

A PubMed-based Quantitative Analysis of Biomedical Publications in the SAARC Countries: 1985-2009

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ABSTRACT

Objective: To conduct a geographical analysis of biomedical publications from the South Asian Association for Regional Cooperation (SAARC) countries over the past 25 years (1985-2009) using the PubMed database.

Study Design: A qualitative study.

Place and Duration of Study: Web-based search during September 2010.

Methodology: A data extraction program, developed by one of the authors (SFS), was used to extract the raw publication counts from the downloaded PubMed data. A search of PubMed was performed for all journals indexed by selecting the advanced search option and entering the country name in the 'affiliation' field. The publications were normalized by total population, adult illiteracy rate, gross domestic product (GDP), secondary school enrollment ratio and Internet usage rate.

Results: The number of PubMed-listed papers published by the SAARC countries over the last 25 years totalled 141,783, which is 1.1% of the total papers indexed by PubMed in the same period. India alone produced 90.5% of total publications generated by SAARC countries. The average number of papers published per year from 1985 to 2009 was 5671 and number of publication increased approximately 242-fold. Normalizing by the population (per million) and GDP (per billion), India (133, 27.6%) and Nepal (323, 37.3%) had the highest publications respectively.

Conclusion: There was a marked imbalance among the SAARC countries in terms of biomedical research and publication. Because of huge population and the high disease burden, biomedical research and publication output should receive special attention to formulate health policies, re-orient medical education curricula, and alleviate diseases and poverty.

Key words: *Biomedical research. Medical education. PubMed. SAARC.*

INTRODUCTION

In recent years, biomedical and medical education research in Asia has gained importance. Furthermore, disparities in research output exist among the countries within the region. Many researchers highlighted marked disparities and low priorities of research in the field of medical education and biomedical sciences in Asian countries.¹⁻³ There is a noticeable under-representation of science, health and clinical research publications from

Asia and other developing countries in the top-ranked journals.^{1,4,5} In science and technology, India, Pakistan and Sri Lanka combined have 382 researchers per million citizens as compared to 4,663 researchers in the USA and 2,881 researchers in the UK.⁶ In these three countries, the combined expenditure on research and development as a percent of gross domestic product (GDP) is 1.64% as compared to 2.67% in USA and 1.84% in the UK.⁶ The purpose of this study was to perform a geographical analysis for the number of biomedical and clinical research publications from the South Asian Association for Regional Cooperation (SAARC) countries over the past 25 years (1985-2009) using the PubMed database.⁷

The SAARC was established on December 8, 1985 as an economic and political organization in southern Asia. The member countries are Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. Its aim was to provide a platform to promote the welfare of the peoples and to improve their quality of life through accelerated economic growth, social progress and cultural development. Despite diversity in their geographical, linguistic, and political structures, all these countries face common health challenges and have some of the poorest health indicators in the world.² SAARC countries also exhibit a high level of human

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deprivation (low level of human capability) and the Human Poverty Index (HPI) is quite high in these countries, except for the Maldives and Sri Lanka.⁸ The region holds a fifth of the world's population (1.5 billion) and bear a triple burden of persisting infectious diseases, increasing non-communicable conditions and a growing recognition of injuries and violence.² Available data suggest that over three-fourth of South Asians live on less than two USD per person per day which indicates extreme poverty⁸ and susceptibility to poverty-related diseases. Because of the huge population and high disease burden, health related research is very important for this region. It is optimistic that SAARC countries have seen a significant growth over the past few decades in health care facilities including establishing of new educational and research institutions.

The objective of this study was to conduct a descriptive analysis of biomedical publications in the SAARC countries as indexed in PubMed from 1985 to 2009.

METHODOLOGY

A PubMed-based quantitative analysis was carried out for each SAARC country covering a 25 years period, from 1985 to 2009. During the first week of September, 2010, a search of PubMed was performed for all indexed journals. For each country of interest, a search was carried out by selecting the advanced search option and entering the country name in the 'affiliation' field (e.g. Bangladesh). Finally, the results were sorted by the 'Publication Date' on a yearly basis. A data extraction program, developed by one of the authors (SFS),⁹ was used to extract the raw publication counts from the downloaded PubMed data. The details of the method used to extract the data from PubMed are discussed elsewhere.⁹ Raw publication counts were normalized (adjusted) using several indicators to provide a fair comparison of research publications among different countries. The country indicators used were total population, adult illiteracy rate, GDP, secondary school enrollment ratio and Internet usage rate. The data for the above indicators were obtained from the following sources: average of the country's 1985, 1990, 1995,

2005 and 2008 population and GDP from the World Bank,¹⁰ adult illiteracy rate (2000-2007) from World Health Statistics 2009,¹¹ secondary school enrollment ratio (2003-2008) for either gender from the United Nations Educational, Scientific and Cultural Organization (UNESCO)⁶ and Internet usage from Internet World Stats.¹² Statistical analysis was performed using Microsoft Excel (2007) for descriptive analysis and linear regression to demonstrate the status and slope of the trend line for publications in each country.

Microsoft Excel statistical software was used to calculate the correlation between the rate of publication and increase in rate of publication using the CORREL function in Excel which uses the following formula to calculate the correlation coefficient.

$$\text{Correl}(X, Y) = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

This correlation was found to be high ($r = 0.999945$).

RESULTS

The number of PubMed-listed biomedical research papers published in the eight SAARC countries over the last 25 years totalled 141,783 articles which is 1.1% of the total papers indexed by PubMed in the same period.⁷ Table I shows the average annual PubMed-listed biomedical research publications per country and adjusted publications using various indicators. The relative increase in number of publications in SAARC region from 1990-1999 was 59% and 2000-2009 was 271%, and the average number of papers published per year from 1985 to 2009 was 5671. In the last two and a half decades, the number of publications increased by approximately 242-fold, 1.6-fold from 1990 to 1999. The increase was 3.7-fold in the last decade (2000-2009).

India produced 90.5% of total biomedical publications generated by the SAARC countries followed by Pakistan (4.8%), Bangladesh (1.9%), Nepal (1.4%), Sri Lanka (1.4%), and Afghanistan, Maldives and Bhutan have less than 1%. Hence, in terms of number of publications, India was by far the most prolific of the eight SAARC countries (Table I). The relative increase in number of

Table I: Total and adjusted biomedical publications in SAARC countries: 1985-2009.

	Total publications (% of total)				Publications per million population (adjusted) (% of total)	Publications per billion GDP (adjusted) (% of total)	Publications per million literacy (adjusted) (% of total)	Publications per school enrollment ratio (adjusted) (% of total)	Publications per 1000 internet users (adjusted) (% of total)
	1985-1989	1990-1999	2000-2009	1985-2009					
Afghanistan	01 (0.02%)	11 (0.03%)	52 (0.05%)	64 (0.05%)	03 (0.63%)	12 (1.37%)	11 (1.50%)	03 (0.12%)	0.3 (1.07%)
Bangladesh	95 (2.05%)	809 (2.57%)	1,787 (1.74%)	2,691 (1.90%)	20 (4.19%)	59 (6.76%)	38 (5.25%)	61 (2.26%)	08 (34.54%)
Bhutan	02 (0.04%)	02 (0.05%)	13 (0.01%)	17 (0.01%)	30 (6.17%)	31 (3.58%)	53 (7.42%)	0.3 (0.01%)	0.8 (3.58%)
India	4,262 (92.1%)	28,453 (90.4%)	95,593 (90.2%)	128,308 (90.5%)	133 (27.59%)	227 (26.22%)	201 (27.98%)	2,376 (87.6%)	03 (13.24%)
Maldives	-	03 (0.01%)	10 (0.01%)	13 (0.01%)	51 (10.62%)	23 (2.67%)	53 (7.33%)	0.2 (0.01%)	0.3 (1.41%)
Nepal	18 (0.39%)	260 (0.83%)	1,705 (1.69%)	1,983 (1.40%)	86 (17.93%)	323 (37.26%)	153 (21.24%)	45 (1.66%)	07 (30.39%)
Pakistan	156 (3.37%)	1,333 (4.23%)	5,268 (5.06%)	6,757 (4.77%)	52 (10.73%)	84 (9.69%)	94 (13.08%)	205 (7.55%)	0.7 (3.05%)
Sri Lanka	96 (2.07%)	581 (1.85%)	1,273 (1.23%)	1,950 (1.38%)	107 (22.15%)	108 (12.46%)	117 (16.20%)	22 (0.83%)	03 (12.77%)
Total	4,630	31,452	105,701	141,783	481	866	719	2,713	24

publications in India from 1990-1999 was 60% and 2000-2009 was 262% and the average number of papers published per year from 1985 to 2009 was 5,132. In the last 10 years (2000-2009), the number of publications increased by approximately 6-fold in Pakistan, 5-fold in Nepal, 4-fold in Sri Lanka, 4-fold in India and 3-fold in Bangladesh.

Normalizing by the population indicator, India had the highest research publications with 133 (27.6%) publications per million populations (Table I). Sri Lanka was second with 107 (22.2%) publications followed by Nepal with 86 (17.9%). Normalizing by the GDP indicator, Nepal had the highest research publications with 323 (37.3%) per one billion average yearly USD GDP at current values (Table I). India was second with 227 (26.2%) publications followed by Sri Lanka with 108 (12.5%). The next two indicators used were adult illiteracy rate and secondary school enrollment ratio. For both indicators, India had the highest publications 201 (28%) per million literacy ratio and 2,376 (87.6%) per enrollment (Table I). Nepal was second with 153 (21.2%) per million literacy followed by Sri Lanka with 117 (16.2%) publications. For secondary school enrollment ratio, Pakistan ranked second with 205 (7.6%) per enrollment ratio followed by Bangladesh with 61 (2.3%) publications. Normalizing by Internet usage, Bangladesh had the highest research publications with 8 (34.5%) publications per 1000 Internet users followed by Nepal 7 (30.4%) and India 3 (13.2%) (Table I).

Figure 1 shows a trend graph of the three countries (India, Pakistan and Bangladesh) with the highest raw publication rates. The trend line for India shows that on average around 560.7 additional medical publications are produced each year. This number is known as the slope of the trend line. Pakistan and Bangladesh show trend line slopes around 33.6 and 9.8 respectively. The slope or yearly increase in publication rates for all SAARC countries were calculated for the 25-year period shown in Figure 2. The comparison of Table I and Figure 2 shows that the higher the rate of publications, the higher the slope for that country.

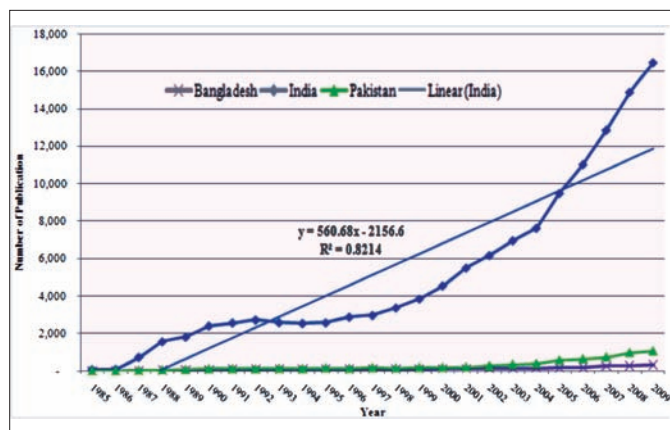


Figure 1: Publication trends for top three SAARC countries.

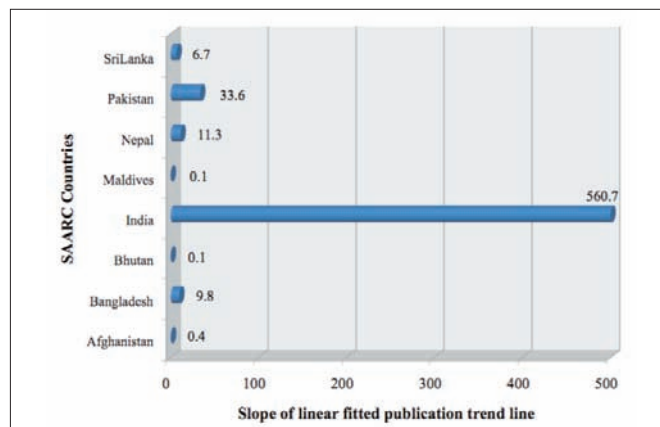


Figure 2: Publication trend (slope) for each SAARC country.

DISCUSSION

Health research provides timely and accurate evidence-based strategic information about the extent and burden of health-related problems of a country and helps to formulate policies, set priorities and use the limited healthcare resources effectively and efficiently to increase the quality of life of the population. According to some estimates, less than 10% of the world's biomedical research and development funds are earmarked for 90% of the world's burden of disease.¹³ Though 93% of the world's burden of preventable mortality occurs in 'resource-poor' countries, too little research funding is allocated to address the health problems in those countries.¹⁴

Researchers in the developing countries are either reluctant to adequately participate in the research process and as a result miss the 'benefits' and become 'users' of research findings³ or do not publish their findings and consequently "important information from less-developed countries is lost to a wider audience."¹⁵ The number of papers published in the BMJ with corresponding authors in countries (most are developing countries) other than Europe, North America, Australia and New Zealand from 2004-2008 were 5.4%.⁴ Another study showed that there is a marked under-representation of developing countries in high-impact general medical Journals (BMJ, Lancet, NEJM, Annals of Internal Medicine and JAMA).⁵ The present study also confirmed the poverty of overall research status in the biomedical field in SAARC countries. It is speculated that many of the Millennium Development Goals (MDGs) will not be achieved;¹⁶ and one of the important reason is that almost all MDG related research is funded and conducted by the 'North'.¹⁶

The reports on the number of biomedical publications of different countries of the world,³ Arab World,⁹ Asian countries^{4,17} and SAARC region¹⁸ have been published. The imbalance of research productivity between developed and developing countries is significant and

the situation in the Asia is not impressive. Sadly, important research findings and data in this region “has gone unnoticed, untapped, unpublished and unretrievable”¹⁹ and “the distribution of research topics and the quality of research reports continue to be unsatisfactory”.²⁰ Rahman and Fukui studied the global profile and trend of biomedical publications from 1990-2000 and found that developing countries (from Africa, Asia, and South America) fall behind the developed world (Europe, North America, and Australia) in terms of both the number of publications and the total volume of research.^{3,4} Study conducted to demonstrate the collaboration patterns among SAARC countries in the area of health by analyzing the PubMed-indexed papers published on 1997 and 2002 showed a substantial increase in the publication activity in most of the countries, decrease in collaborative publications by other countries, and increase in co-authored papers among SAARC countries.¹⁸

The findings of the present study also highlight the marked regional disparities in biomedical publication output; seven SAARC countries except India published only approximately 10% of the total PubMed-indexed papers since SAARC was established. India has an established record of research and publication of basic, clinical and public health research, which was also shown by the previous studies.^{3,17,18,20} India was in the list of 20 top-ranking countries in terms of research volume (period 1990-2000)³ and was in the top 10 countries based on publications per 1 billion USD GDP.¹⁷ Another study demonstrated an increase in the availability of public health research output from India over the past few years.²⁰

SAARC region has the greatest total disease burden of any region in the world and relevant public health research is crucial in each country to alleviate this burden.^{19,20} The cause of low level of publications in other SAARC countries is that health research is not a priority sector and researchers are not adequately trained and motivated to conduct quality research.^{1,17,21} In Bhutan and the Maldives, there are no medical schools and the research infrastructure and funding appear to be inadequate.¹⁸ Most of the researchers are trained in overseas institutions and usually they publish papers in affiliation with those institutions even though research is conducted in and funded by home countries. Afghanistan joined SAARC in 2007; the low level of publication may be due to the continuous state of war in the country since late 1970s. However, an increasing trend of publication has been observed in Afghanistan in last decade with a 4.7-fold increase from 2000 to 2009. In Pakistan, medical research has progressed quantitatively during the period of 1992-2002 and mean impact factor of journals publishing papers from Pakistan increased by 41% during this period.²² This rising trend is supported by the present as well as a previous study.¹⁸

A study conducted in Bangladesh (1990-1996) to quantify the volume of health related research found that about two-thirds of the research was conducted by an international organization, ICDDR (International Centre for Diarrheal Disease Research) and the average number of research articles was less than one per year from medical school attached tertiary teaching hospitals.²³ This issue is crucial as medical research is not given high priority by medical and scientific community in the region;^{1,21} there is an urgent need to boost the research activities by incorporating research methodology in medical curricula, appointing researchers in clinical and academic departments and allocating more funds to conduct research. A possible solution to increase the status of research is to make research involvement an obligatory part of medical schools' curricula,² e.g. involving medical students in designing and implementing research study;²¹ awarding medical degree to medical students only after they have authored a research project;²⁴ and introducing dual-degree programs (e.g. MD-PhD, MD-MPH).²⁵ Medical schools and other health professional institutes should develop mechanisms to create a 'research culture' to produce evidence-based information that “can be used by every stakeholder - from policy makers to medical teachers - to increase the relevance, quality, cost-effectiveness and equity of medical education, which have a direct impact on the healthcare of the region [Asia] where about 60% of the world population resides”.¹

The countries of the SAARC region face similar health problems and there are many areas where cooperation among SAARC countries would be mutually beneficial.^{2,18} The countries of the region need to define priority health problems, set appropriate agendas and mobilize funds to conduct their own health research securing appropriate support from SAARC Secretariat, World Health Organization (WHO) and other national and international organizations. Overall, a 'systems perspective' should be in place focusing on stewardship, finance, human and institutional capacity, and production and utilization of research to overcome the health research and health system challenges.² Steps should be taken to enhance collaboration and share national experiences; support cross border training; develop research network, databases, capacity and infrastructure; establish long-term political visibility of research on health and patient care; and use of health research to formulate policy and professional practices and provide quality healthcare. Further studies should be carried out to assess health research output by incorporating findings of published research reports and establishing relationship with disease burden and health system priorities in SAARC region. Other developing countries/regions should take similar approaches to improve health research output, formulate evidence-

based policies and enhance the quality of people's lives by turning 'knowledge into power'.

There are a number of limitations of this study related to data source and the search strategy, as mentioned by previous studies. PubMed provides a crude estimate of research productivity; it was found that research findings are published in many local journals and sometimes in their native language without being cited in PubMed.^{3,9,17} As PubMed database considers only the corresponding authors' affiliations as a place of origin of the article, contribution of other authors from other countries in collaborative studies is not considered.⁹ Moreover, inclusion of review of reports commissioned or initiated by governmental, international or other funding organizations or by academic institutes and through analysis of other biomedical databases would together provide most up-to-date picture of biomedical research output of the region.²⁰ If above-mentioned factors were taken into consideration, the actual amount of research output for each country would be higher than currently reported.^{3,17}

CONCLUSION

The imbalance among the SAARC countries in terms of biomedical research and publications is marked and research as a whole receives low priority in this region. As the region holds a fifth of the world's population and bears a triple burden of persisting infectious diseases, increasing non-communicable conditions, and a growing recognition of injuries and violence, emphasis should be given to increase productivity of biomedical research and publications to shape health policies, re-orient medical education curricula, and alleviate diseases and poverty.

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