



Original article

The research output from medical institutions in South Asia between 2012 and 2017: An analysis of their quantity and quality



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ABSTRACT

Introduction: The eight countries of South Asia share similar backgrounds, together with similar health care related problems and a lack of medical facilities. They also have a total of 828 medical institutions both in the public and private sectors but sadly, their research output is generally thought to be poor both in quality and quantity.

Methods: We analyzed the research output from this region in terms of the number of publications in indexed journals, their citations and the h-index of the institutions using the Scopus database between 2012–2017. These were compared with ten randomly selected leading institutes of the world.

Results: Only 353 (42.7%) had produced a single indexed research article in the six years of the study period. The cumulative research output of all the countries during this period was 97,170, the biggest contributor being India (86.3%) followed by Pakistan (9.9%) and Bangladesh (1.4%). In terms of the mean number of the citations and h-index, India led with 1775 citations per institute with a mean h-index of 12.1.

Conclusion: Despite the immense health problems facing the countries, the overall research output from the South Asian countries is poor as evidenced by the cumulative number of publications or a comparison on a global scale. This needs urgent and serious attention. We suggest that intercountry research collaborations, student exchanges, compulsory research projects in undergraduate and postgraduate curricula, adequate funding, and incentives for research publication may be some of the ways forward.

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1. Introduction

South Asia consists of eight countries – Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka – which are related to each other historically and comprise almost a quarter of the world's population. The region has many similar socioeconomic, cultural, educational, and political characteristics as well as challenges.^{1,2} Its health systems are generally inaccessible, inadequate, and unequally distributed. There is also a scarcity of data on not only the prevalence of disease but also the results of

treatment and the distribution of health facilities. The evidence for the most aspects of the region's health care is largely derived from the experience of research carried out in Western countries and published in Western journals, much of which is of little relevance to countries where patients are generally poor and have very different diseases and little access to expensive technology. There is thus a pressing need for research into health care in South Asia which is relevant to the region's needs. However, this has been sadly lacking.

Although South Asian countries have a large number of medical institutes and teaching hospitals, with most of them in its most populous countries India, Pakistan, and Bangladesh, their research output is generally minuscule compared with most advanced nations and is often not relevant to the region's needs.^{3–6} Factors such

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as overwhelming patient numbers, paucity of doctors, a lack of incentive to perform research, and the absence of training in research methodology as a part of the curriculum in undergraduate and most of the postgraduate training programs have been cited as some of the major reasons why the output has been so poor.^{7–9}

Some of us had previously carried out a quantitative analysis of the research output from the 579 medical institutes in India and found that 57% of them had not published a single article which was included in the Scopus database between 2005 and 2014.¹⁰

In this study, we have extended this analysis to include the other countries in South Asia over a more recent period, 2012–2017, and have assessed the quantity and quality of their research output.

2. Materials and methods

Using the Scopus database, we:

- Analyzed the total number publications from the individual medical institutes and teaching hospitals from the South Asian countries over the last six years,
- Assessed the quality of publications using the total number of citations and the h-index,
- Compared the research output of the countries, both in terms of quantity and quality, and
- Compared the research output with some of the best-known academic medical centers in the world.

2.1. Quantitative analysis

The total number of documents (including randomized controlled trials [RCTs], systematic reviews and meta-analyses, original articles, review articles, case series, case reports, conference proceedings, and symposia reports) produced by the medical institutes from the eight nations was calculated over the period of six years and tabulated on an Excel sheet.

The institutes were searched according to the various formatting permutations and combinations of their respective names, using the *affiliation search* on the Scopus database. (For example, Sir Ganga Ram Hospital or Sir gangaram hospital or Sir ganga ram hospital, etc). The total number of documents retrieved was filtered from 2012 to 2017, and the number tabulated. The average number of publications (per institute) was calculated for the individual nations and compared.

The subsequent ranking was done as follows:

1. The total number of publications from the top 30 institutes was ranked in a descending order.
2. Top 10 institutes from the individual nations were listed in a descending order according to their total number of publications.
3. The top 25 institutes in the region were compared with 10 of the best-known medical institutes in the world.

2.2. Qualitative analysis

The total number of citations and the h-index were tabulated for each medical institute for the period of study (2012–2017).¹¹

The subsequent ranking was performed as follows:

1. Top 30 institutes from South Asia in the descending order of their overall number of citations.
2. Top 30 institutes in the descending order of their h-index.

3. Comparison of the top 20 institutes from South Asia with 10 best-known medical institutes worldwide.

2.3. Patient and public involvement

The present study did not involve any cohort of patients or public. Therefore, informed consent was not applicable to the same. The authors calculated the total number of publications and the quality indicators of all the individual institutions during the study period and presented an analysis of the same.

3. Results

The publications from a total of 828 medical institutes in the region were studied. Of these, 580 (70%) were from India, 105 (12.5%) from Bangladesh, 71 (8.5%) from Pakistan, 52 (6.2%) from Nepal, 8 (0.9%) from Sri Lanka, 7 (0.8%) from Bhutan, 4 (0.5%) from the Maldives, and 1 (0.1%) from Afghanistan. They together produced a total of 97,170 articles during this period, with the largest contribution of 83,892 (86.3%) from India, followed by 9665 (9.9%) from Pakistan, 1402 (1.4%) from Bangladesh, 1367 (1.4%) from Nepal, 837 (0.9%) from Sri Lanka, and 6, 4, and 3 articles from Afghanistan, Bhutan, and the Maldives, respectively, (<0.1%). Of the 828 total institutes from the South Asian Association for Regional Cooperation (SAARC) nations, there was research output from only 354 according to the records of the Scopus database (42.7%).

Fig. 1 shows the comparison of the nations in terms of the total number of medical institutes analyzed, the mean number of publications during 2012–2017, and the average number of citations and h-index. India led in the mean number of publications ($n = 376$), followed by Pakistan ($n = 136$) and Sri Lanka ($n = 104$). In terms of the average number of citations, India led again with 1775 citations per institute, followed in sequence by Sri Lanka ($n = 532$) and Nepal ($n = 503$). India also had the highest mean h-index ($n = 12.1$), followed in sequence by Pakistan ($n = 7.4$) and Nepal ($n = 4.4$).

Table 1 shows the list of the top 30 institutes in South Asia, in terms of the total number publications from 2012 to 2017. These contributed to 53.3% of the total ($n = 51,774$). The top 10 institutes were from India, which contributed to 32% of the total research. These were the All India Institute of Medical Sciences (AIIMS), New Delhi; Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh; Christian Medical College (CMC), Vellore; Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow; Kasturba Medical College (KMC), Manipal; Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry; Tata Memorial Hospital (TMH), Mumbai; Maulana Azad Medical College (MAMC), New Delhi; Amrita Institute of Medical Sciences (AIMS), Kochi; and Medical College, Kolkata in the descending order. Two institutes from Pakistan also featured in this list, with the Aga Khan University Hospital and the Dow University of Health Sciences being placed at the 13th and 25th positions, respectively.

Table 2 shows the top publishers from the individual nations during 2012–2017. The most prolific in terms of the total research output were Kabul University ($n = 6$) in Afghanistan, Bangabandhu Sheikh Mujib Medical University (BSMMU) ($n = 504$) in Bangladesh, Bhutan Royal University, Thimphu ($n = 4$) in Bhutan, AIIMS, New Delhi ($n = 8491$) in India, Indira Gandhi Memorial Hospital ($n = 2$) in the Maldives, B.P. Koirala Institute of Health Science ($n = 308$) in Nepal, the Aga Khan University Hospital ($n = 1339$) in Pakistan, and the University of Colombo, Faculty of Medicine ($n = 530$) in Sri Lanka.

Table 3 shows a global comparison of the top 25 most prolific institutions from the SAARC with 10 well-known medical

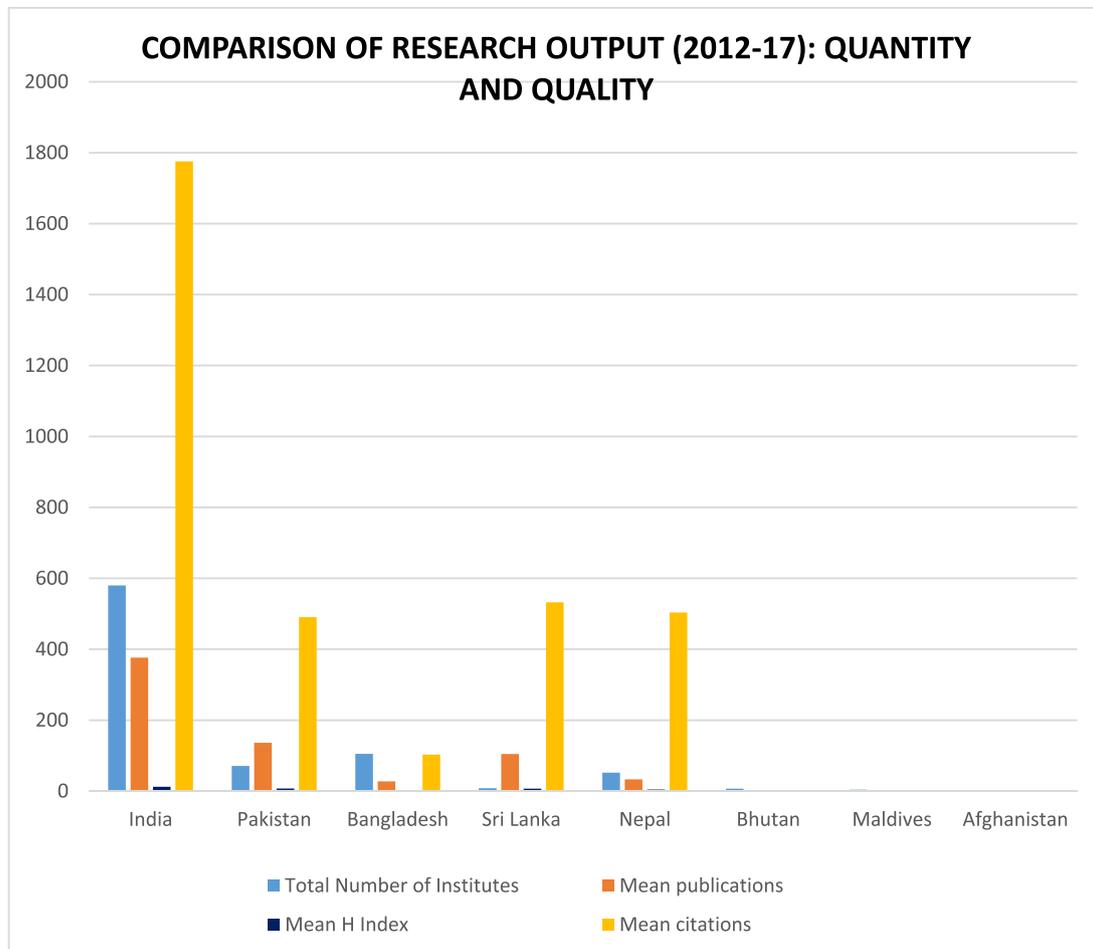


Fig. 1. Overall comparison of the medical institutions of South Asian countries (qualitative and quantitative).

institutions worldwide. The list is a random comparison with some academically prolific institutes from all over the world and is not to be construed as a global ranking of the institutes. The Mayo Clinic, Rochester, USA, produced 44,272 articles between 2012 and 2017, which was equivalent to 45.5% of the total research output of all the South Asian nations during this period. In comparison, the most prolific institutions in the SAARC region, i.e., the AIIMS, New Delhi, and PGIMER, Chandigarh, India, produced 8491 and 7681 articles during the years of assessment, comprising just 19% and 17%, respectively, of the total research output from the Mayo Clinic.

Table 4 shows the top 30 institutes in South Asia in the descending order of their overall citations. The AIIMS, New Delhi, leads with a total of 51,574 citations against 8491 publications during this period, with 6.1 citations per publication followed by PGIMER, Chandigarh ($n = 46,049$); SGPGIMS, Lucknow ($n = 20,568$); TMH, Mumbai ($n = 15,004$); AIMS, Kochi ($n = 12,254$); CMC, Vellore ($n = 11,825$); B.P. Koirala Institute of Health Sciences, Nepal ($n = 11,409$); Fortis Healthcare, India ($n = 10,537$); CMC, Ludhiana ($n = 10,457$); and Sree Chitra Thirunal Institute of Medical Sciences and Technology, Thiruvananthapuram ($n = 10,447$) who are the top 10.

Table 5 shows the top 30 institutes in the descending order of their h-indices. PGIMER, Chandigarh, tops this list with an h-index of 63 between 2012 and 2017. This is followed in sequence by the AIIMS, New Delhi ($h = 60$); AIMS, Kochi ($h = 47$); CMC, Vellore ($h = 40$); SGPGIMS, Lucknow ($h = 37$); TMH, Mumbai ($h = 37$); Sree Chitra Thirunal Institute of Medical Sciences and Technology,

Thiruvananthapuram ($h = 36$); St. John's Medical College, Bengaluru ($h = 35$); Asian Institute of Gastroenterology (AIG), Hyderabad ($h = 32$); and LV Prasad Eye Institute, Hyderabad ($h = 30$), among the top 10. Among the other nations in the list of top 30, the University of Colombo, Faculty of Medicine, Sri Lanka, stands at the 14th place, with an h-index of 27.

Table 6 illustrates the global comparison of nations with the 10 selected well-known institutes from all over the world, in terms of the quality of research (defined by the citations and the h-index). The list is in the descending order of the total number of citations. Massachusetts General Hospital, USA, leads the list, with a figure of 8,31,663 citations against 40,401 publications from 2012 to 2017, making it 20.5 citations per publication, with an h-index of 296. Among the SAARC nations, the AIIMS, New Delhi, stands at the 10th position in this random global comparison, with 51,574 citations (6.2% of the total number of citations by Massachusetts General Hospital) and an h-index of 6.1.

4. Discussion

Our findings suggest that despite the strong emphasis on the importance of medical research in most Western countries, the overall number of publications from South Asia is very low. The populations in this region suffer both from communicable and noncommunicable diseases, some of which are unique to these countries and occur against a background of widespread poverty, a

Table 1
Top 30 institutes from the SAARC nations in terms of the number of publications, 2012–2017.

S. No.	Name of the institute	Country	Publications	h-index	Citations
1	All India Institute of Medical Sciences, New Delhi	India	8491	60	51,574
2	Post Graduate Institute of Medical Education and Research, Chandigarh	India	7681	63	46,049
3	Christian Medical College, Vellore	India	2385	40	11,825
4	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	India	2297	37	20,568
5	Kasturba Medical College, Manipal	India	1993	22	3970
6	Jawaharlal Institute of Postgraduate Medical education and Research, Puducherry	India	1988	24	5416
7	Tata Memorial Hospital, Mumbai	India	1818	37	15,004
8	Maulana Azad Medical College, New Delhi	India	1723	26	5778
9	Amrita Institute of Medical Sciences, Kochi	India	1406	47	12,254
10	Medical College, Kolkata	India	1359	21	3624
11	University College of Medical Sciences, New Delhi	India	1358	25	4281
12	Vardhman Mahavir Medical College, New Delhi	India	1352	25	4249
13	The Aga Khan University Hospital	Pakistan	1339	22	5208
14	LV Prasad Eye Institute, Hyderabad	India	1332	30	8326
15	Sree Chitra Thirunal Institute of Medical Sciences and Technology	India	1224	36	10,447
16	Lady Hardinge Medical College	India	1208	23	3728
17	Post Graduate Institute of Medical Sciences, Rohtak	India	1135	22	3196
18	Institute of Postgraduate Medical Education and Research, Kolkata	India	1067	26	4806
19	Kasturba Medical College, Mangalore	India	1033	19	3000
20	Dr. Ram Manohar Lohia Hospital	India	946	18	2202
21	Government Medical College, Chandigarh	India	929	23	3557
22	Jawaharlal Nehru Medical College, Aligarh	India	923	25	3703
23	Armed Forces Medical College, Pune	India	913	17	2918
24	Sir Ganga Ram Hospital	India	900	22	4254
25	Dow University of Health Sciences, Pakistan	Pakistan	886	18	2165
26	Nizam's Institute of Medical Sciences, Hyderabad	India	842	28	4419
27	Apollo Hospital Group, Chennai	India	840	27	3945
28	Sree Balaji Medical College and Hospital, Chennai	India	818	18	1184
29	Sher-i-Kashmir Institute of Medical Sciences, Srinagar	India	804	26	5175
30	Sawai Man Singh Medical College, Jaipur	India	784	19	2363

SAARC, South Asian Association for Regional Cooperation.

lack of medical expertise, and limited access to efficient health care. There are also the continuous demands from a large, expanding, and mainly young population for medical care which is, by and large, not complex or expensive to provide. These problems offer a great opportunity to conduct interesting research to find answers which are relevant to the area and which might be replicated in other poor countries in the world, but sadly, the will to do this seems to be lacking. This is reflected by the low priority given to medical research in South Asian countries, which is evident by the less than 0.5% of their gross domestic product (GDP) spent on medical research and development.¹² The “10/90” gap, which states that only 10% of the global health research funding is allocated to 90% of the preventable mortality burden of the world, has been emphasized by the Global Forum for Health Research, especially for the South Asian countries.¹³ Swaminathan et al.⁸ reported a combined share of less than 0.15% of GDP being spent on medical research by India, Bangladesh, Pakistan, and Sri Lanka compared with 0.44% in the United Kingdom, 0.65% in the United States of America, and even 0.09% in China. An analysis of the trend of funds being spent on research by the Indian Council of Medical Research (ICMR) by the same authors revealed a stagnation over the last few decades until 2016. Ranasinghe et al.¹⁴ reported similar trends of underfunding in Sri Lankan institutes between 2000 and 2009. Similarly, Shankar et al.¹⁵ suggested a similar lack of funding and research infrastructure for the medical institutes in Nepal despite the great need to investigate the country's major medical problems.

Our study shows that the major proportion (83.6%) of research publications originate in India compared with the other South Asian countries. This was also reported by Majumder et al.,¹⁶ who analyzed that of the total of 1,41,783 articles from the region which were included in PubMed between 1985 and 2009, 90.6% were from India. Similarly, Rahman and Fukui,¹⁷ in 2001, had reported India's position among the top 10 based on publications per one billion USD GDP. Conversely, countries such as Sri Lanka,

Bangladesh, and Nepal have not shown any significant rise over the last many years. The main factor implicated by most authors has been the lack of funds devoted toward biomedical research in these countries.¹⁸ Member nations such as Afghanistan have had a long-drawn-out war and political instability since 1970s, which have been a major disincentive for performing any medical research. Another factor was lack of priority given to medical research. This was exemplified in a study by Sadana et al.,⁹ who reported that despite an availability of nearly 1.5 million USD to the Pakistan Medical Research Council between 1994 and 2000, less than half was utilized. However, in spite of these constraints, Majumder et al.¹⁶ reported a nearly 4.7-fold rise in the number of publications from Afghanistan from 2000 to 2009. A similar growth was also observed for Pakistan, both in terms of quantity and quality of research output from 2000 to 2009.

The South Asian nations sadly lag very far behind Western countries. The cumulative number of researchers from these nations was found to be only one-fifth to one-tenth of the number of researchers from the USA or the UK alone.¹⁹ We have also shown that the cumulative 6 years research output from the only two institutions in the USA amounted to 84,673 articles, which is 87% of that of the cumulative research output from all the South Asian nations in the same period. However, recently, other countries in Asia such as China, Japan, and Korea seem to be doing better, in terms of their annual research output. Rottingen et al.²⁰ reported a figure of 701 publication per million population from China between 2002 and 2011, which was nearly equal to the corresponding figure for the SAARC countries taken together. Paraje et al. reported that when compared with the rest of the world, only India is in the top twenty countries producing health-related literature with a global share of 1.16% from 1990 to 2001 against 36.68% and 8.57% for the USA and the UK, respectively.²¹ Even though there have not been many studies of the correlation of medical research with the quality of health care, some authors have reported an association

Table 2

Top institutes from the individual SAARC nations in terms of the total number of publications, 2012–2017.

Name of the institute	Country	Publications	h-index	Citations
Bangabandhu Sheikh Mujib Medical University (BSMMU)	Bangladesh	504	17	1415
Dhaka Medical College	Bangladesh	176	9	619
Mymensingh Medical College	Bangladesh	151	6	177
Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM)	Bangladesh	119	13	451
Sir Salimullah Medical College	Bangladesh	67	5	89
National Institute of Preventive and Social Medicine (NIPSOM)	Bangladesh	57	6	113
Rajshahi Medical College	Bangladesh	40	9	143
Chittagong Medical College	Bangladesh	37	7	628
National Institute of Cardiovascular Disease (NICVD)	Bangladesh	37	6	209
Ibrahim Medical College, Dhaka	Bangladesh	31	5	60
Institute of Child and Mother Health (ICMH), Dhaka	Bangladesh	29	9	181
Royal University Bhutan, Thimphu	Bhutan	4	3	14
All India Institute of Medical Sciences, New Delhi	India	8491	60	51,574
Post Graduate Institute of Medical Education and Research, Chandigarh	India	7681	63	46,049
Christian Medical College, Vellore	India	2385	40	11,825
Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	India	2297	37	20,568
Kasturba Medical College, Manipal	India	1993	22	3970
Jawaharlal Institute of Postgraduate Medical education and Research, Puducherry	India	1988	24	5416
Tata Memorial Hospital, Mumbai	India	1818	37	15,004
Maulana Azad Medical College, New Delhi	India	1723	26	5778
Amrita Institute of Medical Sciences, Kochi	India	1406	47	12,254
Medical College, Kolkata	India	1359	21	3624
Indira Gandhi Memorial Hospital, Male	Maldives	2	2	2
B.P. Koirala Institute of Health Science	Nepal	308	17	11,409
Manipal College of Medical Science	Nepal	161	9	377
Tribhuvan University Teaching Hospital	Nepal	151	9	373
Kathmandu University School of Medical Science	Nepal	115	6	166
Kathmandu medical College	Nepal	108	9	296
Nepal Medical College	Nepal	65	6	185
Bir Hospital	Nepal	62	4	69
Kathmandu Medical College Teaching Hospital	Nepal	52	4	72
Nepal Medical College Teaching Hospital	Nepal	46	4	65
Manipal Teaching Hospital Nepal	Nepal	42	3	53
The Aga Khan University Hospital	Pakistan	1339	22	5208
Dow University of Health Sciences, Pakistan	Pakistan	886	18	2165
Bahria University Medical and Dental College	Pakistan	541	14	1332
Liaquat National Hospital	Pakistan	480	14	1140
Liaquat University of Medical and Health Sciences	Pakistan	370	8	506
Dow Medical College	Pakistan	329	15	910
Mayo Hospital, Lahore	Pakistan	326	10	440
Khyber Medical College, Peshawar	Pakistan	325	8	335
Lady Reading Hospital, Karachi	Pakistan	315	12	452
King Edward Medical University, Lahore	Pakistan	314	15	863
University of Colombo, Faculty of Medicine	Sri Lanka	530	27	2991
National Hospital of Sri Lanka, Colombo	Sri Lanka	187	9	645
Medical Research Institute, Colombo	Sri Lanka	39	8	194
Lady Ridgeway Hospital For Children, Colombo	Sri Lanka	50	4	77
Sri Jayawardenepura General Hospital, Nugegoda	Sri Lanka	14	4	317
Kabul University	Afghanistan	6	3	33

SAARC, South Asian Association for Regional Cooperation.

between the two. For instance, Pons et al.²² found a low-moderate negative correlation between the risk-adjusted mortality ratio and the weighted citations ratio for congestive heart failure and acute MI in a cohort of patients with congestive heart failure in a high-volume tertiary care center.

Another important aspect of assessing research output is the quality of publications. Several indicators, such as the number of citations, SciVal, h-index, impact factor, etc., have been used in assessing this. Nieminen et al.²³ analyzed the relationship between the quality of research and citation frequency. There have been criticisms regarding the accuracy of using established quality-assessing indicators to compare the ranking of institutions at a global level. Comparison of top four global ranking indicators, i.e., QS university ranking, Times World University Rankings, Academic Ranking of World Universities, and Webometrics ranking has reflected challenges in terms of adjustments for institutional size, i.e., the number of researchers, and time frame among the many other factors.²⁴ An important observation made by the authors was that

the frequency of citation depends on many factors, notably the reputation of the journal publishing it and the relevance of the disease/health-care condition to the community. Thus, even a study with average statistics and obscurely reported results in a popular journal may gather more number of citations than an intricately done immaculate work in a routine journal. Therefore, although citations may speak volumes about the popularity of a research work, it should not be the sole marker of quality. Another indicator is the h-index. Even though this index is a marker of both quality and quantity of research output, it is affected by factors such as the length of the academic career of the researcher or the institution being studied.²⁵ As observed by Bornmann et al.,²⁶ the h-index proves reliable only when comparing researchers of a similar age and working within the same field. A study by Meyers and Quan²⁷ suggested modifications of the h-index adjusted to the number of years since the first publication by the author to overcome this disparity. However, these have not been validated so far. We found, as have others, that there was also a close association between

Table 3
Global comparison of the SAARC nations in terms of the number of publications, 2012–2017.

Name of the institute	Country	Publications	h-index	Citations
Mayo Clinic, Rochester	USA	44,272	253	688,517
Massachusetts General Hospital	USA	40,401	296	831,663
Charite Universitätsmedizin, Berlin	Germany	23,402	184	360,981
Peking Union Medical College	China	18,864	104	150,325
Karolinska University Hospital, Stockholm	Sweden	14,815	172	263,409
University Hospital, Zurich	Switzerland	11,899	145	183,331
Guy's and St Thomas' NHS Foundation Trust	UK	10,617	140	163,988
All India Institute of Medical Sciences, New Delhi	India	8491	60	51,574
Post Graduate Institute of Medical Education and Research, Chandigarh	India	7681	63	46,049
King's College Hospital	UK	5053	99	77,708
Royal Melbourne Hospital	Australia	4575	15	77,363
Okayama University Medical School	Japan	3166	52	27,518
Christian Medical College, Vellore	India	2385	40	11,825
Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	India	2297	37	20,568
Kasturba Medical College, Manipal	India	1993	22	3970
Jawaharlal Institute of Postgraduate Medical education and Research, Puducherry	India	1988	24	5416
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Post Graduate Institute of Medical Sciences, Rohtak	India	1135	22	3196
Institute of Postgraduate Medical Education and Research, Kolkata	India	1067	26	4806
Kasturba Medical College, Mangalore	India	1033	19	3000
Dr. Ram Manohar Lohia Hospital	India	946	18	2202
Government Medical College, Chandigarh	India	929	23	3557
Jawaharlal Nehru Medical College, Aligarh	India	923	25	3703
Armed Forces Medical College, Pune	India	913	17	2918
Sir Ganga Ram Hospital	India	900	22	4254
Dow University of Health Sciences, Pakistan	Pakistan	886	18	2165

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Table 4
Top 30 institutions from the SAARC countries in order of the number of citations (2012–2017).

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6	Christian Medical College, Vellore	India	2385	40	11,825
7	B.P. Koirala Institute of Health Science	Nepal	308	17	11,409
8	Fortis Healthcare	India	564	25	10,537
9	Christian Medical College, Ludhiana	India	755	26	10,457
10	Sree Chitra Thirunal Institute of Medical Sciences and Technology	India	1224	36	10,447
11	LV Prasad Eye Institute, Hyderabad	India	1332	30	8326
12	St. John's Medical College, Bangalore	India	358	35	6259
13	Maulana Azad Medical College, New Delhi	India	1723	26	5778
14	Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry	India	1988	24	5416
15	The Aga Khan University Hospital	Pakistan	1339	22	5208
16	Sher-i-Kashmir Institute of Medical Sciences, Srinagar	India	804	26	5175
17	Health Services Academy, Islamabad	Pakistan	97	18	5016
18	Institute of Postgraduate Medical Education and Research, Kolkata	India	1067	26	4806
19	Nizam's Institute of Medical Sciences, Hyderabad	India	842	28	4419
20	University College of Medical Sciences, New Delhi	India	1358	25	4281
21	Sir Ganga Ram Hospital, New Delhi	India	900	22	4254
22	Vardhman Mahavir Medical College, New Delhi	India	1352	25	4249
23	Asian Institute of Gastroenterology, Hyderabad	India	205	32	4246
24	Kasturba Medical College, Manipal	India	1993	22	3970
25	Institute of Liver and Biliary Sciences	India	517	29	3964
26	Apollo Hospital Group, Chennai	India	840	27	3945
27	P. D. Hinduja National Hospital and Medical Research Centre, Mumbai	India	579	24	3755
28	Lady Hardinge Medical College	India	1208	23	3728
29	Jawaharlal Nehru Medical College, Aligarh	India	923	25	3703
30	Medical College, Kolkata	India	1359	21	3624

SAARC, South Asian Association for Regional Cooperation.

Table 5
Top 30 institutes from the SAARC nations in order of their h-indices (2012–2017).

S. No.	Name of the institute	Country	Publications	h-index	Citations
1	Post Graduate Institute of Medical Education and Research, Chandigarh	India	7681	63	46,049
2	All India Institute of Medical Sciences, New Delhi	India	8491	60	51,574
3	Amrita Institute of Medical Sciences, Kochi	India	1406	47	12,254
4	Christian Medical College, Vellore	India	2385	40	11,825
5	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	India	2297	37	20,568
6	Tata Memorial Hospital, Mumbai	India	1818	37	15,004
7	Sree Chitra Thirunal Institute of Medical Sciences and Technology	India	1224	36	10,447
8	St. John's Medical College, Bangalore	India	358	35	6259
9	Asian Institute of Gastroenterology, Hyderabad	India	205	32	4246
10	LV Prasad Eye Institute, Hyderabad	India	1332	30	8326
11	Institute of Liver and Biliary Sciences	India	517	29	3964
12	Nizam's Institute of Medical Sciences, Hyderabad	India	842	28	4419
13	Apollo Hospital Group, Chennai	India	840	27	3945
14	University of Colombo, Faculty of Medicine	Sri Lanka	530	27	2991
15	Maulana Azad Medical College, New Delhi	India	1723	26	5778
16	Institute of Postgraduate Medical Education and Research, Kolkata	India	1067	26	4806
17	Sher-i-Kashmir Institute of Medical Sciences, Srinagar	India	804	26	5175
18	Christian Medical College, Ludhiana	India	755	26	10,457
19	University College of Medical Sciences, New Delhi	India	1358	25	4281
20	Vardhman Mahavir Medical College, New Delhi	India	1352	25	4249
21	Jawaharlal Nehru Medical College, Aligarh	India	923	25	3703
22	Fortis Healthcare	India	564	25	10,537
23	Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry	India	1988	24	5416
24	P. D. Hinduja National Hospital and Medical Research Centre, Mumbai	India	579	24	3755
25	Lady Hardinge Medical College	India	1208	23	3728
26	Government Medical College, Chandigarh	India	929	23	3557
27	Seth GS Medical College and KEM Hospital, Mumbai	India	717	23	2982
28	Govind Ballabh Pant Hospital	India	637	23	3479
29	Kasturba Medical College, Manipal	India	1993	22	3970
30	Post Graduate Institute of Medical Sciences, Rohtak	India	1135	22	3196

SAARC, South Asian Association for Regional Cooperation.

Table 6
Global comparison of the SAARC nations based on the quality of research (citations), 2010–2017.

Name of the institute	Country	Publications	h-index	Citations
Massachusetts General Hospital	USA	40,401	296	831,663
Mayo Clinic, Rochester	USA	44,272	253	688,517
Charite Universitätsmedizin, Berlin	Germany	23,402	184	360,981
Karolinska University Hospital, Stockholm	Sweden	14,815	172	263,409
University Hospital, Zurich	Switzerland	11,899	145	183,331
Guy's and St Thomas' NHS Foundation Trust	UK	10,617	140	163,988
Peking Union Medical College	China	18,864	104	150,325
King's College Hospital	UK	5053	99	77,708
Royal Melbourne Hospital	Australia	4575	105	77,363
All India Institute of Medical Sciences, New Delhi	India	8491	60	51,574
Post Graduate Institute of Medical Education and Research, Chandigarh	India	7681	63	46,049
Okayama University Medical School	Japan	3166	52	27,518
Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	India	2297	37	20,568
Tata Memorial Hospital, Mumbai	India	1818	37	15,004
Amrita Institute of Medical Sciences, Kochi	India	1406	47	12,254
Christian Medical College, Vellore	India	2385	40	11,825
Sree Chitra Thirunal Institute of Medical Sciences and Technology	India	1224	36	10,447
LV Prasad Eye Institute, Hyderabad	India	1332	30	8326
Maulana Azad Medical College, New Delhi	India	1723	26	5778
Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry	India	1988	24	5416
The Aga Khan University Hospital	Pakistan	1339	22	5208
Institute of Postgraduate Medical Education and Research, Kolkata	India	1067	26	4806
University College of Medical Sciences, New Delhi	India	1358	25	4281
Vardhman Mahavir Medical College, New Delhi	India	1352	25	4249
Kasturba Medical College, Manipal	India	1993	22	3970
Lady Hardinge Medical College	India	1208	23	3728
Medical College, Kolkata	India	1359	21	3624
Post Graduate Institute of Medical Sciences, Rohtak	India	1135	22	3196
Kasturba Medical College, Mangalore	India	1033	19	3000
Dr. Ram Manohar Lohia Hospital, New Delhi	India	946	18	2202

SAARC, South Asian Association for Regional Cooperation.

quantity and quality, especially for majority of the “high-publication-output” institutions.²⁸ However, this is also influenced by factors such as the age of the institution and establishment of its training programs. Therefore, it is not surprising to find a huge

disparity in the number of citations between institutions such as SGPIMS, Lucknow, which was established in 1983 and the Institute of Liver and Biliary Sciences (ILBS), New Delhi (estd. 2003). Therefore, the research output must be assessed on both qualitative

and quantitative grounds. Another issue observed by some studies was a deficiency in the representation of the South Asian countries in the leading health journals of the world. A study by Sumathipala et al.²⁹ had reported a marked underrepresentation of the countries other than the those of the North American and European continents in most of the leading journals such as the BMJ, Lancet, JAMA, etc. This also includes a markedly low representation of the South Asian nations in most of these leading journals. Some important reasons for this could be inadequacy of funds to carry out any pathbreaking research or lack of adequate infrastructure and expertise for the same or even the favoritism of publishing native literature by these journals, which mostly belong to the West.^{30,31} Therefore, we are encouraged that the BMJ has taken a step forward by publishing special collections such as the BMJ South Asia, which will provide more opportunities for researchers in these countries to publish their work.^{32,33}

4.1. What are the ways forward?

1. *Establishment of dedicated research wings in the medical institutions and teaching hospitals:* This would involve a joint collaboration of scientists, statisticians, epidemiologists, and clinicians. A dedicated research wing is already incorporated as a part of the hospital in many tertiary care centers of India such as the AIIMS, New Delhi, or Sir Ganga Ram Hospital, New Delhi, in the public and private sectors, respectively. There should be compulsory annual auditing of the research output by the institute, and necessary steps must be sought to enhance the same. There must be compulsory involvement of the trainees and faculty members, in collaboration with the research wing, and projects should be assigned with a definitive deadline for completion. Segal et al.³⁴ studied the association of student's research activities and their postgraduate and undergraduate medical activities in Croatia. They reported a 23% involvement of the undergraduate students in research activities, a figure much higher than that observed in the South Asian nations.
2. *Enforcing mandatory participation in research:* The commonest reasons quoted in India for lack of research output are the overburdening of residents and trainees with work, thereby leaving them drained and uninterested to carry out research activities. Shankar et al.¹⁶ had reported a lack of "role model" in the form of a senior faculty actively involved in research, to be one of the most important factors behind the low research output in Nepal. Therefore, taking economically challenged countries such as Croatia as a role model, where the University of Zagreb has incorporated mandatory training in research methodology as a part of the undergraduate and postgraduate curriculum, similar steps should be enforced upon in the South Asian countries.³⁵
3. *Strengthening of intercountry collaboration among the SAARC nations:* This would involve implementation of strategies such as, cross-border structured training programs with mandatory research work as a part of the curriculum and annual regional meetings of the South Asian nations for presentation of research work in a common forum and planning of collaborative projects.^{36,37} Creation of a politically funded government body dedicated toward ensuring collaborative projects on a large scale among the South Asian nations could also be a suggested measure.³⁸

Our study had its limitations. We only used the Scopus database to extract the number of publications. We did not consider using any other search engine tools such as PMC, Web of Science, etc. Therefore, there could possibly have been some underestimation of the total number of publications from different institutes

individually. However, considering the wide coverage of the Scopus database, we chose it over the others. In our previous study which dealt only with India, we received complaints regarding its methodology and accuracy of the numbers.³⁹ We conducted the search based on the affiliation. Every institution needs to assure a uniform way of writing their respective affiliations, e.g., King Edward Medical College, Mumbai or king edward medical college, Mumbai or Seth Gordhandas Sunderdas Medical College. These are three different affiliations of the same institution. Therefore, the database would not be able to differentiate between the publications by the same institution with different names, as a result of which there might be overestimation or underestimation of the actual number of publications, when seen on the Scopus affiliation search. Similarly, hospitals such as the Fortis Healthcare, India, have more than 20 branches across the country. However, owing to the common affiliation, there is no segregation of the number of publications by an individual branch of the hospital from its respective city/state. Another important limitation could be attributed to the usage of the h-index. Studies have shown a few drawbacks of using the h-index as a marker of quality of publications. As a rule of thumb, the h-index varies directly with the number of years since the first publication. Therefore, many noble laureates might be having low h-index than many lesser known scientists. Hence, while a high h-index might imply accomplishment, the converse is not true.⁴⁰

Despite these limitations, the study however provides an overview of the health research scenario in the South Asian countries, in terms of their quantity and quality, and should therefore be an eye opener to implement better strategies to improve the same.

5. Conclusion

Research in a medical institution anywhere and especially in South Asia should never be an optional but an essential activity for finding the answers to the special problems that beset the region. However, the number of publications from the area is very small, and steps such as offering incentives and international collaboration may be taken to improve this unfortunate situation.

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Conflicts of interest

None.

Appendix A. Supplementary data

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References

1. Commission on Health Research for Development. *Health Research: Essential Link to Equity in Development*. New York: Oxford University Press; 1990. <https://www.ncbi.nlm.nih.gov/books/NBK209096/>.
2. *Independent South Asian Commission on Poverty Alleviation. SAARC Development Goals (SDGS): 2007-2012 Taking SDGS Forward*. Kathmandu: ISACPA; 2007.
3. Medical Council of India. Available at: <http://www.mciindia.org> [accessed on 12.11.15].
4. National Board of Examinations. Available at: <http://www.natboard.edu.in> [accessed on 12.11.15].
5. Bangladesh medical and dental Council. Available at: <http://bmdc.org.bd/recognized-medical-and-dental-colleges/> [accessed on 12.11.18].
6. Pakistan medical and dental Council. Available at: <http://www.pmdc.org.pk/AboutUs/RecognizedMedicalDentalColleges/tabid/109/Default.aspx> [accessed on 12.11.18].

7. Dandona L, Raban MZ, Guggilla RK, et al. Trends of public health research output from India during 2001–2001. *BMC Med.* 2009;7:59.
8. Swaminathan S, Qureshi H, Jahan MU, et al. Health research priorities and gaps in South Asia. *Br Med J.* 2017;357:j1510.
9. Sadana R, D'Souza C, Hyder AA, et al. Importance of health research in South Asia. *Brux Med J.* 2004;328:826–830.
10. Ray S, Shah I, Nundy S. The research output from Indian medical institutions between 2005 and 2014. *Curr Med Res Pract.* 2016;6:49–58. <https://doi.org/10.1016/j.cmrp.2016.04.002>.
11. Hirsch JE. An index to quantify an individual's scientific research output. *Proc Natl Acad Sci U S A.* 2005;102:16569–16572.
12. Health expenditure, public (% of GDP). Available at: <https://data.worldbank.org/indicator/SH.XPD.PUBL.ZS>.
13. Global Forum for Health Research. *The 10/90 Report on Health Research.* Geneva: GFHR; 1999.
14. Ranasinghe P, Jayawardena R, Katulanda P. Sri Lanka in global medical research: a scientific analysis of the Sri Lankan research output during 2000–2009. *BMC Res Notes.* 2012;5:121.
15. Shankar PR, Chandrashekhar TS, Mishra P, et al. Initiating and strengthening medical student research: time to take up the gauntlet. *Kathmandu Univ Med J.* 2006;4:135–138.
16. Majumder MAA, Shaban SF, Rahman S, et al. A Pub-Med based quantitative analysis of biomedical publications in the SAARC countries: 1985–2009. *J Coll Physicians Surg Pak.* 2012;22:560–564.
17. Rahman M, Fukui T. Factors related to biomedical research productivity in Asian countries. *J Epidemiol.* 2001;11:199–201.
18. Kundra R, Srivastava D. Collaboration patterns among SAARC countries in the area of medicine: status and issues. In: *France: International Workshop on Webometrics, informetrics and scientometrics and seventh COLLNET meeting.* 2006.
19. United Nations Educational, Scientific and Cultural Organization Institute for Statistics. Data Centre: Summary Data: Profiles [Internet]. <http://stats.uis.unesco.org/unesco/TableViewer/document>.
20. Röttingen JA, Regmi S, Eide M, et al. Mapping of available health research and development data: what's there, what's missing, and what role is there for a global observatory? *Lancet.* 2013;382:1286–1307.
21. Paraje G, Sadana R, Karam G. Increasing international gaps in health-related publications. *Science.* 2005;308:959–960.
22. Pons J, Sais C, Illa C, et al. Is there an association between the quality of hospitals' research and their quality of care? *J Health Serv Res Policy.* 2010;15:204–209.
23. Nieminen P, Carpenter J, Rucker G, et al. The relationship between quality of research and citation frequency. *BMC Med Res Methodol.* 2006;6:42.
24. Anowar F, Helal MA, Afroj S, et al. A critical review on World University Ranking in terms of top four ranking systems. *Lecture Notes in Electrical Engineering.* 2015;312:559–566.
25. Bornmann L, Daniel H-D. Does the h-index for ranking of scientists really work? *Scientometrics.* 2005;65:391–392.
26. Bornmann L, Wallon G, Ledin A. Is the h index related to (standard) bibliometric measures and to the assessments by peers? An investigation of the h index by using molecular life sciences data. *Res Eval.* 2008;17:149–156.
27. Meyers MA, Quan H. The use of the h-index to evaluate and rank academic departments. *J Mater Res Technol.* 2017;6:304–311.
28. Lee KP, Schotland M, Bacchetti P, et al. Association of journal quality indicators with methodological quality of clinical research articles. *J Am Med Assoc.* 2002;287:2805–2808.
29. Sumathipala A, Siribaddana S, Patel V. Under-representation of developing countries in the research literature: ethical issues arising from a survey of five leading medical journals. *BMC Med Ethics.* 2004;5:5.
30. Vetter N. Research publication in developing countries. *J Publ Health Med.* 2003;25:189.
31. Rochon PA, Mashari A, Cohen A, et al. Relation between randomized controlled trials published in leading general medical journals and the global burden of disease. *CMAJ (Can Med Assoc J).* 2004;170:1673–1677.
32. Bhutta ZA, Nundy S, Abbasi K. Why a special issue of the BMJ on South Asia. *Br Med J.* 2003;327:941–942.
33. Bhutta ZA, Nundy S, Abbasi K. Twelve years on: a call for papers for another special collection of articles on South Asia (Editorial). *Br Med J.* 2016;353:1–2.
34. Segal S, Lloyd T, Houts PS, et al. The association between students' research involvement in medical school and their postgraduate medical activities. *Acad Med.* 1990;65:530–533.
35. Remes V, Hellineus I, Sinisaari I. Research and medical students. *Med Teach.* 2000;22:164–167.
36. Peters DA, Yazbeck AS. A framework for health policy research in South Asia. In: *Human Development Network. Health Policy Research in South Asia: Building Capacity for Reform.* Washington DC: World Bank; 2004.
37. Economist Intelligence Unit. *A Mighty Web: How Research Collaborations Can Foster Growth in South Asia – Analyzing the Potential in Afghanistan, Bangladesh, India, Nepal, Pakistan and Sri Lanka.* British Council; 2015. https://www.britishcouncil.org/sites/default/files/research_networks_jan2015_print.pdf.
38. Gupta I, Mondal S. Health spending, macroeconomics and fiscal space in countries of the world health organization south-east Asia region. *WHO south-east Asia. J Public Health.* 2014;3:273–284.
39. Ray S, Shah I, Nundy S. Our responses to the letters on the article 'The research output from Indian medical institutions from 2005 to 2014. *Curr Med Res Pract.* 2016;6:145–146. <http://doi.org/10.1016/j.cmrp.2016.06.001>.
40. DeLuca LA, St John A, Stolz U, Matheson L, Simpson A, Denninghoff KR. The distribution of the h-index among academic emergency physicians in the United States. *Acad Emerg Med.* 2013;20:997–1003.