

A bibliometric analysis of research publications funded partially by the Cancer Association of South Africa (CANSA) during a 10-year period (1994–2003)

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Abstract

Background: The objective of this study was to establish the quantity and quality of research publications outputs by grant recipients of the Cancer Association of South Africa (CANSA) over a 10-year period (1994–2003).

Methods: Peer-reviewed publications in the PubMed database that were related to CANSA grants and were published between 1994 and 2003 were counted per grantee in 2005, and the mean impact factor of all publications for 2005 was obtained from the Institute for Scientific Information (ISI).

Results: Over the 10-year period, 129 different researchers from 10 different institutions conducted 192 projects that yielded 570 relevant peer-reviewed publications that are recorded in the PubMed database. CANSA grants totalled R28.2 million and the mean impact factor of all the publications was 3.8. The number of publications per grantee, over the period analysed, varied considerably, from zero to 79, with 10% of the grantees publishing more than 10 (one per year). A significant group of 36% did not publish at all. Most of the studies (64%) concerned aspects of cancer biology and therapy, while only 26% of the projects involved issues relating to the prevention, epidemiology and social aspects of cancer.

Conclusions: Because grants from CANSA are partial and do not pay for the major components of most research projects, such as salaries, the data obtained here is insufficient to create a benchmark for the cost of an average, peer-reviewed cancer research publication in South Africa. Nevertheless, it can be concluded that, on average, a contribution of about R50 000 from CANSA (value from 1994 to 2003) contributed to the appearance of one peer-reviewed cancer research publication with an average impact factor of 3.8 in the period under study. The most popular subjects of research were cancer biology and treatment. In order to bring about more balance in the future, more attention needs to be focused on the prevention, early detection, epidemiology and social aspects of cancer.

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Introduction

Over the past 30 years, a few members of the South African public have made relatively large bequests to the Cancer Association of South Africa (CANSA) for the stated purpose of conducting cancer research. CANSA has accepted the challenge to be a worthy custodian of these funds, which have been appropriately ringfenced and are carefully invested in shares for growth by a special Investment Committee of CANSA. Over the years, the capital value of these shares has grown extensively and CANSA is now in the position to make about R4 to 5 million available from dividends and interest for research every year without eroding the capital significantly.¹ This is a significant amount, because the total cancer research funding of the South African Medical Research Council does not exceed R10 million per annum.² Furthermore, this is a significant development because it constitutes an independent, nongovernmental cancer research funding “engine” in South Africa that should be able to be self-sustaining until the cancer problem is substantially solved.

From 2003 to 2006, CANSA underwent a paradigm shift, with much more emphasis being placed on the more social aspects of cancer, such as advocacy, palliation, health promotion, early detection and prevention, than on the so-called “biomedical” aspects of cancer, i.e. studies on the

biology of cancer per se and on enhancing the treatment of cancer. This policy change is reflected in the CANSA mission, which states – “We will substantially reduce the impact of cancer by promoting health in all communities within South Africa, through advocacy and sustainable facilitation of research, prevention, early detection and care”.¹ In the light of this change in emphasis, it was of importance to have an audit conducted of the past 10 years of research funding in terms of publication output and the ranking of different research fields and research projects needing advocacy in the future. Such an audit could be executed readily, because CANSA does not fund more than about 50 projects at a time, in comparison to the Medical Research Council (MRC) and National Research Foundation (NRF), which support hundreds of projects at any time.

Bibliometric studies on cancer research appear to be quite scarce, although a few have been published with a wide spectrum of objectives, including analysing growth trends for a particular country (India), comparisons with other countries, lists of authors with more than 50 publications, core journals, productive institutions,³ and the absolute sum and mean of impact factors of publications on cancer molecular epidemiology normalised by country population and gross domestic

product.⁴ There have also been studies on the analysis of research productivity in the fields of infectious diseases,⁵ microbiology,⁶ parasitology,⁷ ophthalmology⁸ and family medicine.⁹

The unique aspect of this study, which was not addressed by the others, was the relationship between the quantitative aspects of research grants made by a nongovernmental organisation (CANSAs) and the research output in terms of the absolute number and mean impact factor of publications over a 10-year period. A possible reason why most existing studies do not contain information on the financial input into cancer research studies and only focus on the bibliometric output is that the details of individual financial allocations are often kept confidential by the granting body and/or the host institution. In this unique study, financial input details from CANSAs were available, as well as the exact nature of the studies, and from this information a relationship of the mean financial input relative to mean bibliographic output could be ascertained – bearing in mind that the bulk of the financial input from the researcher's institution and other sources was unknown. Nevertheless, this relationship, which is reported here, has been of practical value when deciding on the allocation of research funds in a particular situation and also when anticipating how many publications to expect from a given allocation – while also taking account of inflation since the study was conducted.

Methods

An Excel database was compiled of all researchers who received research grants from CANSAs from 1994 to 2003. The database contained the name and designation of the principal investigator who applied for the funds, the department, institution, title of the registered project and the funding per year. In 2004, all of the researchers were contacted for lists of publications. These lists were compared to lists containing peer-reviewed publications recorded in the PubMed database in 2005 and in 2006.¹⁰ During seven years of the 10-year period, the author acted as an independent consultant research co-coordinator for CANSAs and was aware of each ongoing project. This knowledge subsequently was useful to select references from PubMed that had received CANSAs funding only and to ignore publications by the same author that were not partially funded by CANSAs or were not relevant to the project registered by CANSAs for the award. Selection was also informed by the titles of the projects, which often were similar to the titles of the publications. It was considered unlikely that publications would be forthcoming more than three years after the audit period ended (2003). A master list of all publications was drawn up and double-checked by an independent co-worker, leading to consensus that there were no instances of significant over- or under-recording of relevant publications for any researcher. All of the publications were grouped according to the relevant journals, and the same publication cited by more than one author was considered as one publication. The ISI Impact Factor of each journal for 2005 was recorded and the mean impact factor of all journals was obtained.¹¹

Results

Heterogeneity of output

Over the 10-year period, 129 different researchers from 10 different institutions conducted 192 projects, which yielded 570 relevant peer-reviewed publications that are recorded in the PubMed database. The publications appeared in 253 different journals, of which 28 (4.9%) were not indexed in the ISI web of knowledge and consequently not counted or used to determine the overall impact factor. CANSAs grants totalled R28.2 million and the mean impact factor of all publications listed in the ISI database was 3.8. The top 10 journals and the frequency of articles in which the cancer research publications appeared, were: *S Afr Med J* (39), *Anticancer Res* (21), *J Clin Oncol* (18), *Hepatology* (12), *Prostaglandins Leukot Essent Fatty Acids* (10), *Cancer Lett* (9), *Br J Cancer* (9), *Eur J Cancer Prev* (8), *Oncology* (8) and *J Med Virol* (7).

The average cost to CANSAs for the appearance of a peer-reviewed publication was close on R50 000. The number of publications per grantee over the period analysed varied considerably, from zero to 79, with 10% of grantees publishing more than 10 (one per year), while a significant group of 36% did not publish at all. In order to analyse this output distribution in more detail, the number of publications per researcher was normalised per R100 000, i.e. one publication resulting from a grant of R50 000 would be recorded as two publications for R100 000, and so on, as shown in Figure 1.

The average for the whole group is 2.18 publications per R100 000. However, it can be seen that 46 (36%) of the grant recipients did not publish at all (grantees 1 to 46 in Figure 1). The average for the publishing group was 6.86 publications per R100 000, and the most prolific researcher published 15 publications per R100 000 over the period. In absolute terms, this amounted to 79 publications over 10 years.

Portfolio of projects

In order to ascertain the main focus areas, the 192 projects were divided into an ascending hierarchy of categories according to the number of projects per category, as shown in Table I.

It can be seen from Table I that more than two-thirds of the projects concerned cancer biology and therapy (shaded areas), while epidemiology, prevention, early detection and the psychosocial aspects of cancer were the subjects of only 20% of the projects.

Figure 1: Number of publications per R100 000 CANSAs research grant, 1994–2003

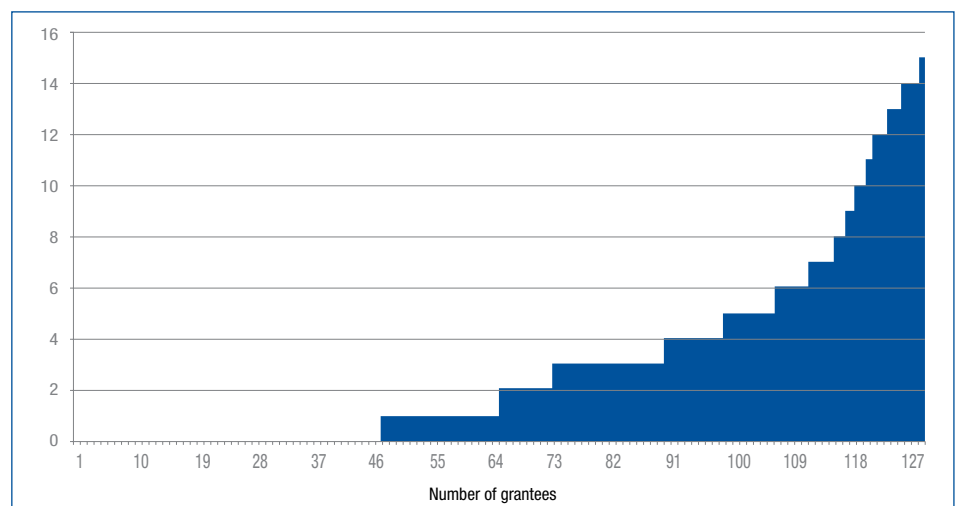


Table I: Number of CANSA-funded cancer research projects in different categories (1994–2003)

	Category	No of projects	Percentage
1	Cancer biochemistry	43	22
2	Therapy-laboratory studies	24	12
3	Cancer physiology	16	8
4	Prevention-laboratory	16	8
5	Therapy-clinic chemotherapy	15	8
6	New drugs	12	6
7	Therapy-clinic radiotherapy	11	6
8	Epidemiology	11	6
9	Psychosocial aspects: stress	10	5
10	Diagnosis biochemistry	9	5
11	General	7	4
12	Early detection pathology	5	3
13	Psychosocial aspects: perceptions	4	3
14	Psychosocial aspects: quality of life	3	2
15	Therapy-clinic surgery	2	1
16	Prevention-education	2	1
17	Health promotion	1	< 1
18	Prevention-vaccine	1	< 1
	Total	192	100

Discussion

How good was the output?

The output of 570 publications over 10 years by 129 researchers, with a mean journal impact factor of 3.8 at a total cost of R28.2 million (\$4.76 million)¹² and an average CANSA grant of R50 000 per publication, may seem to be exemplary from a quantitative and qualitative point of view. However, there appears to be no mechanism for making value judgments, because in every case the CANSA award is an unknown fraction of the real total cost of each individual publication. In order to make really accurate comparisons, much more data would be needed, including a breakdown of the grant budget (salaries, consumables, apparatus, travel) per project, as very few CANSA grants include funds for assistants or technical personnel. Furthermore, the salary of the principal investigator is never paid by CANSA, while NIH grants, for instance, often cover this expenditure.

Nevertheless, some comparative indicators were found. The impact factors of oncology publications in oncology journals in the European Union for 1999 were 2.4 for publications emanating from the European Union (EU) and 3.3 for those from the United States.¹³ The average impact factor of 3.8 for the CANSA grantees compares favourably with this. Furthermore, evidence was found of biological publications costing between \$37 000 and \$251 889 in the timeframe when the average CANSA grant was about R50 000 (or \$8 000).^{14,15,16} It is concluded from this that the international total cost per publication varies widely, but is substantially higher than an average CANSA grant, suggesting that the grant, which is only a fraction of the total expenditure, appears to be a good investment for facilitating the creation of peer-reviewed publications in the South African context.

Why did so many not publish?

As shown in Figure 1, more than a third of the CANSA grantees ($n = 46$, 36%) did not publish anything up to 2005, despite receiving CANSA grants totalling R6.2 million (\$1.05 million) over 10 years (1994–2003). In one case, zero publications were detected after 3.5 years of funding that totalled over R1 million, and the project was stopped forthwith in its fourth year. In most cases it only became clear in year 4, after three years of CANSA funding, that no publications were forthcoming. The agreement between CANSA and the grantee and research institution does not mention any conditions concerning the quantity or quality of publications relative to receiving the grant. It has always been an implicit belief that the researchers would publish to a greater or lesser extent. Analysis of the 46 non-publishing grantees yielded some information that could explain why these grantees did not publish. In almost every case, there was only one application and one project, while the most prolific researchers reapplied for funding every three years – for more than a decade in some cases. Because they did not have any intention of reapplying for a new cycle of funding, non-publication was probably not an issue for the non-publishers. Furthermore, CANSA only funds PhD and/or medically qualified principal investigators. Exceptions were made to this rule in six cases in which investigators without these qualifications were funded, and in each case no publications materialised, probably due to inexperience. In eight cases the principal investigator abandoned the project for various reasons, such as leaving the project, the institution or the country or receiving major funding from another source. In three cases there were no publications towards the end of the third year and the senior principal investigators were given the benefit of the doubt that publications would appear during a further cycle of three years, which again yielded nothing. Of the remaining 24 investigators, 12 were PhDs and 12 were medically qualified. There is no obvious reason why they did not publish.

Petrak and Bozikov did a thorough analysis of journal publications at Zagreb University Medical School from 1995 to 1999.¹⁶ They also found a high variance in the number of publications on the individual level, with 15.4% of the faculty at the rank of professor and 45% at assistant rank not publishing a single paper in the period analysed. No explanation was given. It is clear that the loss of R6.2 million of CANSA research funds due to non-publication cannot be tolerated any further. The funds come from the public, who expect maximum efficiency in the investment, management, application and good governance of the funds. The zero productivity of 46 investigators has diluted the sterling performance of the other 83 who did publish. In order to try to rectify this situation permanently, it has been decided, as policy, that the fourth quarterly payment of any three-year grant, which is due in April of the fourth year, will not be paid if there is no evidence of a publication or manuscript in the final progress report at the end of the third year.

Criteria for CANSA research funding

Table I shows that only 16% of projects conducted in the analysed period involved the psychosocial aspects of cancer, such as coping with cancer, preventive education, epidemiology and health promotion. This low level of funding for research on the psychosocial aspects of cancer was not due to unfair bias or the irrational rejection of suitable applications concerning these subjects. For the past 25 years the CANSA Research Committee has selected projects purely on merit and there is no proof to the contrary. The low number of psychosocial projects selected was due to the low number submitted and/or insufficient merit. South Africa

needs to focus on the early detection and prevention of cancer because of the cost-benefit ratio compared to treatment. Excellent projects in this direction are urgently needed and young, excellent psychosocial researchers should be encouraged to apply. Nevertheless, it should be self-evident that, no matter which aspect of cancer is most deserving for attention at any moment, in any country, the final decisions should concern merit only. In order to obtain an overall picture of the merit of the applicant for a research award, there should be documentation pertaining to peer-review reports and all substantive PubMed-referenced publications, including reviews, editorials, books, chapters and patents, impact factors, past funding and the period of past research. This is the foundation on which new projects are to be built, looking specifically at innovation, feasibility and the overall importance of the project for the struggle against cancer in South Africa and the world.

Conclusion

The output of 570 peer-reviewed publications over 10 years (1994 to 2003), with an average impact factor of 3.8, by 129 researchers who had received 192 CANSA grants totalling R28.2 million appears to be exemplary in terms of the limited available international indicators.¹³⁻¹⁶ However, no information was available to make any direct comparisons and value judgments concerning the return on the investment, because CANSA grants only pay for a fraction of the research costs, and these costs vary from project to project. Nevertheless, a benchmark has been established that a R50 000 grant facilitated the appearance of one peer-reviewed publication in the South African CANSA environment from 1994 to 2003. This benchmark may only have some measure of relevance within the CANSA-related cancer research award environment.

The most popular subjects of research were cancer biology and experimental treatment modalities in the laboratory and in the clinic. In order to bring about more balance in future between different aspects of cancer, more attention and funding needs to be focused on the prevention, early detection, epidemiology and social aspects of cancer, such as care involving palliation.

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Conflict of interest

Employed by CANSA as Head of Research.

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