 2016; FeyzabadI & Vaziri, 2019). The results revealed that the citation-to-article ratio in these articles was 23.17, which is higher than the clinical medicine area, based on data from the ESI (Essential Science Indicators) database, which was reported to be 6.8 in 2012. Moreover, in a study on clinical and medical research impact in Catalonia, the results indicated that the average citation per article was equal to 9.24 (Adam et al., 2012).

Journal Impact Factor (JIF) is an indicator that points out the quality and impact of journals and is extensively used in research evaluations (Agarwal et al., 2016). In various studies, the JIF has been employed as an indicator for impact assessment along with other indicators (Agarwal et al., 2016; Gordon & Bartley, 2015). According to the results, the average impact factor was 3.9 for the journals in which the articles were published. In a study, the average impact factor for Australian health research and clinical research in anesthesia departments was 3 and 2.1, respectively (Reed et al., 2011; Swaminathan et al., 2007). The analysis of journals publishing sports medicine articles showed that most journals belong to the first and second quarters, i.e., the majority of articles are indexed in journals with a higher impact factor. Journals, as one of the information containers, are of special importance because they publish the latest scientific materials in specific areas at short and regular intervals. Publishing and indexing an article in a reputable scientific journal can indicate its high quality.

Scientific collaboration rate and co-authorship are other indicators that have been employed in researches on health to show the impact of their research (Agarwal et al., 2016; Gordon & Bartley, 2015; Sainty, 2013). Scientific collaborations enable sharing of knowledge, skills, and techniques among scholars. Such a flow of knowledge contributes to the process of "knowledge accumulation," resulting in economic development (Scarazzati & Wang, 2019). The evaluation of the authors participating in the present study indicated that on average three

authors collaborated in writing each article. The majority of articles have been published by five authors, and a small number of articles have been published by a single author. In other words, co-authorship was found in most articles.

The results of the analysis of sports medicine articles from the aspect of collaboration at the level of organizations and countries demonstrated that 37.72% of the studies were conducted in collaboration with international organizations. The relationship between scientific collaboration and citation is mentioned in various studies, the results of which showed that studies published in collaboration with various national and international researchers have a more significant impact and receive more citations compared to other studies (Kwiek, 2021; Didegah & Thelwall, 2013).

CONCLUSION

The results of the present study, based on a selected model and a combination of indicators of the UK and Canadian Capital Return frameworks (from the production and development dimension), generally highlighted the validity and effectiveness of all indicators, including activity, quality, and development. The results revealed that the number and quality of all indicators had a significant impact on the field of sports medicine. For instance, the top topic groups have the highest number of articles and citations, and the countries, organizations, and authors in these subject areas have the most collaborations. The results represent the appropriate and thoughtful investment in publishing articles in this area. In other words, funding and budgeting agencies act in the right way to achieve the desired results and observe a positive impact. In addition, the study results indicate the high expertise and credibility of sports medicine activists. These individuals, organizations, countries, and journals have considered both the quantity of their studies, as well as the credibility and quality of their professional activities. So, regarding the developments observed during the years under review, it can be argued that they will continue to witness desirable quantitative and qualitative improvements.

Although this study just examined the main indicators of activity, quality, and development, it did not consider other indicators related to the impact assessment of research on knowledge development. Results, however, can generally be used as basic data for managers of universities, organizations, institutions, and research investors. Firstly, it helps them to know the status of sports medicine studies. Secondly, the results give them the opportunity to learn about their impact, on planning for funding as well as focusing on national and international collaborations. Given the ascending trend of sports medicine

studies, the growth of articles in this area is predicted to be more significant in the coming years. Therefore, the need for their impact assessment on knowledge production and development should be considered vital by medical research policymakers for their more appropriate orientation.

Authors' Contributions

The authors made a substantial contribution to the design of the study, acquisition, analysis, writing, and final approval of the manuscript.

Acknowledgments

This study was sponsored by Yazd University, Iran.

Declaration of Conflict Interest

The author declares that there is no conflict of interest.

REFERENCES

Abou Elmagd, M. (2020) The role of sports medicine in physical education. International Journal of Physical Education, *Sports and Health*, 7(6), 76-83. https://doi.org/10.22271/kheljournal.2020.v7.i6b.1898

Adam, P., Solans-Domenech, M., Pons, J.M., Aymerich, M., Berra, S., Guillamon, I., Sanchez, E. & Permanyer-Miralda, G. (2012) Assessment of the impact of a clinical and health services research call in Catalonia. *Research Evaluation*, 21(4), 319-328. https://doi.org/10.1186/1478-4505-11-15

Agarwal, A., Durairajanayagam, D., Tatagari, S., Esteves, S.C., Harlev, A., Henkel, R., Roychoudhury, S., Homa, S., Puchalt, N.G., Ramasamy, R. & Majzoub, A. (2016) Bibliometrics: Tracking Research Impact by Selecting the Appropriate Metrics. *Asian J Androl*, 18(2), 296-309. https://doi.org/10.4103/1008-682X.171582

Bunn, F., Trivedi, D., Alderson, P., Hamilton, L., Martin, A., Pinkney, E., & Iliffe, S. (2015)

Canadian Institute of Health Research. Developing a CIHR Framework to Measure the Impact of Health Research. Ottawa: Canadian Institute of Health Research; 2005.

Cohen, G., Schroeder, J., Newson, R., King, L., Rychetnik, L., Milat, A. J, Bauman, A. E, Redman, S. & Chapman, S. (2015) Does health intervention research have real world policy and practice impacts: testing a new impact assessment tool. *Health Research Policy and Systems*, 13(1), 1-12. https://doi.org/10.1186/1478-4505-13-3

Didegah, F. & Thelwall, M. (2013). Which Factors Help Authors Produce the Highest Impact Research? Collaboration, Journal and Document Properties. *Journal of Informetrics*, 7(4), 861-873. https://doi.org/10.1016/j.joi.2013.08.006

Donovan, C., Butler, L., Butt, A. J, Jones, T. H. & Hanney, S. R (2014) Evaluation of the impact of National Breast Cancer Foundation-funded research. *Med J Aust*, 200(4), 214-218.

https://doi.org/10.5694/mja13.10798

Falagas, M. E., Zarkali, A., Karageorgopoulos, D. E., Bardakas, V. & Mavros, M. N. (2013). The impact of article length on the number of future citations: a bibliometric analysis of general medicine journals. Plos One, 8(2), e49476. https://doi.org/10.1371/journal.pone.0049476

FeyzabadI, M. & Vaziri, E. (2019). The Impact of Iranian Cohort Studies on Knowledge Production and Development. *Scientometrics Research Journal*, 5(10), 63-88. https://doi.org/10.22070/rsci.2019.3722.1231

Gordon, L.G. & Bartley, N. (2015). Views from senior Australian cancer researchers on evaluating the impact of their research: results from a brief survey. *Health Research Policy and Systems*, 14(2), 1-8. https://doi.org/10.1186/s12961-015-0073-0

Guthrie, S., Wamae, W., Diepeveen, S., Wooding, S. & Grant, J. (2013). *Developing a research evaluation framework*. Santa Monica: RAND Corporation.

Heyeres, M., Tsey, K., Yang, Y., Yan, L., & Jiang, H. (2019). The characteristics and reporting quality of research impact case studies: A systematic review. *Evaluation and program planning*, 73, 10-23. https://doi.org/10.1016/j.evalprogplan.2018.11.002

Hiney, M. & Curran, B. (2015). Outputs and outcomes of HRB awards completed in 2012 and 2013. Dublin: Health Research Board.

Jamali, H.R. (2012). Comparison of Models and Frameworks of Medical Research Impact Assessment. *Health Information Management*, 9(5), 757-767. [Persian].

Kork, A.A., Antonini, C., García-Torea, N., Luque-Vílchez, M., Costa, E., Senn, J., Larrinaga, C., Bertorello, D., Brichetto, G., Zaratin, P. & Andreaus, M. (2022). Collective health research assessment: developing a tool to measure the impact of multistakeholder research initiatives. *Health Research Policy and Systems*, 20(1), 1-13. https://health-policy-systems.biomedcentral.com/articles/10.1186/s12961-022-00856-9

Kwiek, M. (2021). What large-scale publication and citation data tell us about international research collaboration in Europe: Changing national patterns in global contexts. *Studies in Higher Education*, 46(12), 2629-2649. https://www.tandfonline.com/doi/full/10.1080/03075079.2020.1749254

Leimu, R. & Koricheva, J. (2005). What determines the citation frequency of ecological papers? *Trends in Ecology & Evolution*, 20(1), 28-32. https://doi.org/10.1016/j.tree.2004.10.010

Manrique, S., Wroblewska, M. N., & Good, B. (2019). Rethinking research impact assessment: a multidimensional approach. *Journal for Research and Technology Policy Evaluation*, (48), 159-175. http://dx.doi.org/10.22163/fteval.2019.385

Milat, A. J, Bauman, A. E & Redman, S. (2015). A narrative review of research impact assessment models and methods. *Health Research Policy and Systems*, 13(18), 1-7. http://dx.doi.org/10.1186/s12961-015-0003-1

Nason, E., Curran, B., Hanney, S., Janta, B., Hastings, G., O'Driscoll, M., & Wooding, S. (2011). Evaluating health research funding in Ireland: assessing the impacts of the Health

Research Board of Ireland's funding activities. *Research Evaluation*, 20(3), 193-200. https://doi.org/10.3152/095820211x12941371876823

Nason, E., Janta, B., Hastings, G. & Hanney, S. (2008). Health research- making an impact the economic and social benefits of HRB- funded research. Dublin: RAND Corporation. 12. Penfield T, Baker MJ, Scoble R, Wykes MC. Assessment, evaluations, and definitions of research impact: A review. *Res Eval,* 2014, 23(1), 21-32.

Newson, R., King, L., Rychetnik, L., Bauman, A.E., Redman, S., Milat, A.J., Schroeder, J., Cohen, G. & Chapman, S. (2015). A mixed methods study of the factors that influence whether intervention research has policy and practice impacts: perceptions of Australian researchers. *BMJ open,* 5(7), 1-13. http://dx.doi.org/10.1136/bmjopen-2015-008153

Reed, R.L, Kalucy, E.C, Jackson-Bowers, E. & McIntyre, E. (2011). What research impacts do Australian primary health care researchers expect and achieve? *Health Research Policy and Systems*, 9(40), 1-9. https://doi.org/10.1186/1478-4505-9-40

Sainty, M. (2013). Research impact: a United Kingdom Occupational Therapy Research Foundation perspective. *British Journal of Occupational Therapy*, 76(12), 528-537. https://doi.org/10.4276%2F030802213X13861576675204

Scarazzati, S. & Wang, L. (2019). The effect of collaborations on scientific research output: the case of nanoscience in Chinese regions. *Scientometrics*, 121(2), 839-868. https://doi.org/10.1007/s11192-019-03220-x

Swaminathan, M., Phillips-Bute, B.G & Grichnik, K. P. (2007). A bibliometric analysis of global clinical research by anesthesia departments. *Anesth Analg*, 105(6), 1741-1746. https://doi.org/10.1213/01.ane.0000286149. 57763.e7

Bunn, F., Trivedi, D., Alderson, P., Hamilton, L., Martin, A., Pinkney, E. & Iliffe, S. (2015). The impact of Cochrane Reviews: a mixed-methods evaluation of outputs from Cochrane Review Groups supported by the National Institute for Health Research. *Health Technology Assessment* (Winchester, England), 19(28), 1-99. https://doi.org/10.3310/hta19280

Van Eerd, D., Moser, C., & Saunders, R. (2021). A research impact model for work and health. *American Journal of Industrial Medicine*, 64(1), 3-12. https://doi.org/10.1002/ajim.23201.

Wooding, S., Hanney, S.R, Pollitt, A., Grant, J. & Buxton, M.J. (2014). Understanding factors associated with the translation of cardiovascular research: a multinational case study approach. *Implementation Science*, 9(47), 1-12. https://doi.org/10.1186/1748-5908-9-47

World Health Organization. *Health 2020*: A European policy framework and strategy for the 21st century. World Health Organization. Regional Office for Europe; 2013.

Zachariah, R., Guillerm, N., Berger, S., Kumar, A.M., Satyanarayana, S., Bissell, K., Edginton, M., Hinderaker, S.G., Tayler-Smith, K., Van den Bergh, R. & Khogali, M. (2014). Research to policy and practice change: is capacity building in operational research delivering the goods? *Tropical Medicine & International Health*, 19(9), 1068-1075. https://doi.org/10.1111/tmi.12343