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An analysis of trends in publications on 'tobacco control'

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Abstract

Objectives: Publications on tobacco control were quantitatively analysed to gain insight into the essential characteristics of the research field and trends and patterns in publication activities. The goal was to detect changes in the number of publications before and after the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) was introduced.

Study design: A bibliometric analysis was performed to assess the current status and research themes of tobacco control papers listed in the Web of Science database published between 1990 and 2015.

Methods: Quantitative analyses were conducted to investigate publication activities, geographic distribution and individuals' research fields within tobacco control.

Results: The number of publications on tobacco control was over 81 times higher in 2015 than in 1990. At least 50% of the papers were published by authors in high-income countries. In addition, in the first 5 years after the WHO FCTC was introduced, publications on tobacco control increased considerably and the first publications from authors from Malaysia and Uruguay appeared. Researchers from the Americas Region of WHO contributed to the field much more frequently than those from the other five WHO regions.

Conclusion: Findings from this study suggest that researchers' interest from most countries increased after the WHO FCTC was introduced. However, research outputs from low- and middle-income countries remained comparatively low. Promoting more interest in tobacco control among researchers in these countries may help control the future prevalence of smoking.

Keywords

Bibliometric analysis, FCTC, Framework Convention on Tobacco Control, tobacco control

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Introduction

Tobacco use is one of the largest public health issues that the world has faced (Smith, 2009; World Health Organization [WHO], 2016), causing nearly 6 million deaths each year (WHO, 2016; Wu et al., 2014), which is more than the number of annual deaths due to HIV, tuberculosis and malaria combined (Lien and DeLand, 2011; Mendez et al., 2013). Using tobacco also increases the risk of multiple conditions, including cancer (Bascombe et al., 2016; Taha and Tee, 2015), myocardial infarction and stroke (Pust et al., 2008). The negative effects of tobacco use on human health lead to billions of dollars in health care costs as well as lost productivity to countries each year (Mamudu et al., 2011; Orme et al., 2001). Although it is a preventable cause of mortality and morbidity (Chen et al., 2015; Nierkens et al., 2005; Pawar et al., 2015; Twyman et al., 2016; White and Baird, 2013), smoking is prevalent in more than 1 billion people worldwide (Daynard, 2009; Feng et al., 2010; Lee and Paek, 2012; Sahoo et al., 2008; Styles et al., 2012; Wipfli et al., 2010).

Considering the harmful consequences of smoking, there is a need to control the use of tobacco to improve public health. The severity of the issue has captured the attention of researchers and the public worldwide. Tobacco control has thus become an important and growing research field that has been studied by numerous researchers in multiple countries. A vast body of literature on tobacco control consisting of thousands of researchers' publications has now been developed.

The main objective of this study was to quantitatively analyse recent trends in the tobacco control research field. Academic publications are considered one of the most important resources for this type of analysis (Durmuşoğlu, 2016). Thus, a bibliometric analysis can be used to quantitatively analyse the scientific and technological literature (Abejon and Garea, 2015; Nicolaisen, 2010). Accordingly, the specific focus of this study lay in exploring the change in number of publications before and after the WHO Framework Convention on Tobacco Control (FCTC) was introduced as this treaty was a milestone for tobacco control activities. The FCTC was developed in response to the globalisation of the tobacco epidemic (WHO FCTC, 2003) and aims to help governments control the prevalence of tobacco use in their societies. For that reason, the effects of the FCTC on the number of publications as a whole and on countries in particular were investigated as was the content of these papers as revealed by bibliometric analysis.

Similar analyses focusing on various aspects of the tobacco research field have been published. For instance, Haines-Saah et al. (2015) conducted a content analysis of the imagery used on health warning labels. They investigated how these images depicted smokers and showed that the imagery used may not be helpful in warning people as intended. In another study, Gao et al. (2012) analysed the newspaper coverage of tobacco control issues in China and found that newspapers in China are devoting increasing attention to tobacco control. However, coverage of the newspapers in China was insufficient when compared to the coverage in the USA and Australia. Several studies have also focused on specific types of tobacco products. In one of these studies, Zyoud et al. (2014a) examined waterpipe smoking and presented trends in publications on waterpipe smoking, while in another, Zyoud et al. (2014b) conducted a bibliometric analysis on publications of electronic cigarettes.

Nykiforuk et al. (2010) searched the literature on smoke-free areas and showed that the patterns in publications were consistent with those of policy activities. In addition, Zyoud et al. (2014c) performed a Scopus-based examination of publications on 'tobacco use' in Middle Eastern Arab countries and detected upward trends in publishing activities. In addition, Warner et al. (2014) and Chapman and Derrick (2012) focused on papers published in the *Tobacco Control* journal. Warner et al. (2014) found a recent substantial increase in the number of publications from low- and middle-income countries. Cohen et al. (2010) also performed a bibliometric analysis of publications on tobacco (10% of the retrieved articles were included) to identify epidemiological and study focus,

and form of tobacco use focused upon. They also examined changes in topics (such as health effects, preclinical topics, prevalence/use and cessation) in tobacco-related research areas over time.

In addition, there have been some country-specific bibliometric analyses of tobacco use and control. For instance, Kira et al. (2011) and Qiu and Chen (2009) focused on the tobacco-related literature in New Zealand and China, respectively, while García-López (1999) and De Granda-Orive et al. (2011) examined publications on smoking prepared by authors with an address in Spain.

However, analyses focusing specifically on tobacco control have been limited. Willemsen and Nagelhout (2016) investigated country-specific differences and the focus of tobacco control research publications in Europe between 2000 and 2012. They searched the PubMed, Web of Science, Scopus and PsycINFO databases to assess the growth in tobacco control publications in 31 different European countries. They found that the number of publications had almost doubled and that Scandinavian countries were more productive than other European countries.

In 2015, Halas et al. completed a 'review of reviews' on tobacco control published between 2003 and 2014. In addition, McGee et al. (2014) examined newspaper coverage of tobacco control in New Zealand, while Asut and Balcı (2014) focused on publications on tobacco control in Turkey. In 2009, Kusma et al. performed a bibliometric analysis on tobacco control using a scientometric approach to examine papers published until 2008.

To our knowledge, a bibliometric analysis of research outputs on 'tobacco control' both worldwide and by country (focusing on the change in number of publications before and after the introduction of the WHO FCTC) has not previously been performed. This paper therefore aims to address this gap. The critical questions addressed by this study were as follows:

- How did the number of publications change from 1990 to 2015 and before and after the FCTC was introduced?
- Which countries have made the greatest contribution to the tobacco control field, and how did countries' contributions change after the FCTC was introduced?
- Which WHO regions contributed most to the tobacco control field during the 25-year period?
- What were the contributions of different research areas (as defined by the Web of Science) to tobacco control research?
- What was the distribution of papers across journals?

Method

Bibliometrics is a specific type of research in which the scientific literature is the object of analysis (Gu et al., 2017). It was initially used in the library and information science fields but has spread to other fields, especially quantitative assessments of academic outputs (Mao et al., 2015). It is an important methodology that uses statistical methods to identify the characteristics of publications according to features such as field, source, topic, author and country (Abejon and Garea, 2015). In this study, research trends in tobacco control were explored by identifying the following: the growth in the number of publications from 1990 to 2015, the most productive countries, WHO regions, journals within this field and frequently studied research areas.

Search strategy

Publications on tobacco control were retrieved from the Thomson Reuters Web of Science database. The Web of Science contains a broad range of bibliographic databases, citations and scientific publication references in technological, sociological, scientific and humanistic knowledge disciplines

(Sanchez et al., 2017). It covers all articles published by approximately 500 publishers and indexed by Science Citation Index (SCI), Social Sciences Citation Index (SSCI) and Science Citation Index Expanded (SCIE) (Durmuşoğlu, 2016). It includes more than 50,000,000 articles and 15,000 journals, which have high quality standards (Hew, 2017; Merigo et al., 2015). The documents included in this study were collected from Web of Science All Databases, which contains several databases such as the Web of Science Core Collection, MEDLINE, the SciELO Citation Index, BIOSIS Previews, the Korean Journal Database and the Derwent Innovations Index.

The following terms were used to search within the topic field of the selected database: 'tobacco control' OR 'tobacco use', 'control' OR 'smoking', 'control' OR 'tobacco use', 'cessation', 'programme' OR 'smoking', 'cessation', 'programme' OR 'tobacco use', 'cessation', 'program' OR 'smoking', 'cessation', 'program' OR 'tobacco use', 'prevention' OR 'smoking', 'prevention' OR 'tobacco use', 'intervention' OR 'smoking', 'intervention'. The term 'programme' and 'program' are frequently used as synonyms, and thus, both terms were searched for in this study. It is important to note that the comma placed between search terms meant that all associated terms had to be used together in the relevant publication. In addition, searching took place in the 'topic' field looking for the term in the titles, abstracts, keywords and keyword plus.

Based on the topic search with the identified terms, 128,491 publications were identified. Papers published before 1990 and after 2015 were excluded from the analysis. Patents were also excluded from the study due to the lack of information on research area and country. A total of 107,585 papers therefore remained in the analysis. Finally, the relevance of the remaining documents on tobacco control was examined by manually reviewing the title and abstract of each paper. Ineligible documents (99,731 of all) were excluded from the study, yielding 7,854 publications for more detailed analysis.

Figure 1 represents the procedure used to retrieve the publications included in this study.

Results

Findings from the bibliometric analysis are presented in the following sub-sections by category.

Number of publications

The number of publications is often used to assess work within a scientific area. Figure 2 shows the number of publications in the tobacco control field by year. In 1990, a total of 8 papers were published on tobacco control, whereas 650 papers on this topic were published in 2015. In the early 1990s, an increasing trend could be observed in the number of publications. However, the trend fluctuated from 1995 to 1998. This increasing trend in the number of papers accelerated after 2000–2001. One of the reasons for this finding may be the establishment of the WHO FCTC, as the draft of this treaty was discussed by an intergovernmental technical working group between October 1999 and March 2000 (WHO, 2009).

Although the number of publications decreased slightly in some years, there was an upward trend in the number of papers published between 1990 and 2015, and by 2015, the number of publications on tobacco control had increased 81.25 times the number in 1990.

Type of publications

The 7,854 documents collected were analysed by document type. The vast majority of the publications (80.53% overall) were scientific articles. There was a considerable difference between the number of articles and other types of documents. Review studies represented the second most

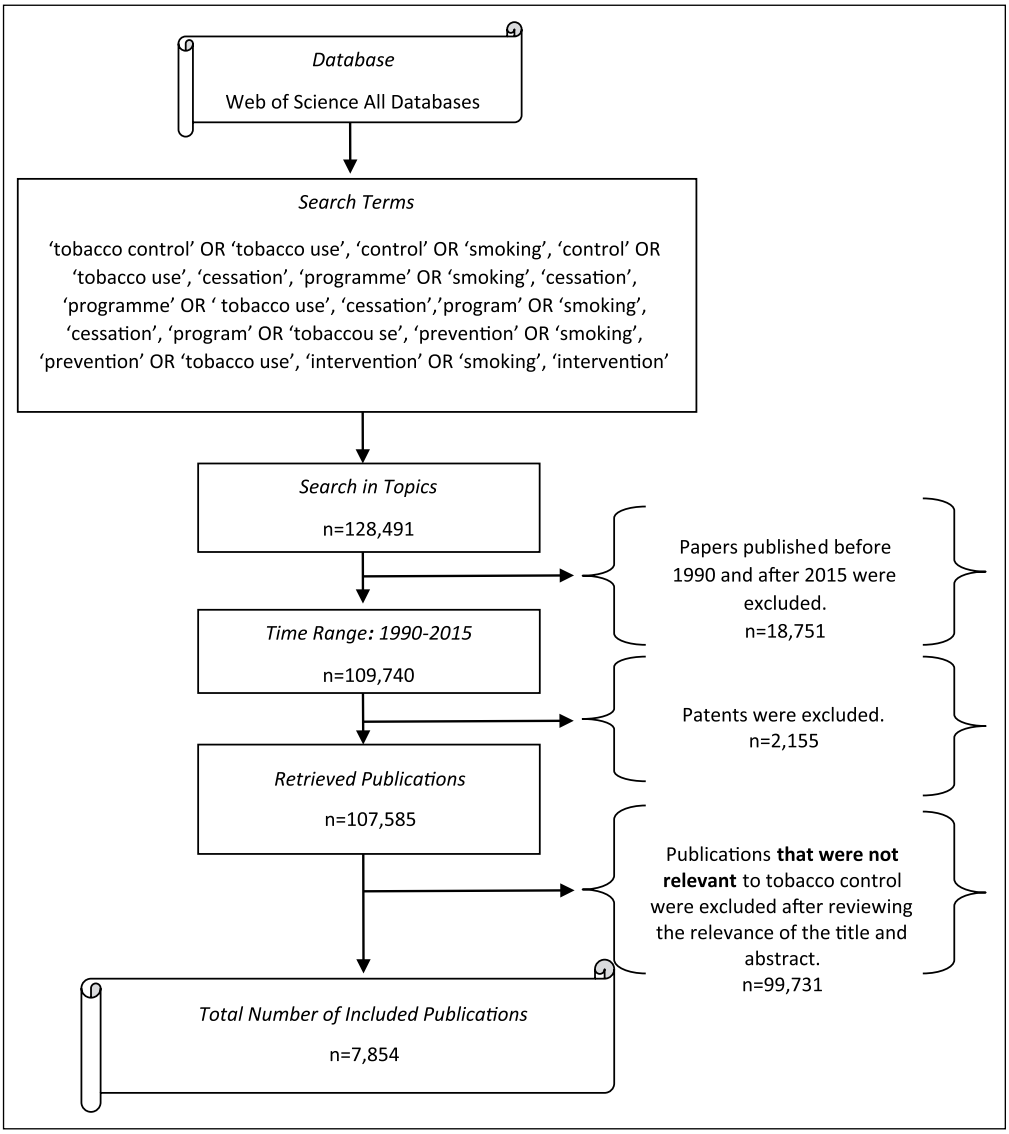

Figure 1. Summary of the data inclusion procedure.

common type after articles, but only accounted for 5.63% of all documents, followed by editorials at 5.23%. The remaining retrieved papers included meeting abstracts, proceedings papers, biographical texts, book reviews, brief reports, corrections and letters.

Authors' country of origin

An analysis of authors' country of origin was performed to determine individual countries' contributions to the tobacco control field. In this analysis, we used the number of publications as a proxy/measure of the scientific efforts of each country.

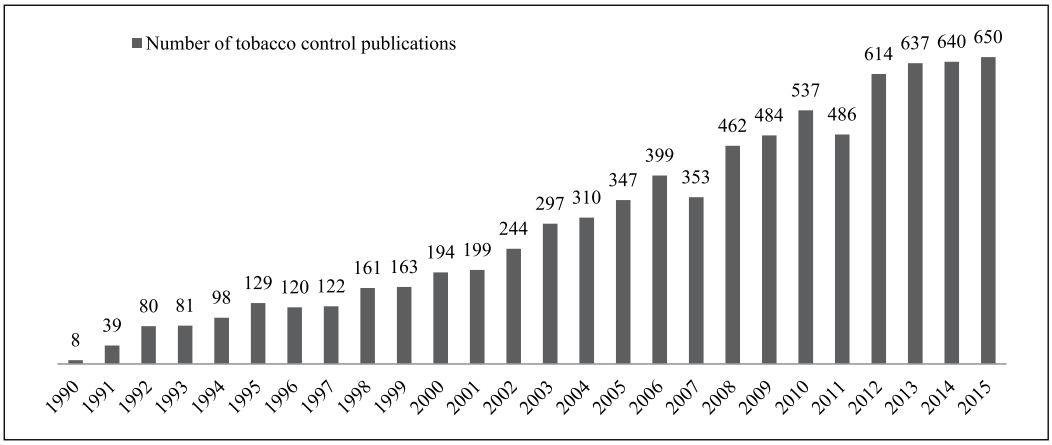

Figure 2. Number of publications on tobacco control and in the tobacco use fields over the study years.

Country information for each paper was based on the institutional affiliations provided in the Web of Science database for the papers. If the authors' country information was not listed, the country information for that paper was recorded as 'unknown'. In addition, if a country was listed more than once on a document, the document was counted only once for that country. Finally, the addresses of all authors were accounted for instead of considering the affiliations of the corresponding author only.

When the countries of each paper were searched, a total of 10,409 affiliations from 121 different countries were collected and analysed. Table 1 presents the countries' ranks according to their contributions to the relevant field. The first column in Table 1 denotes the number of papers for each corresponding country.

Authors originating from the USA contributed to the tobacco control literature the most, with at least one author from the USA included in 4,033 of 7,854 papers (the overall proportion of US-origin papers was 51.35%). Canada was the second most productive country, producing 8.70% of the publications, while the UK and Australia were third and fourth, accounting for 8.62% and 8.24%, respectively. Authors from the first four countries contributed to at least 50% of all documented papers on tobacco control.

Table 1 also details the status of signing the FCTC, signature dates of the countries and number of publications on tobacco control by country for 5-year periods. As depicted in Table 1, after the FCTC had been signed and incorporated into the field, some countries including Malaysia and Uruguay started to generate their first publications in the tobacco control field. Moreover, the number of publications on tobacco control in Taiwan increased 31 times in the first 5 years after the FCTC was introduced compared to the 2000–2004 year period, while the number in Ireland increased 22 times. Although the number of publications in some countries including Austria, Bangladesh and Norway decreased slightly, the number of publications on tobacco control increased considerably after the FCTC for the vast majority of countries. These statistics suggest that the FCTC may have been an influential factor contributing to increased research focus on tobacco control. However, this claim requires further assessment.

Country information was also used to determine collaboration within studies. The largest proportion of publications (73.04%) was prepared by authors originating from the same country, while authors collaborated with authors from other countries in 20.82% of the papers. Country information for the remaining papers (6.14%) was not listed.

Table 1. Most productive countries in tobacco control research.

Countries	Tobacco control records (%)	WHO FCTC sign. status[a]	WHO FCTC sign. year[a]	1990–1994 records	1995–1999 records	2000–2004 records	2005–2009 records	2010–2014 records
USA	51.35	Signed	2004	183	395	686	1,073	1,375
Canada	8.70	Signed	2003	17	55	70	171	298
UK	8.62	Signed	2003	11	39	88	178	295
Australia	8.24	Signed	2003	13	43	77	163	293
People's Republic of China	3.72	Signed	2003	3	15	17	55	149
Germany	3.20	Signed	2003	6	14	35	75	103
The Netherlands	3.11	Signed	2003	10	18	20	54	120
Spain	2.61	Signed	2003	4	10	38	45	86
India	2.34	Signed	2003	4	2	6	36	117
France	2.18	Signed	2003	5	15	32	40	61
Switzerland	2.02	Signed	2004	3	11	35	35	60
Sweden	1.90	Signed	2003	7	20	32	38	41
Italy	1.88	Signed	2003	6	8	24	34	60
Brazil	1.54	Signed	2003	0	2	9	34	61
New Zealand	1.41	Signed	2003	2	8	9	28	53
Japan	1.38	Signed	2004	7	14	14	30	36
Mexico	1.35	Signed	2003	0	2	10	41	45
Republic of Korea	1.08	Signed	2003	0	1	6	19	46
Finland	1.03	Signed	2003	5	6	18	21	25
Taiwan	0.97	No info	–	0	4	1	31	29
Denmark	0.88	Signed	2003	4	2	13	19	25
Norway	0.83	Signed	2003	5	5	14	12	25
Ireland	0.81	Signed	2003	2	1	1	22	34
South Africa	0.81	Signed	2003	5	8	4	16	22

(Continued)

Table 1. (Continued)

Countries	Tobacco control records (%)	WHO FCTC sign. status[a]	WHO FCTC sign. year[a]	1990–1994 records	1995–1999 records	2000–2004 records	2005–2009 records	2010–2014 records
Poland	0.80	Signed	2004	0	3	4	14	32
Turkey	0.80	Signed	2004	0	1	6	23	25
Thailand	0.79	Signed	2003	1	0	7	21	25
Malaysia	0.67	Signed	2003	0	0	0	8	34
Greece	0.66	Signed	2003	2	0	2	16	26
Belgium	0.60	Signed	2004	1	7	6	11	18
Austria	0.46	Signed	2003	1	4	13	6	9
Portugal	0.46	Signed	2004	0	1	5	5	18
Russian Federation	0.43	Accession	2008	3	2	2	10	14
Bangladesh	0.42	Signed	2003	0	3	3	1	23
Argentina	0.41	Signed	2003	1	1	2	5	18
Israel	0.41	Signed	2003	2	4	4	4	12
Lebanon	0.33	Signed	2004	0	0	2	3	14
Iran	0.32	Signed	2003	0	0	1	1	19
Saudi Arabia	0.32	Signed	2004	0	1	0	3	18
Romania	0.31	Signed	2004	0	0	1	7	15
Vietnam	0.29	Signed	2003	0	1	2	2	15
Uruguay	0.28	Signed	2003	0	0	0	5	13
Czech Republic	0.27	Signed	2003	0	1	2	8	9
Nigeria	0.27	Signed	2004	0	1	0	2	12
Pakistan	0.27	Signed	2004	0	0	2	4	12
Others	11.01	–	–	14	47	142	225	363

WHO FCTC: World Health Organization Framework Convention on Tobacco Control.

[a]Status of countries signing the WHO FCTC and dates of the signature were retrieved from the United Nations Treaty Collection (2017).

Table 2. Top 10 most productive journals in which the analysed papers were published.

Source titles	5-Year impact factor[a]	Percentage
Tobacco Control	5.741	9.28
Nicotine & Tobacco Research	3.569	4.16
American Journal of Public Health	5.252	2.83
Preventive Medicine	3.748	2.39
BMC Public Health	2.746	2.16
Addictive Behaviors	3.140	1.97
Addiction	5.489	1.96
American Journal of Preventive Medicine	5.590	1.38
Health Education Research	2.456	1.32
Salud Pública de México	1.184	1.15

[a]Journal impact factors were retrieved from Web of Science.

Performance of the different WHO regions

WHO groups member countries into six regions: Africa, the Americas, Southeast Asia, Europe, the Eastern Mediterranean, and the Western Pacific. The country data of the papers were used to analyse the contributions of each of the six WHO regions to the tobacco control field.

The results indicated that the Americas was the most productive of the six WHO regions; countries in this region produced 64.44% of all papers. The European region produced the next highest proportion, at 35.64%, while authors from the Western Pacific published 17.42%. The remaining papers were produced most often in Southeast Asia, followed by the Eastern Mediterranean and African regions.

Journals

Table 2 provides the top 10 most productive journals and their 5-year impact factors. The largest proportion of tobacco control publications (9.28%) was published in *Tobacco Control*, followed by *Nicotine & Tobacco Research* and the *American Journal of Public Health*, with 4.16% and 2.83% of all papers, respectively. When examining the scope of the top 10 most productive journals, papers on topics such as health, public health, public health policy, addiction and addictive behaviours were accepted for publication. Tobacco control is highly relevant to these topics, which explains why these journals had higher scores than others.

Research areas

The Web of Science divides publication research areas into five main categories: Life Sciences & Biomedicine, Physical Sciences, Technology, Arts & Humanities, and Social Sciences. These main research areas are also divided into sub-areas. For example, 'Life Sciences & Biomedicine' includes agriculture, allergy and anatomy, while 'Social Sciences' includes psychology, education and educational research communication, and public administration.

By using the sub-area provided by Web of Science, each paper's research area was identified and analysed. More than one sub-area can be defined for papers in the database, in which case the first sub-area was considered for the corresponding analysis. Table 3 provides the top 10 most frequently studied sub-research areas for tobacco control.

Table 3. Top 10 most frequently studied research areas for tobacco control.

Research areas	Records on tobacco control	
	Count	Percentage
Public, Environmental & Occupational Health	2,766	35.22
General & Internal Medicine	851	10.84
Substance Abuse	804	10.24
Psychology	472	6.01
Oncology	469	5.97
Health Care Sciences & Services	380	4.84
Education & Educational Research	219	2.79
Respiratory System	177	2.25
Nursing	159	2.02
Cardiovascular System & Cardiology	142	1.81

The analysis showed that the largest proportion of the analysed papers (35.22%) were categorised in Public, Environmental & Occupational Health, followed by General & Internal Medicine, Substance Abuse, and Psychology, at 10.84%, 10.24%, and 6.01%, respectively. These findings showed that the health, psychological, environmental and educational aspects of tobacco control figure strongly in the relevant literature.

Discussion

Overall, a total of 7,854 papers on tobacco control listed in the Web of Science All Databases from 1990 to 2015 were quantitatively analysed. The following conclusions can be drawn from the analysis in this study.

Research outputs on tobacco control have increased over the years. Although there were slight decreases in some years, tobacco control received considerable attention from 1990 through 2015. After 2001, the growth in publications showed an accelerated upward trend. Moreover, country-specific analysis showed a total of 10,409 affiliations from 121 different countries focusing on tobacco control. More than 20% of all retrieved studies were developed as part of an international collaboration. The largest proportion of studies came from authors from the USA, Canada, the UK and Australia, in that order. High-income countries thus contributed most to the growth of the tobacco-relevant literature. In addition, after the FCTC had been introduced, the majority of countries had increased publications on tobacco control, while some countries such as Malaysia and Uruguay produced their first publications on tobacco control. The FCTC, which was the first international public health treaty on tobacco, can be considered as an influential factor on the growth in number of tobacco control publications both worldwide and by country; the draft of this treaty was discussed by intergovernmental technical group in 1999–2000 (WHO, 2009), and the treaty itself became open for signature in 2003 and entered into force in 2005 (WHO FCTC, 2003). The FCTC has been signed by 168 countries, is legally binding in 180 ratifying countries and has been referenced by several decision-making authorities.

The contribution of different WHO regions to the tobacco control literature was also analysed in this study. The Americas was the most productive of the six WHO regions. The European region was second, while Africa was last. Regions with a high performance in this field consisted of the most productive countries such as the USA, Canada, and the UK, which are considered high-income countries by the World Bank.

Considering the results obtained from this study, the contribution of high-income countries to the growth of the tobacco control literature cannot be underestimated. Although the interest of researchers from high-income countries in this field was higher than that of authors from low- and middle-income countries, WHO statistics show that the largest proportion of current smokers live in low- and middle-income countries (WHO, 2016). High rates of tobacco use in these countries may have a greater effect on the public health of the world's population than those of high-income countries. Accordingly, increasing interest in tobacco control among researchers from low- and middle-income countries, as well as in researchers from high-income countries, is needed to help control and reduce the prevalence of tobacco use.

The examined papers addressed research areas mostly associated with health, psychology, environment and education. These papers thus distinguished tobacco control from some other research fields, through the multidisciplinary approach adopted and its focus on psychology, environment and education, among other factors.

Limitations

This study has certain limitations. A primary limitation is that this study was conducted using data collected from the Web of Science All Databases. Although the Web of Science All Databases is a high-quality database that includes databases such as the Web of Science Core Collection, MEDLINE and most journals in JSTOR, it is restricted to 'high-status' journals and publications and is weak on the inclusion of the greyer literatures. Other databases could usefully be searched in future studies.

Publications on tobacco control were quantitatively analysed in this study. Further studies might also consider assessing the quality of publications in this field using qualitative means. In addition, because the search terms in this study consisted of generic tobacco control–related terms, the search terms could be extended for a broader assessment in future research.

Finally, the time range was restricted to the period from 1990 to 2015. This time range could be extended to observe trends in publications over a longer period of time.

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