

Bibliometric Analysis of Research on Mental Health in the Workplace in Canada, 1991-2002



Éric Archambault
Science-Métrieux, Montréal

Grégoire Côté
Science-Métrieux, Montréal

Yves Gingras
CIRST-OST, Université du Québec à Montréal



ABSTRACT

This paper uses the Medline biomedical papers database to measure scientific production on mental health in the workplace (MHWP) during the 1991-2002 period at the world, Canadian, provincial, urban, institutional and researcher levels. The level of scientific output has doubled at the world level and tripled at the Canadian level during the last 12 years. At the provincial level, Ontario, Quebec, British Columbia and Alberta are leading in absolute number of papers. Ontario largely dominates both in terms of output and on a per capita basis. At the level of cities, Toronto and Montreal are the largest producers of papers on MHWP. The most important institutions in terms of papers on MHWP are McMaster University, Université de Montréal, the University of Toronto, the University of British Columbia and the University of Western Ontario. The universities with the largest number of active researchers in MHWP are McMaster University, Université Laval and York University.

Introduction

This paper uses scientometric methods and the Medline database to examine the scientific production of Canadian researchers in the field of mental health in the workplace (MHWP). After a description of the method, we present the results at various levels of aggregation: in section, Canada's output is compared to that of the world. This shows that Canada has a slightly greater percentage of its papers in the area of mental health in the workplace than the world average. The second section examines the scientific output of the Canadian provinces. Not surprisingly, Ontario is a clear leader and Quebec is second, followed by British Columbia and Alberta. Although those provinces lead in absolute terms, Nova Scotia and Manitoba are important in relative terms (papers per capita and specialization index). The third section looks at mental health in the workplace research at the urban and institutional levels, and the last section examines who the most active researchers are in the field.

Methods

Working in collaboration with experts appointed by the Institute of Neurosciences, Mental Health and Addiction (INMHA) and the Institute of Population and Public Health (IPPH) of the Canadian Institutes for Health Research (CIHR),¹ we constructed a controlled vocabulary that precisely defined the field of research on mental health in the workplace. This was validated by looking at the percentage of papers from specialist journals that were selected with these keywords. With these keywords, we computed statistics from the Medline database, which is produced by the US National Library of Medicine.

This database has been conditioned with a view to producing statistics on scientific publications in the biomedical and clinical medicine sector. The construction of the dataset for the scientometric analysis is essentially based on the use of Medical Subject Headings (MeSH) terms. These constitute a controlled vocabulary used for indexing papers in Medline. This paper uses the intersection of MeSH terms that represent the field of mental health (e.g., "stress, psychological") and of MeSH terms associated with the workplace (e.g., "occupational diseases") to identify the papers that have a Canadian as first author.

One caveat associated with the use of this database is that only the first author's address is compiled for each paper. This means that the number of Canadian papers obtained here are minimum figures since they do not consider the effect of co-authorship. In addition, because Medline concentrates on biomedical research and clinical medicine, it is possible that some papers from the social sciences and the humanities are missing. However, the overall comparative and relative statistics should not be affected. Furthermore, the purpose of this study being the mapping of the distribution of Canadian expertise rather than the identification of every researcher, this limitation is not a serious handicap, though one should not use the absolute numbers without this limitation in mind.

The data collected were used to produce detailed statistics on the basis of the following indicators:

Number of papers – Number of scientific papers written by authors located in a given geographical, geopolitical or organizational entity (e.g., country, city or institution).

¹We would like to thank Alain Lesage, Jean-Yves Savoie, Renée Bourbonnais, Carolyn Dewa, Gaston Harnois, Marina Morrow, Michele Parent and Phil Upshall for their comments and suggestions; and Heather Stuart and Aldred Neufeldt for their continued input during this project.

Number of papers per capita – This is a relative measure that accounts for the size of the geographic entities being considered.

Index of specialization – This is an indicator of the intensity of research in a given geographic or organizational entity relative to the overall output for a given reference. For example, if the percentage of Ontario’s papers (the geographic entity) in the field of mental health and work-place is greater than the percentage of papers in this field at the Canadian level (the reference), then Ontario is said to be specializing in this field, since its index of specialization is greater than one.

For the purpose of the paper, relevant indicators have been calculated for data aggregated by province, by city, by most active institution and by leading researcher.

Results

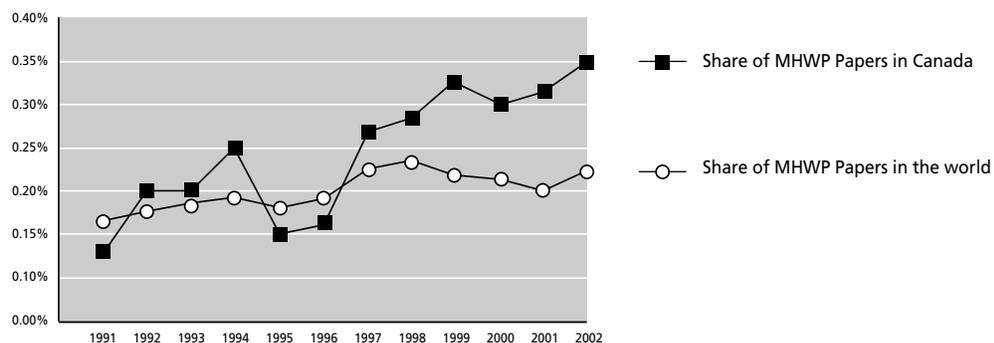
1. Canadian Output at the World Level

Figure 1 reveals that the percentage of papers on MHWP grows faster in Canada than at the world level. In fact, the proportion of papers on MHWP is nearly 50% greater in Canada than at the world level – more than 0.3% in Canada and above 0.2% at the world level. Although the

proportion of Canadian papers on MHWP dropped markedly in 1995 and 1996, there is a clear tendency for more Canadian papers in the biomedical sector to be written in MHWP. In fact, the proportion of papers written in this field grew in eight of the twelve years studied. One must note that the yearly variations observed here are not exceptional for a small scientific field, and the field will no doubt show more stability if growth continues.

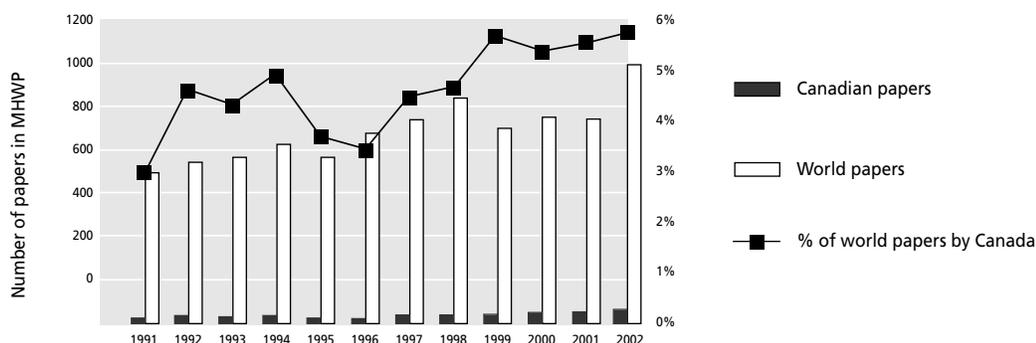
Figure 2 shows that between 1991 and 2002, papers in MHWP increased by 75% in absolute terms at the world level, that is, from 535 papers in 1990 to 940 papers in 2002. In Canada, growth was even greater, with production more than trebling from 14 papers in 1991 to 52 in 2002. The share of the total MHWP papers written by Canada more than doubled, from 2.6% in 1991 to 5.5% in 2002. On average, Canada was responsible for 4.4% of papers on MHWP, and it wrote 3.7% of papers in the biomedical field indexed in Medline. This means that Canada specializes in MHWP (specialization index of 1.2). By comparison, Canada produces about 4% of the world scientific literature in natural and engineering sciences. Although total output is small in absolute terms, the

Figure 1. Share of Papers on MHWP in Canada and In the World Per Year, 1991-2002



Source: Compiled by Science-Matrix from the Medline database.

Figure 2. Papers on MHWP in Canada and in the World per Year, 1991-2002



Source: Compiled by Science-Metrix from the Medline database.

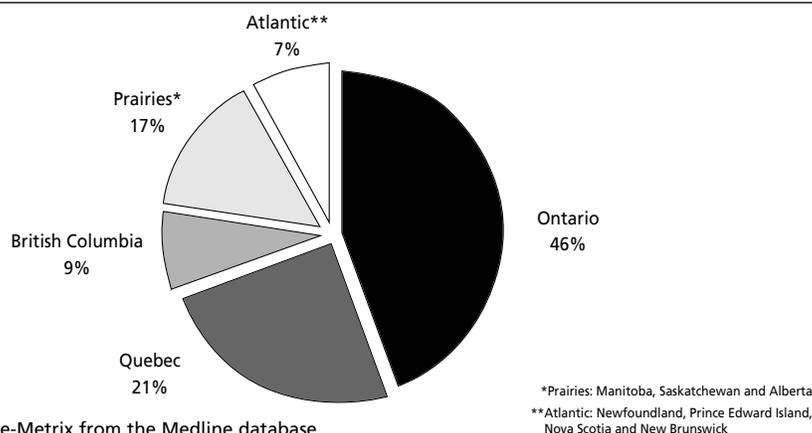
Canadian contribution to MHWP reflects the general scientific contribution of Canada at the world level. Considered in relation to the economic costs of mental illness in the workplace, the field is clearly rising rapidly at the international level and is growing faster still in Canada, which was catching up from this low 2.6% in 1991.

2. Scientific Output at the Provincial Level

In Canada, Ontario has a clear lead over the other provinces in the field of MHWP. The proportion of Ontario's

output is more than double that of its closest competitor, Quebec (46% of Canadian papers are written in Ontario, compared to 21% in Quebec). British Columbia and Alberta are on a par at 9% of the Canadian output. Manitoba and Saskatchewan together account for 8% of the papers, whereas the Atlantic provinces account for 7%. This distribution is similar to that in all scientific disciplines. For instance, Ontario published 45% of the papers covered in Thomson ISI's *Science Citation Index* (SCI) in 2000, Quebec 24% and British Columbia 14%.

Figure 3. Canadian Provinces' Share of Scientific Production in MHWP, 1991-2002



Source: Compiled by Science-Metrix from the Medline database.

Table 1: Number of Papers in MHWP Research by Canadian Province, 1991-2002

Province	1991-1993	1994-1996	1997-1999	2000-2002	TOTAL
Ontario	25	31	55	65	177
Quebec	14	13	27	25	80
British Columbia	4	6	11	15	36
Alberta	9	4	6	15	34
Nova Scotia	3	3	7	7	20
Manitoba	4	8	8	3	19
Saskatchewan	1	3	2	4	10
New Brunswick		1		1	2
Newfoundland	1			1	2
Prince Edward Island			1		1
Canada TOTAL	62	69	113	137	381

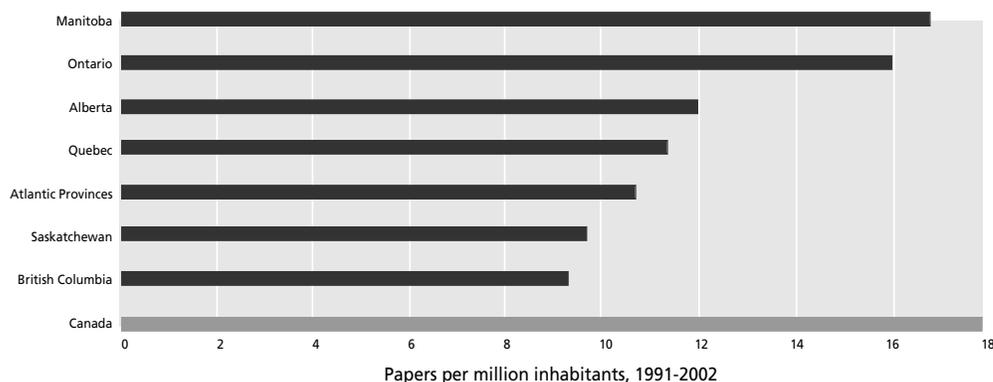
Source: Compiled by Science-Metrix from the Medline database.

Table 1 reveals that output in MHWP is rising steadily in Ontario and British Columbia. Quebec, Alberta and the smaller provinces are experiencing more erratic patterns. However, the number of papers is quite small at the provincial level, and one should be careful in the interpretation of these statistics.

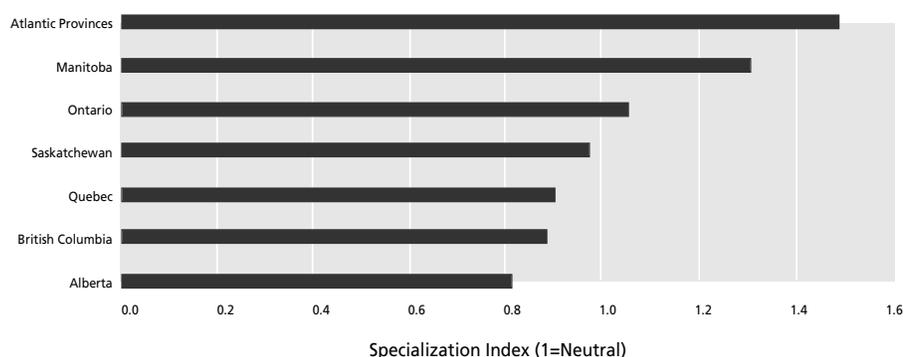
Figure 4 shows that Manitoba, although not a large producer overall, is the leader in number of papers per capita. It also confirms the leadership position of Ontario and shows that Alberta is also an important producer of scientific output in

MHWP research, considering its size. On the other hand, British Columbia is below the Canadian average output per capita. Nova Scotia, which appears as part of the Atlantic Provinces, also scores highly in number of papers per capita.

Figure 5 shows that, although the Atlantic provinces' overall output is low, it is nonetheless more important than that observed generally in biomedical science – in other words, this region seems to specialize in MHWP. However, it is clear from Table 1 that Nova Scotia is essentially responsible for this interest in MHWP.

Figure 4. Papers per Million Inhabitants per Province, 1991-2002

Source: Compiled by Science-Metrix from the Medline database.

Figure 5. Specialization Index of Canadian Provinces, 1991-2002

Source: Compiled by Science-Metrix from the Medline database.

Manitoba comes second, thus confirming that in relative terms it is one of the leaders in Canada in MHWP. Ontario also specializes in this field but to a lesser extent, thus adding to the fact that Ontario is the clear leader in MHWP in Canada in both absolute terms and in relative terms (i.e., papers per capita and index of specialization). Whereas Saskatchewan nearly follows the Canadian average, Quebec, British Columbia and Alberta tend to produce fewer papers in MHWP than one could expect.

It is important to note that since research on MHWP appears to be nascent in Canada, these readings might be subject to change in the near future, not only in terms of papers per capita but also in terms of specialization index.

3. Scientific Output at the Urban and Institutional Levels

Table 2 shows that, at the urban level, Toronto is the clear leader overall in the field of MHWP. One can also see here that its output is rising steadily. Montreal occupies the second rank, while Vancouver comes third. London and Hamilton complete this ranking of Canadian cities, with at least two papers per year on average. Winnipeg, Edmonton, Quebec City,

Ottawa and Halifax all have at least one paper on MHWP per year on average. Halifax is the only city from the Atlantic region that is in the ranks of Canadian cities, having published at least six papers during the 1991-2002 period. This shows that Halifax is the only MHWP research hub in the Atlantic region.

There is no institution in Canada that really stands out as a very large producer of papers on MHWP (see Table 3). In fact, the leader, McMaster University, has only two papers per year on average in the field. Other leaders include the Université de Montréal, the University of Toronto, the University of British Columbia and the University of Western Ontario – all with at least 1.5 papers per year on average. The University of Manitoba, which dominates the field in that province, managed to publish an average of only one paper a year on MHWP.

4. Scientific Output at the Researcher Level

Not surprisingly, McMaster University is confirmed as the leading centre on MHWP research in Canada, for in addition to having the greatest number of papers per institution, it has the largest number of

Table 2: Most Productive Canadian Cities in MHWP Research, 1991-2002*

City	1991-1993	1994-1996	1997-1999	2000-2002	TOTAL
Toronto	11	16	19	33	79
Montreal	11	8	18	18	55
Vancouver	4	4	10	12	30
London	4	3	11	10	28
Hamilton	3	5	9	9	26
Winnipeg	4	8	4	3	19
Edmonton	7	2	3	7	19
Quebec	1	5	7	6	19
Ottawa	3	1	5	7	16
Halifax	3	2	2	6	13
Calgary	1	1	1	7	10
Kingston	2	1	3	3	9
Saskatoon	1	1	2	2	6
Wolfville		1	4	1	6

* Cities that produced a minimum of six papers over the period (1991-2002)

Source: Compiled by Science-Metrix from the Medline database.

authors on the list of most active researchers in the field (seven authors).² The Centre for Addiction and Mental Health (CAMH) and Université Laval, which ranked sixth and seventh among the most active institutions in MHWP, both rank second in number of most active researchers (with

four researchers each). The Institute for Work and Health and Université du Québec à Montréal have three top-ranking researchers each, while Acadia University, Université de Montréal, the University of Toronto and York University have two researchers each.

Table 3: Most Productive Canadian Institutions in MHWP Research, 1991-2002*

Institution	1991-1993	1994-1996	1997-1999	2000-2002	TOTAL
McMaster University	2	4	9	9	24
Université de Montréal	2	6	3	10	21
University of British Columbia	3	6	2	10	21
University of Western Ontario	2	3	7	7	19
Centre for Addiction and Mental Health	6	2	5	4	17
Université Laval		5	7	4	16
University of Alberta	6	1	3	5	15
York University	2	3	2	7	14
University of Manitoba	2	6	1	3	12
UQAM	3	1	6	2	12
McGill University	5		2	2	9
Dalhousie University	3	1	1	3	8
Queen's University	1	1	3	3	8
University of Calgary	1	1	1	5	8
Acadia University		1	4	1	6
Institute for Work & Health			1	5	6
University Health Network			3	3	6

* Institutions that produced a minimum of six papers over the period (1991-2002)

Source: Compiled by Science-Metrix from the Medline database.

² We defined the most productive researchers as those with at least three papers in the field of MHWP in our database, that is, among papers for which the first author is a Canadian. These data were validated manually to detect erroneous homonymic counts and to determine the authors' affiliations. For example, Smith, J. could actually be two authors – Jennifer Smith or John Smith. Of course, it would be an error to impute 10 papers to a J. Smith if Jennifer had written six papers and John, four. The validation involves checking papers one by one to ascertain that counts by author are due to a single researcher rather than names with the same initial.

Although the majority of the most active researchers are located in universities, there are also researchers from the CAMH (as seen above), from the Centre hospitalier affilié universitaire de Québec (CHA Québec), from the Douglas Hospital in Montreal, from Health Canada and from the Institute for Work and Health – thus, about a quarter of leading researchers are located outside a university (though these centres may of course be affiliated to a university).

Conclusion

The study of mental health in the workplace (MHWP) is a relatively new scientific field. Although the economic importance of MHWP is well established, only about one-fifth of a percent of biomedical papers address this issue in the world literature. Despite this, the field is growing in absolute terms at the world level, that is, from 535 papers indexed in Medline in 1991 to 940 in 2002 – a growth of 75% in 12 years.

Although the overall output is still low, research on MHWP is growing faster in Canada than at the world level – Canadian institutions are playing catch-up. During the last three years, the number of papers by Canada has tripled, and they now account for 5.5% of the world output in the field; this is 57% more than its overall share in biomedical sciences (3.5%) as measured in Medline in 2002. Similarly, Canada produced about 4.4% of the scientific literature in 2000 as measured with the Thomson ISI's SCI database. Canada thus specializes in this field, having a proportion of papers on MHWP that is higher than its share of papers in biomedical science as well as in science generally.

In Canada, Ontario is, overall, the clear leader. It produces 46% of Canadian

output and ranks second in papers per capita and third in terms of the index of specialization in the field.

The cities that are most active in the field are Toronto and Montreal, while Vancouver, London and Hamilton have at least two papers on MHWP per year on average. Not surprisingly, leading institutions in the field – McMaster University, Université de Montréal, the University of Toronto, the University of British Columbia and the University of Western Ontario – are located in these cities.

Three-quarters of the top 20 researchers in the field are from universities. McMaster and Laval provide the largest number of leaders (four researchers each), while York hosts two of the leading researchers in the field.

The statistics presented in this paper show that scientific activity in the field is still low. As such, the law of large numbers may not yet apply, and one should expect to see some volatility in the ranking of the leading bodies – be they provinces, cities, institutions or researchers – in the coming years. Nevertheless, this paper gives an indication of research at an early stage in the development of the field, and one can expect changes in the geographical distribution of activities.