Influential journals in health research: a bibliometric study

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Abstract

Background: There is a wide range of intellectual work written about health research, which has been shaped by the evolution of diseases. This study aims to identify the leading journals over the last 25 years (1990–2014) according to a wide range of bibliometric indicators.

Methods: The study develops a bibliometric overview of all the journals that are currently indexed in Web of Science (WoS) database in any of the four categories connected to health research. The work classifies health research in nine subfields: Public Health, Environmental and Occupational Health, Health Management and Economics, Health Promotion and Health Behavior, Epidemiology, Health Policy and Services, Medicine, Health Informatics, Engineering and Technology, and Primary Care.

Results: The results indicate a wide dispersion between categories being the American Journal of Epidemiology, Environmental Health Perspectives, American Journal of Public Health, and Social Science & Medicine, the journals that have received the highest number of citations over the last 25 years. According to other indicators such as the h-index and the citations per paper, some other journals such as the Annual Review of Public Health and Medical Care, obtain better results which show the wide diversity and profiles of outlets available in the scientific community. The results are grouped and studied according to the nine subfields in order to identify the leading journals in each specific sub discipline of health.

Conclusions: The work identifies the leading journals in health research through a bibliometric approach. The analysis shows a deep overview of the results of health journals. It is worth noting that many journals have entered the WoS database during the last years, in many cases to fill some specific niche that has emerged in the literature, although the most popular ones have been in the database for a long time.

Keywords: Health, Bibliometrics, Journals, Web of Science

Abbreviations: GR, Global Ranking; WoS, Web of Science
There are also bibliometric – 42]. This literature has become rele-
47]. Globalization and Health – 31], in public health and preventive medicine – 20]. Bibliometric studies in health ser-
cine in 1967. Healthcare Financial Management and the
International Journal of Health Services appeared in the
Technology Assessment in Health Care, International
Planning and Management, Health Care
and, and the International Journal for Quality
Health Services Research and Policy was published in 1996, and
in the 2000s the Health Services and Outcomes Research
Methodology appeared [3].

For this reason, there is a wide range of intellectual work written about health research and it is time to evaluate its development and main characteristics. Bibliometric analysis can help determine trends and patterns of publications within a research discipline, identifying the focus of research and the national and international strengths and biases [4, 5]. Over the course of the past few decades, several bibliometric analyses have been published regarding diverse topics in the literature of health research, including medicine and international health, where studies have tried to evaluate the contribution of different world regions in research production in infection diseases in terms of both quantity and quality [6], in respiratory research productivity where countries from Western Europe, Canada and Oceania had the best performance after adjustment for population and gross national income per capita [7], in cardiovascular research production where the results showed a promising trend of research productivity for developing world regions with the exception of Africa [8], and also look at the bibliometric profile of tropical medicine and international health [9]. In health informatics studies have included an up-to-date view of the telemedicine and telehealth literature analyzing the changes in content themes [10], assessing the impact of grants in the contribution to scientific knowledge of health information technologies on patient safety and quality of care outcomes [11], quantifying the number of publications on electronic health records and their changes over time [12], and studying the contribution of individual countries to leading journals in medical informatics [13]. Among occupational health, articles have helped to identify the most pertinent journals in the practice of occupational health and to develop search strategies that facilitate finding occupational health intervention studies [14–16]. There are also bibliometric analysis published in health management that investigate the attention and progress of strategic management in the literature [17], in health economics, studies have reported the growth of health economics literature and the change in topics and geographical focus of health economics [18–20]. Bibliometric studies in health service research have looked for trends, gaps and characteristics when comparing among different regions [21, 22], in the same line other studies have assessed the scientific production in health policy [23, 24], in primary health [25, 26], in epidemiology [27, 28], in environmental health [29–31], in public health and preventive medicine [32, 33], in preventive medicine, occupational and environmental medicine, epidemiology, and public health [34], and also public in health research in specific countries or regions [35–42]. This literature has become relevant today perhaps due to the diverse disciplines that are engaged in health research and its importance in order to monitor and disseminate the scientific achievements from the research work.

In this current study we aim to expand the scope of analysis of health research even more, identifying and quantifying the scholarly publications in the field and subfield approaches of public health, environmental and occupational health, health management and economics, health promotion and health behavior, epidemiology, health policy and services, medicine, health informatics, engineering and technology and primary care. Our main goal is to produce an overview of the leading journals in health research literature in the world for a time frame of 25 years from 1990 to 2014. There are many aspects that can indicate the value of a journal; in this study we use the number of citations and their impact factor to reflect the quality of the review process and its popularity in the scientific community. Findings from this research may assist researchers to identify top performance journals in a subject area, learn more about the subfields of health research, and identify emerging areas of research to locate areas of potential study.

Methods
There are different approaches for classifying the bibliographic material. Bibliometrics is one of the most common approaches [43, 44]. In order to represent the results, the analysis uses a wide range of indicators that measure the quality of the publications. Currently, there is no general agreement on the optimal method for measuring research because depending on the perspective considered an indicator may be better than another one. Therefore, the current literature deals with many indicators that have appeared during the last years [45–47].
In this study, the aim is to provide a general picture in order to get a complete overview that can adapt to the interests and perspectives of each specific reader. Thus, several indicators are considered including the total number of publications and citations, the citations per paper, the h-index [48] and the number of papers that a journal has among the most cited ones in a specific field. Note that the most cited papers are found in Web of Science (WoS) by ordering the results of a search from the most cited papers to the less cited [49].

The study uses the WoS database in order to search for the information. WoS is usually regarded as the most influential database for scientific research because it includes those journals that are generally recognized with the highest quality. It was originally created by Eugene Garfield with the name of Institute for Scientific Information (ISI). Later, Thomson & Reuters bought the ISI, renaming it ISI Web of Knowledge and later WoS. Note that other databases are available and could also be used in the analysis including Scopus and Google Scholar. Scientific research is divided in 251 categories in WoS. Four of them involve health research: Public, Environmental & Occupational Health, Health Policy & Services, Health Care Sciences & Services, and Primary Health Care. Note that the first one appears both in the Science Citation Index and in the Social Science Citation Index. These four categories encompass 363 journals. Since these four categories are very broad, the study divides health research in nine categories in order to get a deeper picture of the leading journals in each subfield. However, it is worth noting that sometimes it was not clear where to classify a journal because its scope may include two or three subfields. In any case, the analysis considers a Global Ranking (GR) where all the journals are ranked together. This allows comparison between subfields when needed. The nine categories are:

- Public Health
- Environmental and Occupational Health
- Health Management and Economics
- Health Promotion and Health Behavior
- Epidemiology
- Health Policy and Services
- Medicine
- Health Informatics, Engineering and Technology
- Primary Care

Although the work considers many indicators, the ranking is carried out according to the total number of citations.

### Table 1: Most influential journals in Public Health Research

| R | Journal name                                                                 | TC     | TP     | H      | Year | Volume | IF      | IF5     | T50     | T200 | T200* | GR | First year |
|---|------------------------------------------------------------------------------|--------|--------|--------|------|--------|---------|---------|---------|------|-------|----|------------|
| 1 | American Journal of Public Health                                            | 302196 | 9203   | 198    | 1991 | 81     | 4,229   | 4,997   | 15      | 9    | 1     | 3  | 1911       |
| 2 | Social Science & Medicine                                                    | 281663 | 9656   | 163    | 1990 | 31     | 2,558   | 3,568   | 17      | 14   | 0     | 4  | 1967       |
| 3 | Bulletin of The World Health Organization                                   | 80812  | 2597   | 110    | 1990 | 68     | 5,112   | 6,372   | 8       | 7    | 14    | 22 | 1948       |
| 4 | BMC Public Health                                                            | 60880  | 7434   | 64     | 2001 | 1      | 2,321   | 2,781   | 0       | 0    | 0     | 31 | 2001       |
| 5 | Public Health Nutrition                                                       | 46882  | 2988   | 84     | 1999 | 2      | 2,483   | 2,798   | 1       | 1    | 0     | 41 | 1998       |
| 6 | Drug Safety                                                                  | 46562  | 2005   | 87     | 1990 | 5      | 2,620   | 3,424   | 0       | 0    | 0     | 42 | 1986       |
| 7 | Annual Review of Public Health                                               | 39592  | 595    | 104    | 1991 | 12     | 6,627   | 7,984   | 4       | 1    | 51    | 1980|           |
| 8 | Public Health Reports                                                        | 34617  | 2064   | 67     | 1990 | 105    | 1,644   | 1,791   | 1       | 1    | 2     | 61 | 2001       |
| 9 | Australian and New Zealand Journal of Public Health                          | 22531  | 2219   | 54     | 1996 | 20     | 1,897   | 1,835   | 0       | 0    | 0     | 82 | 1977       |
| 10| Canadian Journal of Public Health-Revue Canadienne de Sante Publique         | 20835  | 2515   | 44     | 1990 | 81     | 1,094   | 1,325   | 1       | 1    | 0     | 88 | 1997       |
| 11| European Journal of Public Health                                            | 20399  | 1851   | 51     | 1997 | 7      | 2,459   | 2,743   | 0       | 0    | 0     | 91 | 1991       |
| 12| Public Health                                                                | 20393  | 2488   | 48     | 1990 | 104    | 1,475   | 1,514   | 0       | 0    | 0     | 92 | 1888       |
| 13| Revista de Saude Publica                                                      | 18366  | 2810   | 41     | 1990 | 24     | 1,219   | 1,587   | 0       | 0    | 0     | 97 | 1967       |
| 14| Scandinavian Journal of Public Health                                        | 17440  | 1568   | 50     | 1999 | 27     | 3,125   | 2,570   | 0       | 0    | 0     | 103| 1973       |
| 15| Journal of American College Health                                           | 15664  | 1011   | 57     | 1994 | 43     | 1,397   | 2,223   | 2       | 1    | 0     | 109| 1978       |
| 16| Journal of Safety Research                                                    | 13917  | 1070   | 47     | 1990 | 21     | 1,303   | 1,940   | 0       | 0    | 0     | 116| 1982       |
| 17| Public Health Nursing                                                         | 11167  | 1373   | 37     | 1990 | 7      | 0,886   | 1,131   | 0       | 0    | 0     | 137| 1984       |
| 18| Maternal and Child Health Journal                                            | 9992   | 1434   | 36     | 2004 | 8      | 2,015   | 2,318   | 0       | 0    | 0     | 143| 1997       |
| 19| Salud Publica de Mexico                                                       | 8805   | 2008   | 30     | 1993 | 35     | 1,034   | 1,221   | 0       | 0    | 0     | 154| 1997       |
| 20| Ethnicity & Disease                                                           | 7952   | 1285   | 32     | 2004 | 14     | 0,921   | 1,233   | 0       | 0    | 0     | 160| 2003       |

**Abbreviations:** TC Total citations, TP Total papers, H Hirsch index, TC/TP Average citations per paper, IF Impact factor, IF5 5-year impact factor, T50 Number of papers among the 50 most cited of the category, T200 and T200* Number of papers among the 200 most cited in all fields of health between 1990–2014 and before 1990, GR Global ranking considering all the journals
citations. The main reason for this is that the citations measure the influence that a journal has in absolute terms. Other alternatives could be considered including the citations per paper and the $h$-index. The main limitation of this indicator is that it does not take into account the number of papers that have generated the number of cites. However, the rest of indicators included in the tables allow the reader to get a comprehensive overview of each journal although the ranking is focused on the number of citations.

The analysis focuses on the last 25 years (1990–2014). The main reason is because this time period is representative of the latest developments of the field. In order to take into account the influence from a classical perspective, the study includes an indicator that shows the number of articles that a journal has among the 200 most cited articles published before 200. This allows the reader to see those journals that were very influential before and see if they are still leading the field or not. Note that the search process carried out in WoS has been developed between March and August 2015. The types of documents considered are: articles, reviews, notes and letters.

### Results

This section presents the main bibliometric results found in WoS for 363 health research journals from 1990 to 2014. The results are ordered by category and each table contains the 20 or 10 most cited journals of each category (see the Additional file 1 for the full list of journals).

#### Public health

Public health refers to the activities to prevent diseases, promote health, and prolong life for the whole population [50]. Therefore, the main objective of public health is assuring conditions for the people in order to be healthy. It is at the core of health research and consequently there are many journals devoted to increase knowledge and raise awareness on this topic. Table 1 shows the most influential journals among this category.

### Table 2 Most influential journals in Environmental and Occupational Health Research

| R | Journal name                                              | TC    | TP    | H     | TC/TP | Year | Volume | IF   | IF5 | T50      | T200 | T200* | GR   | First year |
|---|----------------------------------------------------------|-------|-------|-------|-------|------|--------|------|-----|---------|------|-------|------|------------|
| 1 | Environmental Health Perspectives                        | 311509| 8066  | 192   | 38.62 | 1990 | 89     | 7,029| 7,607| 40       | 22   | 3     | 2    | 1972       |
| 2 | Occupational and Environmental Medicine                  | 71955 | 3211  | 98    | 22.41 | 1994 | 51     | 3,234| 3,466| 0        | 0    | 1     | 26   | 1944       |
| 3 | American Journal of Industrial Medicine                  | 62605 | 3745  | 76    | 16.72 | 1990 | 18     | 1,590| 1,899| 1        | 1    | 1     | 29   | 1980       |
| 4 | Environmental Research                                   | 62104 | 2695  | 91    | 23.04 | 1990 | 53     | 3,951| 4,033| 1        | 0    | 0     | 30   | 1967       |
| 5 | Accident Analysis and Prevention                         | 60584 | 3760  | 83    | 16.11 | 1990 | 22     | 2,571| 3,096| 0        | 0    | 0     | 32   | 1969       |
| 6 | Journal of Occupational and Environmental Medicine       | 57259 | 4235  | 80    | 13.52 | 1990 | 32     | 1,797| 2,09  | 0        | 1    | 1     | 34   | 1959       |
| 7 | Radiation Protection Dosimetry                           | 53396 | 9063  | 55    | 5.89  | 1990 | 30     | 0.861| 0.981| 0        | 0    | 0     | 36   | 1981       |
| 8 | Scandinavian Journal of Work Environment & Health         | 44939 | 1853  | 83    | 24.25 | 1990 | 16     | 3,095| 3,869| 3        | 1    | 0     | 45   | 1975       |
| 9 | International Archives of Occupational and Environmental Health | 37358 | 2381  | 66    | 15.69 | 1990 | 62     | 2,198| 2,199| 1        | 1    | 0     | 56   | 1930       |
| 10 | Aviation Space and Environmental Medicine                 | 34588 | 4265  | 51    | 8.11  | 1990 | 61     | 0.782| 0.998| 0        | 0    | 0     | 62   | 1930       |
| 11 | Annals of Occupational Hygiene                           | 22748 | 1844  | 52    | 12.34 | 1990 | 34     | 2,068| 2,148| 0        | 0    | 0     | 79   | 1958       |
| 12 | Indoor Air                                               | 20871 | 948   | 62    | 22.02 | 1994 | 4      | 4,904| -    | 0        | 0    | 0     | 87   | 1991       |
| 13 | Health & Place                                           | 19584 | 1384  | 58    | 14.15 | 1995 | 1      | 2,435| 3,003| 0        | 0    | 0     | 95   | 1995       |
| 14 | Occupational Medicine-Oxford                             | 19400 | 2080  | 53    | 9.33  | 1992 | 42     | 1,472| 1,682| 1        | 0    | 0     | 96   | 1948       |
| 15 | Journal of Toxicology and Environmental Health-Part A-Current Issues | 17092 | 1670  | 44    | 10.23 | 1998 | 53     | 1,834| 1,868| 0        | 0    | 0     | 104  | 1975       |
| 16 | International Journal of Hygiene and Environmental Health | 15445 | 1080  | 51    | 14.3  | 2000 | 203    | 3,276| 3,331| 0        | 0    | 0     | 110  | 2000       |
| 17 | Toxicology and Industrial Health                         | 15004 | 1429  | 49    | 10.5  | 1990 | 6      | 1,710| 1,591| 3        | 0    | 0     | 115  | 1985       |
| 18 | Journal of Environmental Science and Health Part B-pesticides Food Contaminants and Agricultural Wastes | 13210 | 1901  | 34    | 6.95  | 1990 | 25     | 1,234| 1,129| 0        | 0    | 0     | 122  | 1976       |
| 19 | Environmental Geochemistry and Health                    | 12095 | 1093  | 42    | 11.07 | 1990 | 12     | 2,573| 2,534| 0        | 0    | 0     | 128  | 1979       |
| 20 | Industrial Health                                        | 10652 | 1444  | 35    | 7.38  | 1990 | 28     | 1,045| 1,132| 0        | 0    | 0     | 140  | 1963       |

**Abbreviations:** TC Total citations, TP Total papers, $H$ Hirsch index, TC/TP Average citations per paper, IF Impact factor, IF5 5-year impact factor, T50 Number of papers among the 50 most cited of the category, T200 and T200* Number of papers among the 200 most cited in all fields of health between 1990–2014 and before 1990, GR Global ranking considering all the journals.
The journal that has received more citations and the higher h-index in this field is the American Journal of Public Health with 302,196 citations and an h-index of 198; followed by Social Science & Medicine with 281,663 citations and an h-index of 163. These two journals dominate the number of citations in the field with more than 50% of all the cites. Despite these elevated numbers, the highest average citation rate per paper, impact factor, and 5-year impact factor is for the Annual Review of Public Health.

Analyzing the T50 and T200 ranking results, Social Science & Medicine is in the top positions with 17 papers or 34% of the papers in the T50 ranking of the category, followed by the American Journal of Public Health with 30% of the papers in the T50. The same journals have 9 and 14 papers respectively in the T200 ranking. Note that all the journals of the category have an h-index bigger than 20, reflecting its influence and productivity.

Environmental and occupational health

Environmental health studies the impact of our surroundings in health, while occupational health studies all aspects of health and safety in the workplace. This category includes journals regarding the understanding of the impact and control of environmental and occupational hazards on human health and society. Table 2 presents the results for this category.

The journal Environmental Health Perspectives has the highest results in all the measures, with 311,509 citations that are far from any other journal in the category, an h-index of 192, and an impact factor of 7.029. It has also 80% of the papers in the T50 ranking, and 22 papers in the T200 ranking of the most cited papers in all fields of health.

Health management and economics

This category includes journals related to the economics and management of health and healthcare (see Table 3). Medical Care is the journal positioned number one in this category according to the number of citations, h-index, average citations per paper, and 5-year impact factor. It has 62% of the papers among the 50 most cited in the category, and 16 out of the 200 most cited in all fields of health. However, the highest impact factor in the category is for Pharmacoconomics, positioned fourth according to the total number of citations.
Health promotion and health behavior

Health promotion and health behavior refers to the role of behavioral and social influences to address current and emerging public health problems. Table 4 shows the most influential journals in this category.

As we can see in Table 4, there are two journals leading the citation ranking: the American Journal of Preventive Medicine and Preventive Medicine with 115,942 and 111,066 citations respectively. Also these two journals have an $h$-index over 100. The Tobacco Control Journal has the highest impact factor of 5150; however, the American Journal of Preventive Medicine has the highest 5-year impact factor. Additionally, the American Journal of Preventive Medicine has 13 studies in the T50 ranking and five in the T200.

Epidemiology

Epidemiology is a basic science of public health. It studies the distributions and determinants of health problems in different groups of people. Epidemiological information is used to plan and evaluate strategies to control or prevent diseases. Table 5 presents the main journals in this category.

The American Journal of Epidemiology is in the first place of this category, and also among all the categories according to the global ranking (GR). It has also the highest $h$-index of all categories, reflecting his influence and impact. It is followed by the Cancer Epidemiology Biomarkers & Prevention and the Journal of Clinical Epidemiology that occupy positions 5 and 7 in the GR. The highest impact factor and 5-year impact factor is for the Epidemiology journal with values of 6178 and 6894 respectively. Regarding the T50 ranking, the Journal of Clinical Epidemiology has 46 % of the most cited papers in this category and the American Journal of Epidemiology has 22 %. In the T200 ranking, this category has 39 out of the 200 most cited journals in all the fields, eight are from the American Journal of Epidemiology and 16 of the Journal of Clinical Epidemiology.

Health policy and services

This category includes journals from multidisciplinary fields of scientific investigation that study among others the rising demand for health services, how to improve their quality and efficiency, and rigorous policy analysis that ultimately impact our health and well-being (see Table 6).

### Table 4 Most influential journals in Health Promotion and Health Behavior

| R | Journal name                                           | TC  | TP  | H   | TC/TP | Year | Volume | IF   | IF5  | T50 | T200 | T200* | GR First year |
|---|-------------------------------------------------------|-----|-----|-----|-------|------|--------|------|------|-----|------|------|---------------|
| 1 | American Journal of Preventive Medicine               | 115942 | 3947 | 133 | 29,37 | 1990 | 6      | 4,281 | 5,092 | 13  | 5    | 5    | 12  | 1985          |
| 2 | Preventive Medicine                                   | 111066 | 4186 | 122 | 26,53 | 1990 | 19     | 2,932 | 3,917 | 4   | 3    | 3    | 14  | 1972          |
| 3 | Journal of Adolescent Health                          | 78449  | 3676 | 96  | 21,34 | 1990 | 11     | 2,748 | 3,753 | 2   | 0    | 0    | 23  | 1980          |
| 4 | Patient Education and Counseling                      | 59813  | 3611 | 83  | 15,34 | 1990 | 15     | 2,598 | 3,158 | 2   | 0    | 0    | 33  | 1978          |
| 5 | Medical Education                                     | 50964  | 3253 | 79  | 15,67 | 1990 | 24     | 3,617 | 3,963 | 0   | 0    | 0    | 37  | 1966          |
| 6 | Journal of Health and Social Behavior                 | 45820  | 728  | 107 | 62,94 | 1990 | 31     | 2,951 | 4,457 | 8   | 4    | 4    | 44  | 1960          |
| 7 | Supportive Care in Cancer                             | 39781  | 3384 | 62  | 11,76 | 1993 | 1      | 2,845 | 2,986 | 0   | 0    | 0    | 50  | 1993          |
| 8 | AIDS Care-Psychological and Socio-Medical Aspects of AIDS/HIV | 39017  | 2795 | 66  | 13,96 | 1992 | 4      | 2,194 | 2,454 | 1   | 1    | 1    | 53  | 1989          |
| 9 | American Journal of Community Psychology              | 33534  | 1259 | 84  | 26,64 | 1990 | 18     | 1,968 | 2,888 | 1   | 0    | 0    | 63  | 1973          |
| 10| Tobacco Control                                       | 32078  | 1641 | 74  | 19,55 | 1998 | 7      | 5,150 | 4,532 | 1   | 0    | 0    | 66  | 1992          |
| 11| Health Education Research                             | 31136  | 1594 | 73  | 19,53 | 1991 | 6      | 1,944 | 2,508 | 0   | 0    | 0    | 67  | 1986          |
| 12| Qualitative Health Research                           | 28115  | 1864 | 58  | 15,08 | 1995 | 5      | 1,441 | 1     | 1   | 1    | 0    | 70  | 1991          |
| 13| Psychology & Health                                   | 24761  | 1407 | 57  | 17,6  | 1992 | 7      | 2,255 | 2,107 | 5   | 1    | 1    | 74  | 1987          |
| 14| Medical Teacher                                       | 24402  | 3370 | 52  | 7,24  | 1990 | 12     | 2,045 | 2,170 | 1   | 1    | 1    | 75  | 1997          |
| 15| Sociology of Health & Illness                         | 23121  | 1134 | 65  | 20,39 | 1990 | 12     | 2,014 | 2,62  | 0   | 0    | 0    | 77  | 1999          |
| 16| AIDS and Behavior                                     | 22636  | 1863 | 55  | 12,15 | 2003 | 7      | 3,312 | 3,977 | 0   | 0    | 0    | 81  | 1997          |
| 17| American Journal of Health Promotion                  | 21372  | 1072 | 63  | 19,94 | 1995 | 9      | 1,762 | 2,389 | 2   | 2    | 2    | 83  | 1986          |
| 18| AIDS Education and Prevention                         | 20901  | 1123 | 57  | 18,61 | 1992 | 4      | 1,505 | 2,298 | 0   | 0    | 0    | 86  | 1989          |
| 19| Journal of School Health                              | 20436  | 1887 | 56  | 10,83 | 1990 | 60     | 1,659 | 2,132 | 0   | 0    | 0    | 90  | 1930          |
| 20| AIDS Patient Care and STDs                            | 20210  | 1622 | 49  | 12,46 | 1996 | 10     | 3,576 | 3,255 | 0   | 0    | 0    | 93  | 1987          |

**Abbreviations:** TC Total citations, TP Total papers, H Hirsch index, TC/TP Average citations per paper, IF Impact factor, IF5 5-year impact factor, T50 Number of papers among the 50 most cited of the category, T200 and T200* Number of papers among the 200 most cited in all fields of health between 1990–2014 and before 1990, GR Global ranking considering all the journals
Even though Health Affairs is the most cited journal, the Milbank Quarterly has the highest TC/TP ratio, impact factor, and 5-year impact factor, being the most influential in the category. It is also worthiest to notice that Quality of Life Research has 15 out of the 50 most influential papers in the category, followed by Health Affairs with 11 and Milbank Quarterly with eight. Quality of Life Research and Milbank Quarterly have three papers each in the T200 ranking.

Medical discipline

**Medicine**

Medicine is one of the world’s oldest categories in the arena of health research, allowing scientists and physicians to communicate their advances. The results of this category are displayed in Table 7.

American Journal of Tropical Medicine and Hygiene is the most influential according to its total number of citations of 178,865. However, the h-index is the same for the American Journal of Tropical Medicine and Hygiene and the Journal of General Internal Medicine, but the TC/TP ratio and impact factor is higher for the latter. The highest impact factor and 5-year impact factor is for the Implementation Science journal. In the T50 ranking, Academic Medicine appears with 12 papers, the American Journal of Tropical Medicine and Hygiene with 9, and the Journal of General Internal Medicine has 14 in this ranking and three in the T200 ranking.

**Health informatics, engineering and technology**

This category involves the research and integration of resources, devices, and methodologies to optimize the use of information to provide a better healthcare. The Top ten journals in this category are shown in Table 8.

The Journal of the American Medical Informatics Association is the most influential in this category with the highest number of citations, h-index, TC/TP ranking, impact factor, 5-year impact factor. Additionally, it has 52 % of the papers among the 50 most cited of the category, but none in the T200. Health Physics and Health Technology Assessment have one paper each in the T200 ranking.

**Primary care**

Primary care is all the regular health services and social services that are available for the population, and its research is at the cornerstone for building a strong healthcare system. Table 9 presents the Top ten journals in this category.
The most cited journal is the British Journal of General Practice, followed by the American Family Physician, the Journal of Family Practice, and Family Practice. The highest $h$-index is for the Journal of Family Practice. While these four papers are the most cited, Annals of Family Medicine is the journal with the highest impact factor, and 5-year impact factor. Among the 50 most cited papers in this category, the Journal of Family Practice has 34% of them, followed by Annals of Family Medicine with 18%, the British Journal of General Practice with 16%, and Family Practice with 12%. There are two journals in the T200 ranking with one paper each, which are the Journal of Family Practice and Family Medicine.

**Comparison between fields**

Finally, let us provide a general picture of the publication and citation structure of each health category. Table 10 presents the results.

Epidemiology is the most influential category over the last 25 years with the highest number of citations, citations per paper, $h$-index and the largest number of articles among the 200 most cited before and after 1990. Public Health also obtains very remarkable results being the category with the largest number of articles. However, the category with the highest number of journals is Health Promotion and Health Behavior.

**Discussion and conclusions**

This study showed some remarkable viewpoints about health journals currently indexed in WoS database between 1990 and 2014. This analysis shows the results obtained by health journals under a wide range of bibliometric indicators. This is very useful to see the general results from a broader perspective than the Journal Citation Reports of WoS. Particularly, this is very useful for PhD students and newcomers in the field in order to get a general orientation of the leading journals in health research.

The results provide a general picture of the current position of the leading journals in this field for the nine categories analyzed, which can be rank in terms of total papers as follows: (1) Public Health, (2) Health Promotion and Health Behavior, (3) Medicine, (4) Environmental and Occupational Health, (5) Epidemiology, (6) Health Policy and Services, (7) Health Management and Economics, (8) Health Informatics, Engineering and Technology, and (9) Primary Care. The results indicate...
### Table 7: Most influential journals in Medicine

| R | Journal name                                      | TC   | TP   | H    | TC/TP | Year | Volume | IF   | IF5  | T50 | T200 | T200* | GR  | First year |
|---|--------------------------------------------------|------|------|------|-------|------|--------|------|-----|-----|------|-------|-----|------------|
| 1 | American Journal of Tropical Medicine and Hygiene | 17886| 7809 | 120  | 22,9  | 1990 | 42     | 2,736| 2,947| 1   | 1    | 6     | 1921 |
| 2 | Journal of General Internal Medicine             | 11431| 4688 | 120  | 24,39 | 1990 | 5      | 3,423| 3,744| 14  | 3    | 13    | 1986 |
| 3 | Academic Medicine                                | 92662| 7000 | 98   | 13,24 | 1990 | 65     | 3,468| 3,654| 12  | 1    | 17    | 1926 |
| 4 | Transactions of the Royal Society of Tropical Medicine and Hygiene | 84422| 4933 | 83   | 17,11 | 1990 | 84     | 1,931| 2,453| 1   | 0    | 0     | 20   |
| 5 | Psychiatric Services                             | 74932| 4731 | 91   | 15,84 | 1995 | 46     | 1,987| 2,807| 6   | 0    | 0     | 24   |
| 6 | Journal of Pain and Symptom Management           | 71194| 3586 | 95   | 19,85 | 1991 | 6      | 2,737| 3,240| 2   | 0    | 0     | 27   |
| 7 | Tropical Medicine & International Health         | 56435| 3196 | 74   | 17,66 | 1996 | 1      | 2,302| 2,953| 0   | 0    | 0     | 9    |
| 8 | Nicotine & Tobacco Research                      | 28496| 1975 | 61   | 14,43 | 2003 | 5      | 2,805| 3,125| 2   | 0    | 0     | 69   |
| 9 | Palliative Medicine                              | 25715| 1711 | 63   | 15,03 | 1995 | 9      | 2,845| 3,565| 6   | 0    | 0     | 71   |
| 10| Journal of Womens Health                         | 20943| 1932 | 49   | 10,84 | 1997 | 6      | 1,896| 1,989| 1   | 0    | 0     | 85   |
| 11| Journal of Manipulative and Physiological Therapeutics | 18004| 2429 | 45   | 7,45  | 1990 | 13     | 1,248| 1,471| 1   | 1    | 1     | 101  |
| 12| Annals of Human Biology                          | 15402| 1414 | 44   | 10,89 | 1990 | 17     | 1,148| 1,515| 0   | 0    | 0     | 111  |
| 13| Journal of Evaluation in Clinical Practice       | 13335| 1785 | 44   | 7,47  | 1999 | 5      | 1,580| 1,534| 0   | 0    | 0     | 118  |
| 14| Vector-Borne and Zoonotic Diseases               | 13124| 1248 | 41   | 10,52 | 2003 | 3      | 2,531| 2,635| 0   | 0    | 0     | 124  |
| 15| Journal of Public Health Dentistry               | 11983| 1012 | 46   | 11,84 | 1990 | 50     | 1,644| 1,653| 0   | 0    | 0     | 130  |
| 16| Journal of Palliative Medicine                   | 11142| 1586 | 39   | 7,03  | 2005 | 8      | 2,063| 2,466| 0   | 0    | 0     | 138  |
| 17| European Journal of Cancer Care                | 9674 | 1056 | 40   | 9,16  | 1999 | 8      | 1,762| 1,813| 0   | 0    | 0     | 147  |
| 18| Journal of Medical Screening                    | 9179 | 675  | 41   | 13,6  | 1998 | 5      | 2,722| 2,234| 0   | 0    | 0     | 150  |
| 19| Implementation Science                          | 8777 | 883  | 39   | 9,94  | 2006 | 1      | 3,470| 4,098| 1   | 0    | 0     | 155  |
| 20| Medical Anthropology Quarterly                  | 8041 | 608  | 40   | 13,23 | 2000 | 7      | 0,607| 1,117| 0   | 0    | 0     | 159  |

**Abbreviations:** TC Total citations, TP Total papers, H Hirsch index, TC/TP Average citations per paper, IF Impact factor, IF5 5-year impact factor, T50 Number of papers among the 50 most cited of the category, T200 and T200* Number of papers among the 200 most cited in all fields of health between 1990–2014 and before 1990, GR Global ranking considering all the journals

### Table 8: Most influential journals in Health Informatics, Engineering and Technology

| R | Journal name                                      | TC   | TP   | H    | TC/TP | Year | Volume | IF   | IF5  | T50 | T200 | T200* | GR  | First year |
|---|--------------------------------------------------|------|------|------|-------|------|--------|------|-----|-----|------|-------|-----|------------|
| 1 | Journal of the American Medical Informatics Association | 47258| 3139 | 94   | 15,06 | 2000 | 7      | 3,932| 4,182| 26  | 0    | 0     | 40   |
| 2 | Health Physics                                   | 39417| 4799 | 62   | 8,21  | 1990 | 58     | 0,774| 1,105| 4   | 1    | 1     | 52   |
| 3 | International Journal of Medical informatics     | 22736| 1696 | 55   | 13,41 | 1997 | 44     | 2,716| -    | 5   | 0    | 0     | 80   |
| 4 | Methods of information in Medicine               | 17886| 1704 | 47   | 10,5  | 1990 | 24     | 1,083| 1,448| 3   | 0    | 0     | 102  |
| 5 | Journal of Telemedicine and Telecare             | 16334| 1980 | 45   | 8,25  | 1998 | 4      | 1,736| 1,661| 0   | 0    | 0     | 106  |
| 6 | Journal of Medical Internet Research             | 15683| 1271 | 53   | 12,34 | 1999 | 1      | 4,669| 5,724| 4   | 0    | 0     | 108  |
| 7 | International Journal of Technology Assessment in Health Care | 15141| 1346 | 45   | 11,25 | 1995 | 11     | 1,556| 1,565| 3   | 0    | 0     | 112  |
| 8 | Health Technology Assessment                     | 13181| 650  | 56   | 20,28 | 2004 | 8      | 5,116| 5,404| 5   | 1    | 0     | 123  |
| 9 | Journal of Medical Systems                       | 5709 | 1188 | 26   | 4,81  | 1992 | 16     | 1,372| 1,482| 0   | 0    | 0     | 186  |
| 10| International Journal of Health Geographics      | 4350 | 485  | 28   | 8,97  | 2007 | 6      | 1,967| 2,675| 0   | 0    | 0     | 202  |

**Abbreviations:** TC Total citations, TP Total papers, H Hirsch index, TC/TP Average citations per paper, IF Impact factor, IF5 5-year impact factor, T50 Number of papers among the 50 most cited of the category, T200 and T200* Number of papers among the 200 most cited in all fields of health between 1990–2014 and before 1990, GR Global ranking considering all the journals
that Epidemiology is the most influential category although Public Health is the largest one. Focusing on journals, the American Journal of Epidemiology, Environmental Health Perspectives, American Journal of Public Health, and Social Science & Medicine, have the highest number of citations which shows the largest influence in absolute terms. However, some other journals achieve better results when looking to other indicators. For example, according to the citations per paper ratio, the leading journals are Epidemiologic Reviews, Annual Review of Public Health, and Journal of Health and Social Behavior. This indicates that the journals considered in the study have different profiles with a wide variety of objectives. Almost all the leading journals are published in English although some journals may also publish in some other popular European languages including German, Spanish, French and Italian. Note that many journals have entered the WoS database during the last years although the most popular ones have been in the database for a long time.

In conclusion, by bibliometric methodology, the findings and suggestions of this study can help scientific researchers understand the performance and trends of health research globally. With the help of these findings researchers can make informed decisions of their research directions, in terms of identifying top journals of the discipline, and choose exchange platforms for their research. This study also helps to learn more about the subfields of health research, and identify emerging areas of research today such as public health, health promotion and health behavior and epidemiology, and also how most areas of health research have started to decline in number of citations from 2006.

From a general perspective, health research is a very broad area that includes a wide range of topics. This article classifies the material according to some of the most significant topics. However, it is worth noting that more specific topics could also be considered because each journal considers specific topics that do not depend on the topics followed by other journals. Moreover, the

| Table 9 Most influential journals in Primary Care |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| R | Journal name | TC | TP | H | TC/TP | Year | Volume | IF | IFS | T50 | T200 | T200* | GR | First year |
| 1 | British Journal of General Practice | 47635 | 5770 | 74 | 8,26 | 1990 | 40 | 2,356 | 2,516 | 8 | 0 | 0 | 39 | 1953 |
| 2 | American Family Physician | 43288 | 5726 | 62 | 7,56 | 1990 | 41 | 1,818 | 2,056 | 4 | 0 | 0 | 47 | 1970 |
| 3 | Journal of Family Practice | 37511 | 3371 | 78 | 11,13 | 1990 | 30 | 0,735 | 0,729 | 17 | 1 | 1 | 55 | 1974 |
| 4 | Family Practice | 35533 | 2322 | 66 | 15,3 | 1990 | 7 | 1,842 | 2,071 | 6 | 0 | 0 | 58 | 1984 |
| 5 | Annals of Family Medicine | 16159 | 666 | 59 | 24,26 | 2004 | 2 | 4,570 | 5,250 | 9 | 0 | 0 | 107 | 2003 |
| 6 | Canadian Family Physician | 13319 | 5046 | 35 | 2,64 | 1990 | 36 | 1,403 | 1,646 | 0 | 0 | 0 | 120 | 1955 |
| 7 | Family Medicine | 10804 | 1546 | 38 | 6,99 | 2000 | 32 | 0,851 | 1,284 | 3 | 1 | 1 | 139 | 1981 |
| 8 | Scandinavian Journal of Primary Health Care | 9132 | 866 | 35 | 10,55 | 1995 | 13 | 1,610 | 1,889 | 0 | 0 | 0 | 152 | 1983 |
| 9 | Journal of the American Board of Family Medicine | 7230 | 898 | 32 | 8,05 | 2006 | 19 | 1,848 | 2,064 | 2 | 0 | 0 | 168 | 1988 |
| 10 | Primary Care | 6856 | 1244 | 28 | 5,51 | 1990 | 17 | 0,833 | 1,084 | 1 | 0 | 0 | 174 | 1974 |

Abbreviations: TC Total citations, TP Total papers, H Hirsch index, TC/TP Average citations per paper, IF Impact factor, IFS 5-year impact factor, T50 Number of papers among the 50 most cited of the category, T200 and T200* Number of papers among the 200 most cited in all fields of health between 1990–2014 and before 1990, GR Global ranking considering all the journals

| Table 10 Global results for each category |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Category name | NJ | H | TC | TP | TC/TP | T200 | T200* |
| Public Health | 61 | 261 | 1,237,899 | 83,365 | 14,85 | 38 | 28 |
| Environmental and Occupational Health | 47 | 215 | 1,091,045 | 73,649 | 14,81 | 25 | 6 |
| Health Management and Economics | 29 | 188 | 474,540 | 28,547 | 16,62 | 22 | 13 |
| Health Promotion and Health Behaviour | 73 | 218 | 1,156,553 | 78,542 | 14,73 | 21 | 19 |
| Epidemiology | 25 | 325 | 1,806,202 | 66,097 | 27,33 | 39 | 69 |
| Health Policy and Services | 40 | 172 | 484,055 | 37,911 | 12,77 | 8 | 8 |
| Medicine | 51 | 184 | 951,188 | 69,198 | 13,75 | 6 | 6 |
| Health Informatics, Engineering and Technology | 18 | 123 | 214,135 | 21,205 | 10,10 | 2 | 1 |
| Primary Health Care | 18 | 113 | 250,486 | 34,269 | 7,31 | 2 | 2 |

Note that the columns of the T200 and the T200* do not sum up to 200 because some of the most cited papers were published in journals that currently are not indexed in WoS for several reasons

Abbreviations: NJ Number of journals
study assigns each journal to one category but sometimes the journal could also be considered in another category. For solving this issue, the last column of each table (GR) considers the global ranking that each journal obtains when merging all the journals in the same list and ordering according to the number of citations. This allows comparison between journals from different categories. But note that each category or group of journals may have a different profile with a different volume of publications and citations. Therefore, it is not easy to compare journals with different topics and categories. Finally, recall that WoS has several limitations when classifying bibliographic material that should also be considered in this article [49]. Additionally, many other issues may affect research in this field including open access and electronic journals. Note that only those included in WoS are considered in the analysis.

Acknowledgments
Not applicable for this manuscript.

Funding
The authors have no support or funding to report.

Availability of data and materials
All data generated or analyzed during this study are included in this published article and its supplementary information file "Additional file 1".

Authors' contribution
The contribution of the author was as followed: JM developed the original research idea and questions, conducted data analysis, interpreted the results, and wrote the manuscript. AN contributed to the original research idea and questions, conducted data analysis, interpreted the results, and contributed to the writing and revisions of the manuscript. Both authors read and approved the final manuscript.

Authors' information
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Consent for publication
Not applicable.

Ethics approval and consent to participate
Not applicable.

Received: 17 December 2015 Accepted: 8 August 2016
Published online: 22 August 2016

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