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Original Investigation

Publications as an Indicator of Increased Tobacco Control Research Productivity (Quantity and Quality) in New Zealand

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Abstract

Introduction: Tobacco control (TC) research capacity and productivity are critical for developing evidence-informed interventions that will reduce the harmful effects of smoking. The aim of this paper was to investigate New Zealand's (NZ) TC research capacity along with the quantity and quality of publications, following two government initiatives aimed, in part, at improving the quantity and quality of NZ TC research.

Method: Scopus was searched for articles with at least one NZ author and where the topic was of primary relevance to TC. Publications were organized into two time periods, following the government initiatives, 1993–2003 and 2004–2009. We analyzed the number of publications, publication journals, type of publications, impact (using the impact factor), and authorship.

Results: There has been an increase in number and impact of publications and number of authors. The number of publications has increased from an average of 14 (1994–2003) to 38 per year (2004–2009). The number of journals published increased from 64 to 86. The impact during 2004–2009 was almost three fold than in 1993–2003. The number of authors increased from 212 to 345, and the number of authors who had at least one first-authored publication increased from 80 to 124.

Conclusions: These results show an encouraging trend in NZ TC research, with an increase in research productivity, quality, and in research capacity. It is possible that government-initiated and -funded infrastructural support contributed to increasing needed TC research, which supports the worth of such initiatives.

Introduction

Tobacco smoking is a major cause of preventable death. In New Zealand (NZ), a country with a population of just over four million people, tobacco smoking kills nearly 5,000 people each year (Ministry of Health, 2009). More than a decade ago, Wilson and Thomson (1999) asserted that there was a relative lack of tobacco control (TC) research in NZ, given the burden of disease and health inequalities attributable to tobacco smoking. In support of this, they cited a review of publication outcomes of projects by Wellington School of Medicine public health interns in which fewer than one percent of projects had tobacco epidemiology and control as their primary focus (Wilson & Thomson, 1999).

A critical mass of capable and productive TC researchers is important for progressing TC (Cooke, 2005; Lando, Borrelli, Muramoto, & Ward, 2006; McDonald et al., 2009). Indeed, the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC), which NZ ratified in 2003, specifically requires ratifying countries to promote national research in TC and investment in research capacity and infrastructure. Article 20 (p. 17) in the FCTC requires that parties "develop and promote national research and coordinate research programmes at the regional and international levels in the field of tobacco control" (WHO, 2003). To that end, funding is vital for conducting quality empirical research, incentivizing existing researchers, and enabling recruitment of new researchers (Cooke, 2005; McDonald et al., 2009). Unfortunately, the resources to support such capacity building are often insufficient (Stillman, Yang, Figueiredo, Hernandez-Avila, & Samet, 2006). In 2007, the U.S. National Institutes of Health spent $1,224 per related death on tobacco research. In comparison, $5,907 per related death was spent on obesity research (Shafey, Eriksen, Ross, & Mackay, 2009, p. 67). It has been argued that government-funded and -organized frameworks, including structured research communities and access to information or decision makers, can enhance TC research capability and increase productivity (McDonald et al., 2009).

Research capacity and productivity can be monitored by observing empirical evidence (Wipfli et al., 2004). Key indicators include the number of peer-reviewed scientific journal articles, numbers of authors per publication, and type of publications (Askew, Schluter, & Gunn, 2008; McDonald et al., 2009; Yaman & Kara, 2007). Studies have investigated the

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productivity of various disciplines, for example, by looking at the frequency of articles published and cited for public health research (Soteriades & Falagas, 2006), quantity, and quality of research, as represented by peer-reviewed publications for cardiovascular disease (Rosmarakis et al., 2005), productivity by family practitioners in the United States by searching for research articles published in journals (Pathman, Viera, & Newton, 2008), and productivity in ophthalmology and vision science research as measured by published research articles (Pon, Carroll, & McGhee, 2004).

Within TC, a considerable volume of research has been published. A 2008 search of MEDLINE PubMed found nearly 60,000 articles, which used "tobacco" as a keyword (Shafey et al., 2009). Further bibliometric analyses have been published in this field, such as those by Cohen, Chaiton, and Planinac (2010) and Kusma et al. (2009). Kusma et al. (2009) analyzed global TC research activity using number of publications and authorship as indicators and noted an increase in overall productivity within the field, and Cohen et al. (2010) characterized the TC literature according to the nature of topic under study. Others have investigated the evolution of literature related to smoke-free spaces policy through analyzing the journals in which articles were published, authorship and number of articles (Nykiforuk, Osler, & Viehbeck, 2010), and TC research productivity, including journals published to and number of publications, in Spain (De Granda-Orive et al., 2007).

Government investment in research has been found to lead to an increased number of peer-reviewed publications and number of authors and an increase in articles published in international journals. For example, Askew et al. (2008) evaluated publication rates by Australian General Practitioners before and after a government initiative to increase high-quality outputs and found a substantial increase after the investment. The effect of government funding on the number and quality of biomedical research articles published by Chinese researchers was found to be significant (Makris, Spanos, Rafailidis, & Falagas, 2009).

In NZ, it is possible to discern two periods of strategic TC research investment by government. The first was in 1993, when the Public Health Commission Policy Advice to the Minister of Health on Tobacco Control set research and information targets to report on a range of population smoking behavior indicators (The Public Health Commission, 1993). The second was a decade later when the Ministry of Health supported the establishment of a tobacco control research steering group (The Tobacco Control Research Strategy [TCRS] Steering Group, 2009). Part of the remit of this group was to develop a national TCRS (The TCRS Steering Group, 2009). The priorities set in the TCRS included improving the quantity, quality, accessibility, and relevance of NZ TC research and building the TC research infrastructure to enable recruitment, support collaboration, training, and networking. The infrastructure included setting up a publicly available annotated bibliography of NZ TC research and establishing and operating an online discussion and networking forum New Zealand Tobacco Action Network for people involved in TC and TC research (The TCRS Steering Group, 2009). The funding provided was predominantly for infrastructure, although in 2008, a funding source specifically for TC was set up by the Ministry of Health. Other TC research has been funded through initiating bids to contestable funds.

Given the devastating harms caused by tobacco smoking, increased quantity and quality of TC research and researchers are critical in order to develop evidence-informed interventions. However, there has been no assessment of TC research productivity and capacity for over a decade. Previous studies have conducted bibliometric analysis of TC research, but none have focused on NZ. We therefore sought to identify and quantify TC research productivity and capacity in NZ by analyzing the quantity, authorship, and impact of peer-reviewed publications over the last sixteen years in regard to two government-driven milestones.

Method

Search Strategy

We searched Scopus; an online research database that has 100% MEDLINE coverage and also covers the life and social sciences (Scopus, 2009), to find publications with at least one author with an affiliation to NZ. Scopus records the country of affiliation of all authors, not just the first or corresponding author and therefore makes such a search possible. The search strategy was:

(PUBYEAR AFT 1993 AND TITLE-ABS-KEY ((tobacco OR smoking OR nicotine OR snuff OR secondhand OR smokeless OR smoker* OR cigar* OR cigarette* OR smoke) AND NOT (plant* OR fire* OR insect* OR flue-cured OR fish OR hornworm OR wood*)) AND AFFILCOUNTRY (New Zealand)).

We excluded studies published in languages others than English or in which the authors had no affiliation with NZ at the time of publication. We also excluded those articles in which the primary focus was not a dimension of TC, was not a primary variable of interest, or had as its focus the smoking of substances other than tobacco, such as marijuana. To align with the two milestones in NZ TC research, only papers published after 1993 were included. Because of the key role of smoking on sudden infant death syndrome (SIDS) and because of the high incidence of SIDS among Māori (indigenous New Zealanders who comprise 15% of the population and among whom smoking prevalence is around 50%), key texts linking SIDS and smoking were included.

Abstracts were reviewed independently by two reviewers (AK and MG), and where there was a difference of opinion, a third reviewer (CB) also assessed the papers. Publications were organized and analyzed in two time periods to align with the investment milestones noted above and categorized into publication types based on Scopus definitions (article, editorial, review, and short survey). The publication impact factor (IF) was identified for each publication by noting the IF of the relevant journal for the year of publication from the *ISI Web of Knowledge Journal Citations Report* database. Where a journal did not have an IF for that year, the article was excluded from the IF calculation.

Data pertaining to the included articles were exported from Scopus to Microsoft Excel, where of the following descriptive statistics were calculated: average number of publications and publication type per time period, total number of publications

per year, total number of journals published in the time period, total number of NZ authors per time period, and total number of authors who had been first author on at least one publication per time period. Furthermore, for each publication, the IF at the time of publication was noted. This was used to calculate IF per year by adding together the IF for each publication for each year. Finally, we calculated the total IF per time period.

Results

There was an increase in the total number of peer-reviewed publications over time with an apparent increase from 2004 onward. Between 1994 and 2003, the number of peer-reviewed publications averaged 14 per year, whereas from 2004, the average increased to 38. There was also a steady increase in the different types of outputs, in particular, in original research articles from 2004 (Table 1). The number of original research articles more than doubled from an average of 10.5 per year during 1994–2003 to an average of 23 per year during 2004–2009. Editorials doubled from an average of 1.1 in 1994–2003 to 2 per year in 2004–2009, and, the average number of review articles increased more than fourfold (0.9 per year 1994–2003 to 4.3 per year 2004–2009).

In the decade prior to the establishment of the TCRS, there were publications in 64 different journals; after the strategy, the number increased to 86 different journals in just six years. The *New Zealand Medical Journal* published the most articles (30% during 1994–2003 and 37% during 2004–2009), followed by *Tobacco Control* (5% during 1994–2003 and 8% during 2004–2009). From 1994 to 2003, 55% and during 2004–2009, 52% of the publications were published in a journal with an IF. The "total impact" value was substantially higher after 2004 (541) than between 1994 and 2003 (170), despite the 2004–2009 time period being four years shorter. The average IF per publication during 1994–2003 was 1.6 but 3 during 2004–2009. There was a steeper increase in impact per year during 2004–2009, except in 2007, than during 1994–2003 (Figure 1).

The total number of authors, who had contributed to at least one paper during 1994–2003, was 212 and during 2004–2009, it was 345. The total number of authors per year more than doubled during 2004–2009 (88) compared with 1994–2003 (34; Figure 2). Furthermore, there was an increase in the number of first authors of at least one paper: During the 10-year period prior to 2004, there were 80 authors, who had been first author on at least one publication, and in the six years between 2004 and 2009, there were 124 first authors. The increase was steeper during the 2004–2009 than the 1994–2003 period (Figure 3)

Table 1. Number and Type of Article Per Year

Year	Original research article	Editorial	Review	Survey	Total
1994	6	0	0	0	6
1995	8	1	0	0	9
1996	5	0	0	0	5
1997	6	1	2	2	11
1998	9	0	0	0	9
1999	14	1	2	0	17
2000	15	1	3	0	19
2001	15	1	0	1	17
2002	13	1	1	0	15
2003	14	5	1	0	20
Total: 1994–2003	105	11	9	3	128
2004	17	1	1	0	19
2005	25	5	7	0	37
2006	21	1	5	0	27
2007	28	4	5	0	37
2008	36	1	4	0	41
2009	37	2	8	1	48
Total 2004–2009	164	14	30	1	209

Discussion

To the best of our knowledge, this is the first study to identify and quantify TC research productivity in NZ. This paper also adds to the emerging bibliometric literature within TC (Cohen et al., 2010; Kusma et al., 2009; Nykiforuk et al., 2010). Although there was an increasing trend in quality and quantity of peer-reviewed publications and productivity of TC authors prior to 2004, the increase was steeper in the years between 2004 and 2009. This cannot be attributed to the TCRS and support of the TCRS Steering Group. However, our findings show an increase in number of publications, number of authors and first authors since its establishment, and, as implied from the increase in combined IF (based on just over 50% of papers, which were published in a journal with IF in the year of publication), an improvement in the quality of publications. These findings also support previous research, suggesting that infrastructure can enhance capability and productivity (McDonald et al., 2009). Although we cannot definitively link the TCRS aim of improving quality of publications with the higher combined IF, the change occurred since the establishment of the TCRS. The strategy could have helped focus and coordinate research, for example, to pursue funding for identified and supported research priorities. The TCRS promoted formation of collaborative research teams, which has happened. There has been a concurrent

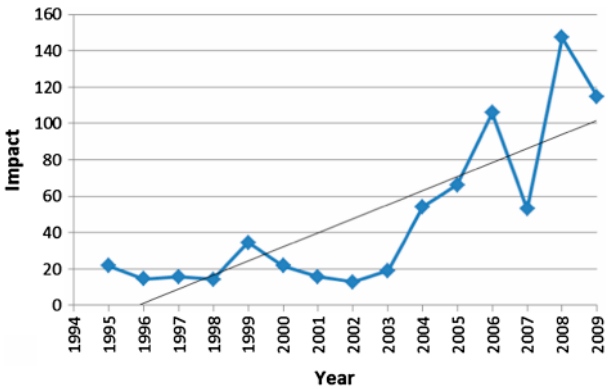

Figure 1. Impact factor (IF) per year (between 1994 and 2009). Based on publications published in a journal with an IF (55% during 1994–2003 and 52% during 2004–2009).

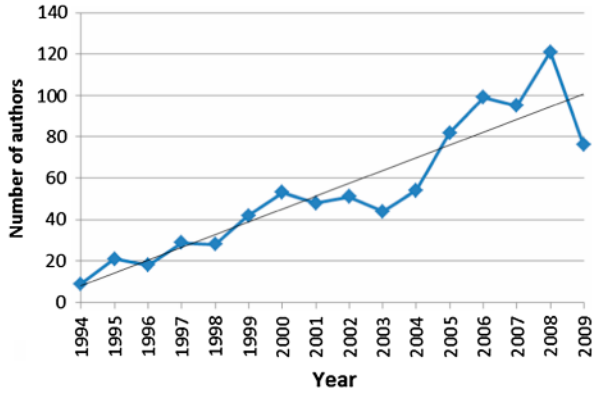

Figure 2. Number of authors contributing to at least one paper each year.

increase in the number of emerging researchers undertaking TC-related research at PhD and postdoctoral level and some senior researchers with TC interests move to NZ. Research teams have formed around both. The substantial increase in average number of original research articles suggests an overall increase in TC research in NZ. Research teams have successfully won support for large programmes of TC research from general social science or health research funds. Sector-wide involvement in the development of the TCRS could have raised awareness of the need to proactively recruit, mentor, and support new researchers.

The findings in this paper are in accord with those of Rosmarakis et al. (2005) who found a relationship between increased funding for and increased quality and quantity of research outputs. Although, the funding provided by the government for the initiative discussed in this paper was modest, our findings suggest that it has had a positive impact on NZ TC research productivity and capacity. However, despite the potential of TC to save lives, the amount of available funding for TC research remains low (Stillman, Wipfli, Lando, Leischow, & Samet, 2005). The TCRS funding was provided to set up a TC research infrastructure; however, the only funds set aside specifically for conducting TC research in NZ are cancer control funding released in 2008. While there has been substantial commitment for funding for other health risks, such as infectious disease, no comparable funding commitment has been made into TC research (Stillman et al., 2005). NZ TC researchers have to apply for funding through fully government, nongovernmental organization, and international contestable funds. Moreover, funding for the TCRS Steering Group was discontinued in 2009.

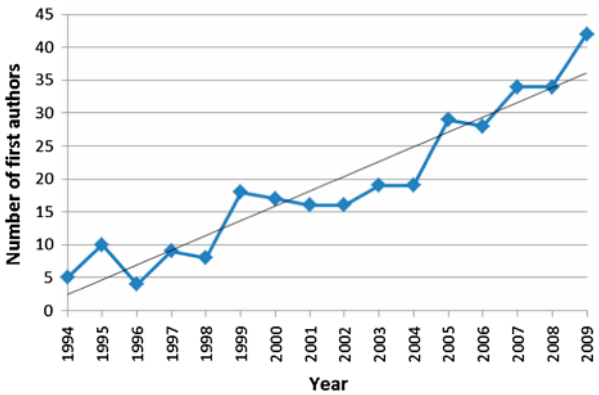

Figure 3. Number of authors who were first authors on at least one publication.

Limitations of this paper include the use of peer-reviewed publications as an indicator of capacity. The use of peer-reviewed publications has limitations (Daniel, 2005); however, it is one way to investigate if there has been any change in research productivity. The use of IF as a measure of quality of scientific research has also been criticized, but so far, there is no other world-wide accepted measure (Rosmarakis et al., 2005). One limitation with using IF is that only about 50% of the papers had been published in a journal with an IF. However, the proportion was similar for both time periods. Another limitation is that database searches predominantly contain publications in English and may not include all articles.

As noted in the WHO FCTC, TC research is an integral part of an evidence-informed comprehensive TC programme. The present findings suggest that improved quantity and quality of TC research in NZ have occurred from 1994 to 2009. Our findings suggest that during that time, NZ was meeting its obligations relating to building capacity and providing empirical evidence in accordance with the FCTC and that there has been a reassuring trend in increase in quality and quantity of peer-reviewed publications as well as evidence of an increase in TC research capacity. The findings highlight the potential value of government investment in infrastructure that supports TC research. Other countries could usefully copy NZ's process of establishing a Steering Group, developing a national TC research strategy, and setting clear priorities for TC.

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Declaration of Interests

None declared.

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