

Country Differences and Changes in Focus of Scientific Tobacco Control Publications between 2000 and 2012 in Europe

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Country Differences and Changes in Focus of Scientific Tobacco Control Publications between 2000 and 2012 in Europe

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Key Words

Bibliometrics · Scientific publications · Tobacco control

Abstract

Background/Aims: The Framework Convention on Tobacco Control (FCTC) stresses the importance of scientific research. We examined the differences between 31 European countries regarding quantity and focus of tobacco control research publications. **Methods:** PubMed, Web of Science, Scopus, and PsycInfo were searched for peer-reviewed articles on tobacco, written by European authors, published between 2000 and 2012. For 2000, 2004, 2008, and 2012 we further identified the main focus of the publication. **Results:** The volume of European tobacco control scientific publications had almost doubled. Scandinavian countries had most publications per inhabitant, while Bulgaria, Cyprus, Estonia, Latvia, Lithuania, Malta, Romania, Slovakia, and Slovenia had relatively little research output. There was a smaller increase in publications about harm from tobacco, relative to publications about treatment, and education, and to publications about environmental interventions. In 2012, 49% of all publications were about health, while the total number of publications on environmental interventions was relatively small (10%). **Conclusion:** Research output had almost doubled, in line with global trends, but is still unevenly distributed across

Europe. Although we observed a shift in European publications away from the harm of tobacco towards protecting smokers and changing the environment, the field is still dominated by publications on smoking and health.

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Introduction

Tobacco use is worldwide one of the main preventable causes of illness and morbidity. In line with the magnitude of the tobacco pandemic, many countries have implemented tobacco control measures. Achievements in tobacco control benefits from scientific research into the causes and consequences of the tobacco epidemic, and from research supporting the evidence for tobacco control interventions. The World Health Organisation (WHO) recognises the importance of scientific research and describes its Framework Convention on Tobacco Control (FCTC) as ‘an evidence-based treaty’ [1, 2]. In article 20 of the FCTC, Parties to the Treaty are requested to ‘develop and promote national research programmes at the regional and international levels in the field of tobacco control’. Having sufficient tobacco control research capacity has been recognized as an important determinant of building strong evidence-based tobacco control

policy [3]. Experts further believe that research has a significant impact on tobacco control policy adoption, especially in the field of clean indoor air laws, taxation, and smoking cessation treatment [4].

Ten years ago, it was noted that a few European countries have formal coordinated tobacco research strategies, or dedicated budgets [5] and research spending on tobacco control was low and extremely fragmented [6]. It is unclear to what extent this situation has improved. An indication of overall research productivity is the number of peer-reviewed publications [7]. To date, only one study has looked at the number of tobacco publications in Europe. Bramness et al. [8] compared the number of publications in the field of addiction, including tobacco control, between 10 European countries and the United States (US), covering the period 2001–2011 and concluded that tobacco research in the 10 European countries was lagging behind that in the United States in absolute terms. While Bramness et al. collected data from 10 countries, we sought to identify changes in tobacco control research productivity in all European countries. This was the first aim of our study.

The second aim of our study was to look at changes in the specific focus of the tobacco control research in Europe. The adoption of the WHO's FCTC in 2005 has probably drawn the attention of policy makers and researchers towards policy interventions, which are important elements of FCTC, such as awareness campaigns, smoke-free policies, restrictions on tobacco promotion, smoking cessation treatment, and tobacco taxes. One would expect less attention to research on the association between smoking and health, since this has already been firmly established. Cohen et al. [9] examined changes in worldwide research focus from the 1980s to the 2000s, and indeed noticed a relative reduction in the number of articles focussing on health consequences of smoking. However, they did not report data specific for Europe and no data after the ratification of FCTC.

The current study set out to examine trends in research output, indicated by the number of scientific publications in 31 European countries between 2000 and 2012, and changes in research focus over time. It was expected that the volume of research publications would have increased overall, but that there would be large differences between European countries. We further expected an increase in publications focussing on FCTC population-wide interventions to the expense of publications examining the association between smoking and health.

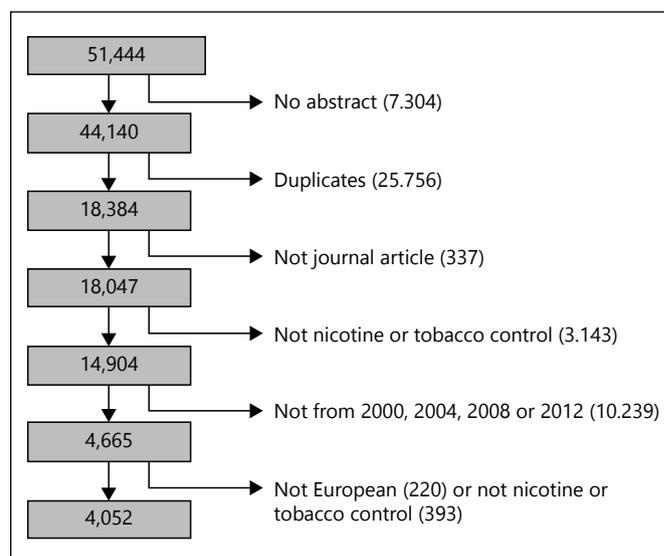
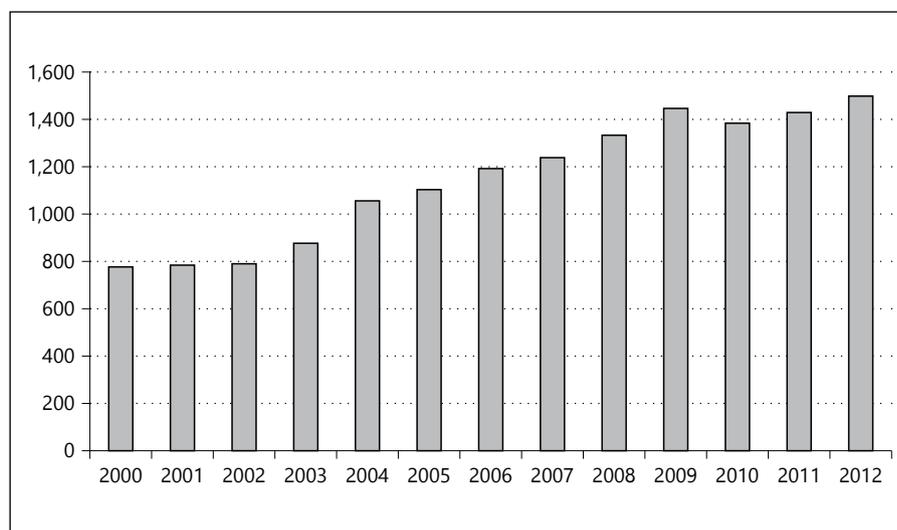


Fig. 1. Selection of publications for analysis.

Methods

We identified and counted scientific publications in the field of nicotine and tobacco research. We wanted to include a wide range of nicotine- or tobacco-related research, covering all scientific disciplines, including fields such as political sciences, economics, and sociology. Therefore, searches were performed in four databases: PubMed, Web of Science, Scopus, and PsycInfo. We selected articles that were published between 2000 until the end of 2012, used the combination of the search terms *smok**, *nicotine*, *tobacco*, and *cigar** in the title field, and used the affiliation or address field to select articles that had as first author a researcher from any of 31 European countries. For the United Kingdom, we used a combination of 'UK' OR 'United Kingdom' OR 'Great Britain'. The search yielded 51,444 publications, which were then imported into Endnote. In Endnote we first excluded publications (see fig. 1) that had no English abstract (7,304), then removed duplicate publications (25,756), further excluded publications that were not a peer-reviewed journal article such as conference proceedings and reports (337), and finally removed articles that were not about a tobacco-control topic (such as fire victims, smoked fish or papers dealing with tobacco horticulture) (3,143). After these exclusions, 14,904 articles related to nicotine or tobacco research remained. These 14,904 articles were used to calculate research volume per year. Research volume and research focus per country were examined for a sample of years: 2000, 2004, 2008, and 2012 (4,665 articles in total). Four years was deemed sufficient to examine the changes in research focus over the years, while keeping the study within reasonable time limits. Among the articles that were from 2000, 2004, 2008 or 2012, a further 220 were found to have a first author not affiliated with a European country and were therefore excluded from further analyses and 393 were not nicotine or tobacco research related, resulting in 4,052 articles for further coding. The volume of research output was defined as the number of papers that were written per country (as indicated by the country of the first author), per year.

Fig. 2. Number of tobacco or nicotine publications in 31 European countries, per year.



Coding was done by three trained students. Training sessions were coordinated by the two authors, using a code book that described and explained the codes in detail. After each session, the code book was further adapted and refined, until no uncertainties remained. All articles were coded as follows. First, an extra check was done on whether the paper was indeed tobacco control related (and not for example botanical). Next, the country of the first author was identified. The articles were then coded on the epidemiological framework, following the example of Cohen et al. [9]. The distinction between agent, host, environment, and vector is a well-known way of conceptualizing the four different targets for tobacco control [10]. We defined these as follows. ‘Agent’ was coded when the paper focused on nicotine or tobacco devices and/or how these are associated with health, genetics, or addiction. ‘Host’ was coded when the paper focused on smoking and smokers’ characteristics, treatment, or education. ‘Environment’ was coded when the paper was about environmental measures to reduce smoking, such as campaigns, taxation, advertising, and smoking bans. ‘Vector’ was selected when the paper had the tobacco industry as main focus of research. Next, papers were coded with respect to type of product: 1 = nicotine, 2 = tobacco or cigarette (conventional tobacco smoking product, factory made tobacco, roll-your-own, cigar, pipe, water pipe), 3 = smokeless tobacco (including snuss, chew, non-combustible), 4 = END’s (Electronic Nicotine Delivery product or e-cigarette). Papers were also coded on the general prevention focus and type of population measure. General prevention focus was coded as: 1 = protection from second-hand smoke, 2 = smoking initiation, 3 = smoking cessation, 4 = harm reduction (reduced smoking, using less harmful alternatives, safer cigarette), 5 = more than one of the above, 6 = none of the above or unclear what the focus is. The type of population measure was coded as: 1 = smoke-free laws, smoking bans, 2 = cigarette price, taxation, 3 = restrictions or bans on advertising or promotion, 4 = health warnings on cigarette packages, plain packaging, 5 = mass media educational campaigns, quit campaigns, 6 = more than one of the above, 7 = none of the above or unclear what the focus is. Further, coders indicated whether the publication had a clear aim to study any of the following three topics (yes, no): smoking and

health, socio-economic disparities related to smoking, pharmacotherapy for smoking cessation. Finally, coders had to indicate whether the study falls into the category of basic science (including in vitro, animal studies, preclinical research).

Three training sessions were needed before the students could code the publications uniformly. Cohen’s kappa was calculated to assess the level of agreement between the students for each code category, based on 100 randomly selected publications from the database. Kappa’s were excellent for country, epidemiological framework, type of product, general prevention focus, and pharmacotherapy (all 0.75 or above), and fair to good for the other categories, with socio-economic disparities having the lowest level of agreement (kappa = 0.54).

All codes were entered in Endnote. The Endnote data file was then exported to SPSS. Data were analyzed using SPSS version 20.

Results

Research Volume

Between 2000 and 2003, the number of research articles on nicotine or tobacco produced by the 31 European countries was around 750 per year (see fig. 2). In 2003, the volume of publications started to grow with around 70 more publications each year, reaching a peak of 1,499 in 2012. This represents an annual growth rate of 5.5%.

Table 1 presents the number of articles per country for the 4 study years. Eight countries had more than 200 publications. Most output was from the United Kingdom (849), followed by Germany (416), Spain (325), Italy (303), the Netherlands (290), Sweden (268), France (250), and Turkey (219). Together, these eight countries produced 72% of the total European volume. With the exception of the Netherlands and Sweden, these countries are

Table 1. Number of publications per country in 2000, 2004, 2008 and 2012 (n = 4,052)

	2000	2004	2008	2012	Total	Total per million inhabitants*
United Kingdom	169	178	225	227	849	13.9
Germany	57	88	144	127	416	5.0
Spain	55	103	67	100	325	7.4
Italy	58	68	87	90	303	5.2
Netherlands	27	57	76	130	290	17.8
Sweden	69	72	69	58	268	29.5
France	45	62	71	72	250	4.0
Turkey	15	62	59	83	219	3.1
Finland	37	32	51	35	155	29.3
Poland	19	29	30	31	138	3.6
Switzerland	25	19	38	55	137	18.3
Denmark	24	32	35	30	121	22.4
Norway	16	29	30	31	106	22.6
Greece	9	19	27	37	92	8.3
Czech Republic	16	16	19	29	80	7.8
Austria	14	16	12	15	57	7.0
Belgium	10	5	21	15	51	4.9
Ireland	6	11	11	15	43	10.2
Portugal	0	9	16	11	36	3.4
Hungary	3	11	6	15	35	3.5
Romania	0	2	5	10	17	0.8
Slovakia	4	5	3	2	14	2.6
Iceland	2	1	4	3	10	33.3
Bulgaria	0	4	0	6	10	1.3
Slovenia	3	0	3	1	7	3.5
Lithuania	0	1	2	4	7	2.1
Luxembourg	1	0	1	2	4	10.0
Estonia	0	2	1	1	4	3.1
Latvia	1	0	0	2	3	1.4
Cyprus	0	0	2	1	3	4.3
Malta	0	0	0	2	2	5.0
All countries	685	932	1,131	1,304	4,052	7.06

* Using the number of inhabitants per 2006 as criterion.

also the largest countries in Europe, each having more than 45 million inhabitants. We then controlled for the number of inhabitants, and found that five countries produce at least 20 articles per million inhabitants. These were all Scandinavian: Iceland, Sweden, Finland, Norway, and Denmark. Finally, there were countries that scored low on both criteria, with very few publications both in absolute and relative terms: Bulgaria, Cyprus, Estonia, Latvia, Lithuania, Malta, Romania, Slovakia, and Slovenia. These had less than 20 publications in total over the 4 study years and no more than 5 publications per million inhabitants.

Research Focus

Over the years, various changes were observed in research focus. With respect to the epidemiological framework, we saw a relative reduction of research output on the ‘agent’ (i.e. harmful or addictive properties of nicotine or tobacco; 153% increase from 2000–2012), compared to research on aspects of the ‘host’ (i.e. smoking, smokers, treatment, education; 235% increase) and the ‘environment’ (environmental measures such as campaigns, taxation, smoking bans; 324% increase). The net effect was that the proportion of publications that has the ‘agent’ as main focus reduced from 61% in 2000 to 49% in 2012 (see table 2). The ‘vector’ (tobacco industry) remained relatively understudied: only 1% of the total.

We further examined which aspects of the ‘agent’ were the most studied. The vast majority was about health aspects of tobacco products (90%), 8% was on nicotine, 2% on any type of smokeless tobacco, and 0.6% was on electronic cigarettes. While in 2000 only 4 papers dealt with smokeless tobacco (0.6%), we found 35 in 2012 (2.7% of publications in 2012). Publications on electronic cigarettes were virtually nonexistent until 2008 (2 articles; 0.2%). This increased to 21 articles in 2012 (1.6% of the total in that year).

As shown in table 2, only 8% of publications were about environmental interventions. A further inspection of these 329 articles revealed that smoking bans were most often the study topic and that this increased from 10 in 2000, 20 in 2004, 41 in 2008, to 61 in 2012. In contrast, only 26 papers across these 4 years studied mass media campaigns, 17 tobacco price or taxes, 14 advertising or tobacco promotion, and 11 health warnings on cigarette packs.

In addition to the agent, host, environment, and vector distinction, we coded general prevention focus (table 3). Of all papers, 30% was about smoking cessation, 6% on smoking initiation, 8% on protection from passive smoking, and 1% on harm reduction (the rest was more than one, none or unclear). The smoking cessation literature seemed to have increased relative to the other topics, from 26% of all publications in 2000, 28% in 2004, and 30% in 2008 to 33% in 2012. In absolute numbers, this body of literature has more than doubled (from 176 articles in 2000 to 426 in 2012).

The proportion of papers per year on any aspect of ‘smoking and health’, came down from 56% in 2000, 49% in 2004, and 50% in 2008, to 45% in 2012. The proportion of papers that had socio-economic disparities as the main focus increased from 2% (15 papers) of all publications in 2000, 3% in 2004 (25 papers) and 2008 (36 papers) to 5%

Table 2. Number of articles according to epidemiological framework, per year (%)

	2000	2004	2008	2012	Total
Agent	415 (61)	499 (54)	570 (50)	637 (49)	2,121 (52)
Host	220 (32)	358 (38)	461 (41)	516 (40)	1,555 (39)
Environment	42 (6)	60 (6)	91 (8)	136 (10)	329 (8)
Vector	8 (1)	15 (2)	9 (1)	15 (1)	47 (1)
Total	685 (100)	932 (100)	1,131 (100)	1,304 (100)	4,052 (100)

Table 3. Number of articles according to general prevention focus, per year (%)

	2000	2004	2008	2012	Total
Smoking cessation	176 (26)	263 (28)	343 (30)	426 (33)	1,207 (30)
Protection from SHS*	47 (7)	65 (7)	88 (8)	101 (8)	301 (8)
Smoking initiation	38 (6)	74 (8)	72 (6)	66 (5)	250 (6)
Harm reduction	8 (1)	5 (1)	9 (1)	19 (1)	41 (1)
More than one	19 (3)	23 (2)	30 (3)	60 (5)	132 (3)
None of these	397 (57)	502 (54)	589 (52)	632 (48)	2,020 (52)
Total	685 (100)	932 (100)	1,131 (100)	1,304 (100)	4,052 (100)

* SHS = Second hand smoke.

(69 papers) in 2012. A substantial volume of all research, around 10% was on pharmacotherapy for smoking cessation. This remained rather stable over the years. Around a quarter of all papers were in the domain of basic, pre-clinical research. We observed a reduction from 30% in 2000, to 24% in 2004 and 19% in 2008, but 2012 saw a higher proportion of research papers in this domain (29%).

Discussion

The total volume of European scientific publications in the field of tobacco and nicotine almost doubled within 10 years. This is remarkably similar to what has been reported for scientific publications in general, with global scientific output doubling roughly every nine years [11]. The increase in volume of publications accelerated around 2003, coinciding with the European Union signing the FCTC treaty. This suggests that this event had some positive effect on research, but we cannot be sure of this. Additional data on changes in national and EU-wide funding for tobacco control research might help to elucidate this point. This obviously is an interesting area for further research.

The finding that the United Kingdom and Germany are the biggest producers of tobacco research articles in Europe was also found in previous studies for the period 1999–2003 [12] and 1900–2008 [13]. This is also in line with the United Kingdom and Germany being the two most productive EU countries with respect to overall scientific output [14]. The finding that the Scandinavian countries are most productive (when controlling for number of inhabitants) has also been found in the addiction field [8] and the public health field [15]. This has been explained by the average English proficiency, the national spending on research [16], and the cooperation between Nordic countries on tobacco control [17].

The shift in the number of European publications away from the agent of the tobacco epidemic (harmful or addictive properties of nicotine or tobacco) towards host (smoking, smokers, treatment, education) and environment follows a global trend that started three decades ago [9]. However, in absolute terms, the field is still dominated by research focussing on the agent (49% of all publications), while the environment (8%) and the vector (1%) are less often studied. This is despite the almost universal recognition that population-level strategies are the most urgently needed to combat the global tobacco epidemic [1, 18]. In resource-constrained settings, research

funding should contribute to interventions that have the most population impact, or are most effective among high-risk groups. When we look at the crucial FCTC interventions (smoking bans, smoking cessation support, mass media awareness campaigns, advertising and promotion restrictions, health warnings on cigarette packs, and tax increases) smoking cessation-related research was associated with the largest increase in publications (a third of all publications in 2012). We could only identify 17 papers across the 4 study years (0.4% of total) on tobacco taxation, while this has been identified as the most effective tobacco control measure [19].

In Europe, attention has been drawn to the fact that socio-economic inequalities in smoking are widening [20, 21]. This recognition is reflected in our finding that the number of research papers that have socio-economic disparities as a study topic increased from around 2% of the total scientific output in 2000 to 5% in 2012.

Although no clear increase was observed in the relative interest for harm reduction as a study topic compared to smoking cessation, we did see more studies on smokeless tobacco products and electronic cigarettes in absolute terms in 2012 compared to the other study years, which reflects increased interest to these topics [22, 23].

Strengths and Limitations

A major strength of our study was that we did not use samples, but identified all relevant peer-reviewed publications in the four selected study years. Our results reflect the total corpus of peer-reviewed publications, making the need to seek statistical confirmation of differences between groups redundant. Furthermore, we included no less than 31 European countries, making the results of interest to national policy makers in many European countries who can now compare their country's output to other countries and to the EU average. The only previous study that looked at tobacco control publications in Europe was restricted to 10 countries that were believed to produce as much as 95% of all publications in Europe [8]. However, our study identified Turkey, Poland and Switzerland as high-producing countries that were not included in their study. Another strength of our study was that we used multiple literature databases covering all scientific disciplines, providing a comprehensive account of nicotine and tobacco research output.

A limitation was that, for practical reasons, we restricted the coding of papers to four years (2000, 2004, 2008, 2012). While this might have been sufficient for the purpose of identifying general trends over this 13-year period, the 4 years cannot be regarded as representative for all

years. Increases in the volume of publications triggered by major policy changes in specific years could not be captured by our data.

A second limitation of our study was that we explored trends in international peer-reviewed publications, which is not necessarily the same as trends in actual research. Research might be carried out at the national level, which is not published in peer-reviewed journals. Furthermore, we excluded potentially relevant papers if they did not have an English abstract. Since this might be the case more often in some countries than in others, a positive bias might be introduced towards countries that have a stronger tradition of publishing in English language journals. This obviously gives some advantage to the United Kingdom and Ireland, and maybe to countries such as the Netherlands and Scandinavian countries that have a population that speaks English particularly well [2]. However, this bias is becoming increasingly less important. A study looking at publications within the European Union on alcohol and drug misuse between 1976 and 2000 found that articles were published in 13 different languages, with two-thirds in English, but that the proportion of English language papers increased over time, with 85% of all publications in 1996–2000 [24]. Furthermore, publications in non-English journals were included in our study when they had an English abstract.

It should be noted that the inter-rater reliability was relatively low for socio-economic disparities, due to difficulties of identifying whether socio-economic disparities was the main research topic of a paper. Our intention was to exclude papers that only applied the socio-economic background of respondents as a confounder, but this was not always clear from the abstract. Other categories that had suboptimal inter-rater reliability were type of population measure, smoking and health, and basic science.

Finally, we did not look at the indicators of scientific quality, for example, by journal impact factor or number of citations. It was not feasible to add this information to the database because of the large number of papers in our study. Taking publication quality into account would probably reduce the relative contribution of some countries to the total, in particular, the contribution of countries that have little international collaboration. A Spanish study found that the number of citations was strongly associated with international collaboration [12].

Implications

Our study showed that the Eastern European countries Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia, and Slovenia are particularly depleted of to-

bacco control research. Ten years ago, an expert group concluded that research spending on tobacco control within Europe is extremely fragmented [6]. This situation seems hardly changed as these Eastern European countries are concerned, and this calls for an increase in EU tobacco control research funding and development of stronger research networks that include those countries that currently are missing the boat. Since the European Commission provides only a small amount of the overall funding for research in Europe [25], additional core funding for tobacco control research may have to come from national governments and might be included in national health plans, financed by revenue from tobacco taxes, as recommended by the WHO [26].

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Competing Interests

None declared.

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