The bibliographic impact of epidemiological studies: what can be learnt from citations?

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The bibliographic impact of epidemiological studies : what can be learnt from citations ?

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The impact of an epidemiologic study on occupational risk factors has two main dimensions. The first one is public health and social impact, including consequences on working conditions. Investigators and participants of a study expect that the results will have a public health impact, at least in the long term, with improvement of working conditions, better surveillance, better management of health disorders, and in some cases social consequences such as changes in the list of compensated work-related diseases. The second dimension is the bibliographic or bibliometric impact of the articles which present the results of the study. Researchers cannot ignore this dimension, quantified with indices such as the Impact Factor (IF) or the number of citations [1-3].

At first glance, there is a large gap between these two different approaches of the “impact” of a study, public health versus bibliographic. The usefulness of publications presenting the results of the study in scientific journals is not very straightforward if “impact” is considered first as the impact in the working environment, or among occupational physicians, or for the patients[4]. However, public health and societal impact also involves research-related activities such as publication of literature reviews, since one single study in one country is not sufficient for decisions such as regulatory decisions [5].

Little is known about the bibliographic impact of studies, despite of the fact that it is relatively easy to document. Our objective was to illustrate, from an example, possible links from field research to dissemination of scientific results, and first to verify that results of epidemiologic studies were taken into account in reviews. These reviews could lead to recommendations or guidelines, and could in a next step be used in practice, for prevention at the workplace, or management of work-related diseases.

Methods

Two sets of articles were considered, a set of four on Low back Pain (LBP), and a set of five on Upper Limb Disorders (ULD). The three inclusion criterias were : presentation of original results from studies performed in our laboratory, dealing (exclusively or not) with occupational risk factors, and with an etiologic approach. In order to analyse citations over at least a five year period, only articles which could be retrieved in the Web of Science and published before 2005 were considered.

For LBP, the four articles, issued from three different studies, presented results on LBP in general, or sciatica. For ULD, five articles presenting results from the same study were considered. The articles, presented in appendix and in table 1, differed according to the outcome, incidence or prevalence of a specific disorder. Outcomes were self-assessed (for LBP, sciatica, and shoulder disorders) or defined using a standardised clinical examination, performed by the occupational physicians

Citations of the nine articles, until 1st of July 2009, were retrieved through the Web of Science and Google Scholar [2,6]. They were analysed separately for the two subsets, LBP and ULD.

Citations in the Web of Science, which allowed to retrieve precise and comparable information, were described according to the type of journal and the type of paper. Five categories of journals were considered : occupational medicine (“occupation”, “work”, or a similar term in the title, and a focus on health or medicine); ergonomics (“ergonomics”, or a similar term, in the title); generalist or clinical journal (general medical journal, or reference to a medicine specialty in the title); epidemiology and public health (presence of one of those terms, or “Social” and “Medicine”, in the title, or similar in a language other than English); other. Articles classified as “reviews” are those based on a systematic search with a description of the selection method. Reviews dealing with interventions, rather than with factors associated with disorders or their consequences, were not taken into account here in the list of reviews. The country of origin was assessed according to the country of the first author (more precisely: country where the work had been performed).

The delay between publication and citation was also considered. Since it was calculated as the difference between year of citation and year of publication, some of the citations “in the five years” are in fact in the six years.

For both subgroups of articles, and only for reviews dealing with etiology or risk indicators, we looked at how the content of our articles was used. For other citations, which most often presented original results, we considered that the part dealing with comments on our article(s) was too limited for an analysis of the content.

Results

The number of citations per article, after exclusion of self-citations, ranged from 6 to 64 in the Web of Science and from 5 to 60 in Google Scholar.
In general, citations present in the Web of Science were also retrieved by Google Scholar, except for the most recent ones. Among the 22 citations in the Web of Science in 2009, only ten were also given by Google Scholar. On the other hand, Google Scholar gave additional citations: those in journals not taken into account in the Web of Science; books, dissertation theses and reports, and also citations from websites. Generally speaking, Google Scholar retrieved more citations in languages other than English, and documents seldom cited themselves. Duplicates could also occur. For only one paper (Reference 1 in Appendix) more citations were retrieved by the Web of Science than by Google Scholar, with 19 citations in the Web of Science not retrieved by Google Scholar. The “missing” references included citations in specialised journals (such as « vehicle design » or « Journal of sound and vibration ») but also reviews[7-8]. For one paper (reference 8 in Appendix), there was a large discrepancy in the opposite direction, with 28 references in the Web of Science compared to 52 in Google Scholar; a noticeable part of the additional citations in Google Scholar came from South America (14 from Brasil, 3 from Chili, one from Columbia).

For LBP articles the total number of citations in the Web of Science was 127, and 113 after exclusion of 14 self-citations. It was further reduced to 109 after exclusion of 4 duplicates (citations which appeared twice or more because several of the four articles were cited). The delay between publication and first citation ranged from 0 to 3 years, and the number of citations in the first five years from 4 to 14.
Fourteen citations were reviews, dealing with various topics [7-20]. Four of them focused on lifestyle and personal factors, beyond occupational factors : LBP and body weight [8], cigarette smoking [9-10], gender and clinical pain experience in general [11]. Three were about physical load, and manual material handling [7,12-13], one about psychosocial work factors [14]. Effects of exposure to car driving and whole body vibration, for low back or health in general, was the subject of three reviews [15-17], and one additional review was about sitting [18]. Finally, one review dealt with risk factors for LBP in general [19], and one with prediction of sickness absence [20].

For Upper limb disorders the number of citations in the Web of Science was 111, after exclusion of 25 self-citations. It was reduced to 96 after exclusion of 15 duplicates. The median delay from publication to first citation was 2 years. The number of citations in the first five years ranged from 8 to 28. There were no duplicates with the citations of the LBP articles.

Among the 96 citations, most of them presented results from a single study. Seven were formal reviews dealing with ULD in general [21] or risk factors associated with ULD : occupational factors[22], psychosocial work factors [23-24], etiology of Carpal Tunnel Syndrome (CTS) [25], work-related factors of CTS [26, 27] , work-related factors of elbow disorders [28], gender differences in ULD [29]. Three were also less formal syntheses or general presentations, mainly for a target audience of researchers or practitioners belonging to fields other than occupational health[30-32]. For one of them[30], partly based on reviews by the National Institute for Occupational Safety and Health (NIOSH) and the National Research Council (NRC), the manuscript was in free access.

Among the 109 citations of the LBP articles, 43 were in occupational medicine journals, 13 in ergonomics journals, nine in epidemiology and public health journals. Thirty-six were in clinical journals. Eight were citations in other types of journal, including biology and experimental studies (more precisely, on sex differences in chronic pain in mices).

For ULD articles, there were relatively less citations in occupational medicine journals and more in clinical journals. Only 27 of the 96 citations were in the field of occupational medicine. Ten were in ergonomics journals. A large proportion of citations (42 /96) came from generalist journals and clinical journals in the fields of rheumatology, physical therapy, neurology, hand surgery and care. There was one citation for 21 journals, two citations for nine journals, three citations for one journal. Nine citations were in epidemiology or public health journals. The remaining journals dealt with various topics, such as environmental research, obesity, midwifery and women's health, applied mathematics and computation. It must be noted that citations in clinical journals could also deal with experimental design and laboratory animals. This was the case with a study on Carpal Tunnel Syndrome in rats, published in Journal of Orthopaedic and Sports physical therapy.

Among the 109 citations of the LBP papers, the US came first with 18 citations (16.5%), followed by the Netherlands and the United Kingdom (14 citations each), and Canada (12 citations); Denmark, Finland, France and Germany provided 6 to 8 citations. There were three citations from Italy, three from Japan, three from Norway, and one or two from 12 other countries.

Among the 96 citations of the ULD papers, there was also a large variety in the country of the first author, with a majority from the US (34 authors, 35.4%), followed by the Netherlands (9 authors), the United Kindom, France, Brasil and Finland (6 or 7 each), Canada (5), Italy (4), Australia (3) and nine other countries with one or two first authors.

In the citations classified as reviews, we examined how the content of our article(s) had been used. In all of them our results were correctly interpreted. This was the case even if the general conclusion of the review was different from the main message in our article, which was the case for a few of them [13, 25]. On some topics, especially on the role of occupational factors, conclusions could differ according to the review.

Discussion

Both the Web of Science and Google Scholar provide interesting information on the bibliographic impact of articles. Google Scholar is generally considered as less accurate and reliable[6]. One can wonder why some citations, especially reviews, are missing from Google Scholar. Another reason for preferring the Web of Science is that additional analyses are easier to achieve, since the data are presented in an homogeneous way, with enough information for retrieving the papers[2]. However, Google Scholar gives specific information, for example on the impact in various countries through citations in national scientific journals, which are less often referenced in the Web of Science.

Among the citations, only a small proportion, especially for Upper limb disorders, was reviews considering results from several similar studies in the field of occupational health. Others could be viewed as dissemination of results from occupational health to research and practice in other clinical fields. The impact in other fields of clinical research of these epidemiologic results, published in occupational health journals, was not expected, especially since the data collection was rather far from a clinical context. One can wonder whether the same would be observed for other studies on a similar topic, or dealing with other work-related diseases. The fact that some results are slightly different for the two sets of articles suggests that the conclusions might differ according to the topic. In other fields such as occupational cancer, the links from publications to reviews, and from reviews to policies, are probably more direct, including classification of substances as carcinogens, leading to norms for exposure at the workplace.

In the process of dissemination of scientific results from field studies, we thought that reviews, which provide a synthesis on a given question, reflected scientific consensus. However, a lack of consistency between the conclusions of the reviews can be observed in some cases, especially on the role of occupational factors for LBP and ULD.

The approach here was based on articles describing original results, with a specific interest in citations in litterature reviews. It would be interesting too to consider a "top-down" approach starting from reviews, guidelines, or recommendations, and checking citations of these articles. However, analysing citations for this purpose would require other methods, since the number of citations is expected to be much larger, especially in Google Scholar.

One of our results, which might be rather general for epidemiologic studies, is that the bibliographic impact is a slow process, with few citations in the two years following publication, whereas the impact factor of journals are based on citations in the first two years[3]. This is important also for those who have collected the data : they cannot rely much on scientific production for an impact in the short term.

Disseminating results in clinical journals is not an answer to the main expectations of field professionals who took time and energy to collect data in a working environment. The results show that the impact of a study must be seen not only as bringing scientific answers and helping changes in a specific field and for a given country, but as having an impact in the larger scientific community, in terms of countries and scientific fields. This includes potential impact among clinicians, with a better understanding of the role of working conditions in the etiology of LBP and ULD.

Assessing also the public health impact of scientific results in the workplace is a wide-ranging question, probably difficult to answer, and relies on promotion of scientific results not only from the researchers, but also from field actors and decision makers.

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What this paper adds

There is a limited work on impact of studies in general, and little is known about the bibliographic impact of studies, despite of the fact that it is relatively easy to document. Our objective was to illustrate, from an example, possible links from field research to dissemination of scientific results.

This description of the bibliographic impact of two sets of original articles suggests that published results dealing with occupational health disseminate into various research fields, beyond occupational health, ergonomics, and public health.

Analysing citations is relatively easy, and can bring interesting information. Citations could be more widely used for adressing the bibliographic impact of studies.

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Appendix, articles in the analysis

Low back pain

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Upper Limb disorders

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Table 1 The articles and the citations

Date of publication, reference number (cf Appendix)	Journal	Outcome (specific topic)		Number of citations (self-citations excluded)		Year of the first citation (Web of Science)	Number of citations in the first five (or six) years
				Web of Science	**Google Scholar**		
February 1992 (1)	SJWEH	LBP (1)	LBP (association with driving)	64	60	1994	13
March 2000 (2)	J Epid Comm Health	LBP	LBP (risk factors according to various definitions)	26	35	2000	14
May 2002 (3)	JOEM	LBP	Sick leave for LBP	17	21	2003	9
September 2003 (4)	Occup Med	LBP	Sciatica	6	5	2006	4
March 1998 (5)	OEM	ULD (2)	Carpal Tunnel Syndrome (CTS)	27	34	2000	11
August 2001 (6)	SJWEH	ULD	CTS, wrist tendinitis, lateral epicondylitis	35	41	2003	14
September 2003 (7)	JOEM	ULD	Medial epicondylitis	13	12	2004	11
January 2004 (8)	OEM	ULD	Shoulder disorders	28	52	2004	28
June 2004 (9)	SJWEH	ULD	Ulnar nerve entrapment	8	13	2006	8

(1) Low Back Pain (2) Upper Limb Disorder