

August 2015

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Khan, Nadim Akhtar and Ahangar, Humma, "Research Productivity of Government Medical College Jammu: A bibliometric analysis" (2015). *Library Philosophy and Practice (e-journal)*. 1262.
<http://digitalcommons.unl.edu/libphilprac/1262>

Research Productivity of Government Medical College Jammu: A bibliometric analysis

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Abstract

Purpose The study aims at examining the research productivity of Government Medical College Jammu and provides a Bibliometric profile of biomedical publications of Government Medical Jammu.

Methodology

Necessary Bibliometric indicators have been employed to assess the trends and volume of research published. Documents published by researchers and practitioners of Government Medical College Jammu for the period 1973 to May, 2011 and indexed in Scopus Database have been analysed.

Results The results of the present study reveals that the Government medical college Jammu is accelerating in terms of output. A total of 514 publications were contributed by the college during the study period. Highly productive departments are General medicine, pharmacology, surgery and pathology with 97 (18.87%), 69 (13.42%), 46 (8.95%) and 39 (7.59%) publications respectively. The majority of publications were contributed by multi authors (470, 91.44%). The most highly cited departments are paediatrics, endocrinology and Dermatology with average citations 4.28%, 3.5% and 3.38% respectively. In terms of collaboration the share of national collaboration was highest followed by regional and international collaboration. Intra disciplinary collaboration was found maximum (254, 54.04%) in the institution.

Originality / value This study is the first of its kind, revealing research trends and serves as an indicator of the productivity of the college's practitioners and researchers. Bibliometric

analysis of this type can provide helpful information about changes in the patterns of scholarly communication. Furthermore, the study may persuade to undertake more focussed health research for improving the health of individuals in the state.

Limitations The study had some limitations. The focus of the present study is on publications indexed by Scopus, which are indeed a small portion of the several studies conducted by the researchers in Government Medical College Jammu. Therefore, study does not fully reflect the entire productivity of the total number of researchers in the fields under study.

Keywords Research Productivity, Bibliometrics, Citation impact, Authorship Pattern, Collaboration pattern, Research Trends

Introduction

The significance of research in any discipline of study can never be underestimated. Scientists, academics and researchers have been engaged in research in their fields of study for years in the wake of quest for exploring countless elements in the vast universe. **Council of Canadian Academies (2010)** reveals that research plays a key role in shaping the world. Through research, we gain a better understanding of today's most pressing and complex social and scientific issues such as cultural diversity, human rights, disease prevention, and climate change. The main aim of research is discovering and development of methods and systems for advancement of human knowledge (**Okafor & Dike, 2010**). The research findings not only help the people, to speak in broader and wider sense, it helps students to remain abreast with the latest happenings in their field of study. However, doing a research and coming to a certain conclusion doesn't mean the end of the research, but the quest to make more and more explorations. People often find themselves eager to see the advances in medical science and its practices. This is believed, to be possible only through the availability of different primary sources of information which play a major role for communicating the latest research findings. It has been found that these sources include papers on almost all issues pertaining to human health and safety. It can range from minor disorders to bigger ones, with the sole objective of saving human and animal lives, in mind. **Science and Engineering Indicators (as cited in Webster, 2005)** finds that over the years, research in the field of science, to speak specifically, has assumed a lot of importance and prominence. Biomedical sciences have become one of the most heavily-researched areas of science. Nearly half of all papers listed in the Science Citation Index (SCI) between 1989 and 2000 came from within this field, compared to a 1999 figure of 15 per cent from physics and 13 per cent from chemistry. In total, over 3,500,000 biomedical articles, notes and reviews were published worldwide over this period. In the UK, 55 per cent of all science publications are biomedical.

It is often presumed that in absence of quality research institutions in developing countries coupled with paucity of infrastructure and manpower, research activities in biomedical sector are yet to receive the fillip the extent they deserve. However, the activities are understood to be picking up more and more as the countries understand the pressing need of the same. This need is felt in India as well, where, of late, academics, researchers, doctors and even students in smaller institutions in different states have begun to undertake research on various aspects of medical science. Despite hit by the turbulence over few

decades medical research in the state of Jammu and Kashmir is also making progress with research being promoted at various medical colleges and institutions across the state. Many research articles are finding their place in well reputed journals globally. Is it really so? The present study therefore is undertaken on one of the premier institutions of Jammu and Kashmir State- Government Medical College Jammu (GMC), with the aim of analyzing the growth, contribution and impact of research carried out by the faculty members, researchers or students of aforementioned institution.

Objectives

The objectives of the study are

1. To assess the research contribution of various departments.
2. To study the authorship pattern and the levels of collaboration.
3. To determine interdisciplinary research trends.
4. To know the types of the documents consulted.
5. To analyze the overall citation pattern.

Methodology

The study has harvested data from SciVerse- Scopus. As stated in the official website, SciVerse Scopus is one of the largest abstract and citation databases of peer-reviewed literature and quality web sources worldwide with more than 20,500 titles from more than 5,000 international publishers. It Contains 49 million records, 78% with abstracts, also includes over 5.3 million conference papers and provides 100% Medline coverage (**Scopus, 2013**). Data for the study included publications that were published since 1973 and indexed up to May, 2011 in SciVerse Scopus. The affiliation search feature was used to get precise results. The search was conducted through a number of search expressions like, Govt. Medical College Jammu; Government Medical College Jammu, GMC Jammu etc. As such, 514 records were found which belonged to authors affiliated with Govt. Medical College, Jammu. The number of published works was considered as an index of quantity of research productivity. The department wise demarcation was based on authors departmental affiliation reported in their respective publication and indexed by SciVerse Scopus, too. Analyzed parameters included patterns of authorship, patterns of collaboration, preferred document types, number of citations received by per publication (a statistics known as citation impact) and interdisciplinary research approaches. The papers by two or more than two authors have been clubbed together and termed as multi authored publications. For the purpose of the study we classified the works that were done in collaboration into three main categories:

(a) International: Collaborative works in which one of the author belong to country other than India are labeled under International collaborative works

(b) National: Works wherein one of the authors is affiliated with institutions located in States other than J&K are tagged as National Collaborative works.

(c) State Works: Publications in which contributing authors neither belonged to any other country or State other than J&K is grouped under State Collaborative Works.

Review of related Literature

The evaluation of academic research performance is nowadays a priority issue. Bibliometric indices are an indispensable tool in evaluating the research output of individuals and institutions (**Sypsa and Hatzakis, 2009**). Bibliometric is the scientific and quantitative study of publications and is used to identify the pattern of publication, authorship, and secondary journal coverage to gain insight into the dynamics of growth of knowledge in the areas under consideration. The main derivatives of bibliometrics are: publication counts, citation counts, co-citation analysis, scientific 'mapping' and citations in patents (**Thanuskodi, 2010**). Bibliometrics is a means for situating a country in relation to the world, an institution in relation to a country, and even individual scientists in relation to their own communities (**Mazboudi & Abdelaziz, 2010**). Bibliometric indicators seek to measure the quantity and impact of scientific publications -as a proxy for the overall output of scientific research- and are based on a count of scientific papers and the citations they receive (**UNESCO, 2005**). Bibliometric indicators are increasingly being used for research assessment, especially in university and government labs, and also by policymakers, information specialists and librarians, and researchers themselves (**Thomas Reuters, 2008**). Analysis based on bibliometric indicators can be used to address the issues such as: (i) Is country contributing more or less to research output in a particular field or sub-field? (ii) Is it performing better than others?, and (iii) Is it contributing more research output in a particular area compared to others? (**Gupta & Dawan, 2006**).

Webster (2005) in his study tried to map UK's biomedical research output from 32 selected medical fields during the span of 12 years from 1989 till 2000 and reveals that the UK stand at the second place as the producer of medical research with 17% world output in the field of Asthma and Malaria followed by surgery with 8%. **Falagas, Papastamataki and Bliziotis (2006)** assess the research productivity of different world regions in the field of Parasitology using the PubMed database and journal citation reports for the period 1995-2003. The study shows that Western Europe exceeds all world regions in research production, with 34.8% of all articles (6,302 articles) coming from this area. USA ranked second (3,599 articles, 19.9% of total) and Latin America and the Caribbean third (3,111 articles, 17.2% of total). Another study carry out by **Vergidis, Karavasiou, Paraschakis, Bliziotis and Falaqas (2005)** estimated the quantity and quality of worldwide research production in the field of microbiology for the period 1993-2005 using the PubMed and Journal Citation Reports databases. The results reveal that in terms of research production for the period studied, Western Europe exceeded all other world regions, with the USA ranking second. The mean impact factor was highest for the USA at 3.4, while it was 2.8 for Western Europe and 2.4 for the rest of the world combined. Furthermore, the three regions in which research productivity increased the most were Asia, Latin America, and Eastern Europe. **Annyang (2011)** analyzes a report published by Royal society Knowledge, networks and countries, in the 21st century global scientific cooperation, which clearly revealed that China's scientific research output rose from sixth to second worldwide thus replacing UK. According to the author now the country's scientists are set to take the top spot from the United States in the next few years, other nations like UK, Japan, Germany and France each also command strong positions in

the global league tables, producing high quality publications. **Rahman, Sakamoto and Fukui (2004)** investigate the contribution of Japan in basic biomedical science in the decade of 1991-2000. The data revealed that Japan's contribution to highly reputed journals was about 6.6% of total with as ever increasing drift of about 0.01% per year, thus showing an ever increasing trend in promotion of scholarly content in the biomedical field from Japan. **Lewison (1998)** analyse the sources of funding for UK gastroenterology research papers and the relative impact of papers funded by different groups and of unfunded ones. The study reveals that Gastroenterology papers comprise about 7% of all UK biomedical research and 46% of them have no acknowledged funding source while 54% acknowledge funding source. It was identified that papers with no funding sources were less frequently cited and in journals of lower impact. Government funded papers are more highly cited by a factor of 1.90; papers funded by charities and foundations by a factor of 2.12; papers funded by the pharmaceutical industry by a factor of 2.25; and papers funded by the group of 12 GI charities by a factor of 3.12. A report on the publication output of Australia's health sector indexed in Institute for Scientific Information's (ISI) three main indices: Science Citation Index (SCI), Social Sciences Citation Index (SSCI) and Arts and Humanities Citation Index (A&HCI) for the period 1981- 1995 by **Butler, Biglia and Bourke (1998)** concludes that there is a strong positive relationship between success in attracting external funding sources and success in achieving very high citation impact. In 27 of the 41 ISI subject categories studied, all the most highly cited publications attracted external funding. **Bala and Gupta (2009)** carried out a study to investigate the activities of the Government Medical College & Hospital Chandigarh in order to reveal the research output and impact under broad and narrow subject areas. The study highlighted the characteristics of highly cited papers and productive authors during the time period of 16 years (1992-2007) and revealed that the institution recorded annual publication growth of 19.79% with average citation per paper as 0.89.

Scientists do not work in isolation (**Cronin, 1982**). There has been a growing awareness of the importance of research collaboration in the scientific community as it leads to effective utilization of time, money and efforts, and at the same time it serves as *manga carta* (several heads working together) which help in yielding better output. The foremost purpose for collaborative research can be attributed to the interdisciplinary nature of investigations, escalating cost of instrumentation, laboratory facilities and common interest of scientists in the same field. Furthermore, collaborative research is significantly related to the quality of the paper and is positively related to future research output, as research collaboration and research output positively influence each other Fox and Faver (**as cited in Vimala & Reddy, 1996**); (**He, Geng & Hunt, 2009**). International collaboration provide an avenue for the researcher to move into a wider network of contacts and participate in cutting-edge and innovative activity, to keep science successful and competitive and to become 'Global' and engage in 'Big Science' (**Jayasuriya, 2012**). **Gupta and Dhawan (2006)** carried out a study to highlight about patterns of collaborative research, the findings of the study revealed that there has been a significant growth of collaborative research output in India and the country's share of papers through national collaboration is greater than its share through international collaboration. **Arya and Sharma (2011)** in their study highlight the collaboration in research and authorship trend in the area of veterinary sciences all over the world with special reference to India. The results of the study show a clear trend towards collaborative research. The degree of collaboration is high and multi authorship is

prominent in the field of veterinary indicating that veterinarians prefer to work as a team. Price (as cited in O'Neill, 1998) observes that multiple authorships sooner or later outnumber single authorships. Price has made three predictions that single authorship would be extinct by 1980, more than half of all papers published by 1980 would be multi authored and we would, "... move steadily toward infinity of authors per paper". Subramanyam (1983) reveals that although multi authorship is dominant but solo research also exists. The author points out that the extent of collaboration in research has steadily increased, individual research effort is nowhere near extinction. According to Pillai (2007), multiple - authorship has been a characteristic feature of modern science and there has been a consistent trend towards increased collaboration in all branches of science. Collaboration and team work are among the most important necessities of scientific and technological work today. Constantian (1999) brings to light that sole authorship remained the predominant form until the mid 1950. One hundred years ago, 98% of articles contained in the journal "The new England journal of medicine" (NEJM) were contributed by a single authors; as of 1999, the figure for sole authored papers is less than 5%. Nishant (2013) in his study indicates that double authored and multi authored papers have increased during the years 1997-2006, on the other hand single authored papers have decreased over the years. It can be attributed to the fact that internet and email made it very easy for scientists to share and communicate. Furthermore, geographical location is not an impediment anymore and hence more number of papers is produced which were either double authored or multi authored. Lancaster (1991); Mali, Kronegger and Ferligoj (2010) reveal that publications written by multiple authors are generally cited more than single authored papers. Those scientists who are involved in co-authored publications tend to have stronger citation records than those who do not have co-author publications. It is recognized that the most urgent public health challenges facing our Nation cannot be adequately addressed within a single discipline, and instead require a more comprehensive approach. New discoveries and innovative solutions may become possible when researchers in different disciplines meet at the interfaces and frontiers of those disciplines to pool their diverse knowledge. Gayraud (2005) considers interdisciplinary research as a subset of the collaborative research's concept. Rogers, Scaife and Rizzo (2003) reveal that the terms multidisciplinary and interdisciplinary are often used interchangeably to refer to researchers from different institutes or disciplines or backgrounds coming together to collaborate on a common goal, be it basic or applied research. Interdisciplinary research is a mantra of science policy (Metzger & Zare, 1999). Interdisciplinary research involving the disciplines of epidemiology, vector biology, immunology and genetics, on Lymphatic filariasis in Papua New Guinea have led to new insights into the ecology and pathogenesis of human lymphatic filariasis (Bockarie & Kazura 2003).

Data Analysis and interpretation

Department wise productivity

During the period under study, a total of 514 publications have been contributed by the authors affiliated with Govt. Medical College- Jammu as seen from the Scopus database. Authors from 28 different departments have remained active participant in the research world. The Department wise rank distribution of publication is listed in Table-1, which shows Department of General Medicine leads in terms of productivity with 97 publications (18.87%), followed respectively by the Departments of Pharmacology, Department of

Surgery and Department of Pediatrics with 69 (13.42%), 46 (8.95%) and 39 (7.59%) publications. On the other hand, 2 publications are contributed each from Departments of Anatomy, Department of Chest Disease & Tuberculosis; Department of Forensic Medicine; Blood Transfusion; Microbiology and Endocrinology. The least output of (1 publication) is from Department of Nephrology.

Table 1: Department wise Contribution

Rank	Department	No. of Publications
1	General Medicine	97 (18.87)
2	Pharmacology	69 (13.42)
3	Surgery	46 (8.95)
4	Pediatrics	39 (7.59)
5	ENT	36 (7)
6	Pathology	35 (6.81)
7	Anaesthesiology	23 (4.47)
7	Orthopaedics	23 (4.47)
7	Gynaecology and Obstetrics	23 (4.47)
8	Ophthalmology	19 (3.7)
9	Radiology	18 (3.5)
10	Internal Medicine	15 (2.92)
11	Neurology	11 (2.14)
12	Social and Preventive Medicine (SPM)	10 (1.95)
12	Physiology	10 (1.95)
13	Dermatology	8 (1.56)
14	Cardiology	5 (0.97)
15	Psychiatry	4 (0.78)
15	Cardiovascular and Thoracic Surgery	4 (0.78)
16	Community Medicine	3 (0.58)
16	Neurosurgery	3 (0.58)
17	Anatomy	2 (0.39)
17	Chest Disease and Tuberculosis	2 (0.39)
17	Forensic Medicine	2 (0.39)
17	Blood Transfusion	2 (0.39)
17	Microbiology	2 (0.39)
17	Endocrinology	2 (0.39)
18	Nephrology	1 (0.19)

Figures in parentheses indicate percentage

Decade wise Contribution

From Table 2, it is evident that GMC-J has gained momentum in the 21st century as 82.30% publications are attributed to it. During 1983 to 2002, it has remained somewhat dormant and one

cannot witness any major contribution during this period. However, it is only after 2002 research activities have received impetus.

Table 2: Decadal Contribution

Period	No. of Publications	Percentage
1973-1982	42	8.17
1983-1992	24	4.67
1993-2002	25	4.86
2003 - May 2011	423	82.30
Total	514	100

Authorship Pattern

Table 3 gives a clear view of authorship pattern. 470 publications (91.44%) are the result of team efforts and the remaining 44 publications are done at individual level. This confirms that Multi authored papers are outnumbering the single authored papers.

When the authorship pattern is viewed in the top 6 contributing departments (publications > 30), it is clear from Table 4 that all publications (69) from *Department of Pharmacology* are result of collaborative efforts. And a maximum 25.6% single author contribution is found in the Department of Pediatrics.

Table 3: Authorship Pattern

Pattern	No. of Paper	Percentage
Single Authored	44	8.56
Multi- Authored	470	91.44
Total	514	100

Table 4: Authorship pattern in top 6 contributing Departments

Department	Single Author		Multi Author		Total
	No. of paper	Percentage	No. of Paper	Percentage	
General Medicine	6	6.2	91	93.8	97
Pharmacology	0	0.0	69	100.0	69
Surgery	3	6.5	43	93.4	46
Pediatrics	10	25.6	29	74.4	39
ENT	2	5.5	34	94.4	36
Pathology	3	8.6	32	91.4	35

Disciplinary Collaboration

Publications, in which an author has worked with individuals belonging to the same discipline irrespective of their institutional affiliation, were treated as work of intra-disciplinary collaboration. And publication in which an author has worked with individuals associated with different discipline irrespective of their institutional affiliation were regarding as works of inter-disciplinary collaboration. As such, of 470 publications which were done in collaboration, 254 publications (54.04%) were result of intra-disciplinary team work and 216 publications (45.96%) of interdisciplinary cooperation.

Table 5 shows the output of top 14 departments that have produced more than 9 publications in collaboration. It is clear that authors from Departmental of Pharmacology have more tendency of interdisciplinary collaboration as 91.30 percent of their publications are produced in this mode. With 75 percent of interdisciplinary collaborative works, Department of Pathology occupies the second rank. However, Department of Anaesthesiology and Department of Internal Medicine has yet to make their mark in interdisciplinary collaboration.

Besides, Department of Anaesthesiology and Department of Internal Medicine whose authors have only worked in intra-disciplinary mode, Department of Orthopaedics has produced 82.35 percent works in intra-disciplinary collaboration which is followed by Department of Pediatrics with 79.31 percent.

Table 5: Disciplinary Treatment of Collaborative Works of Top 14 Departments

Department	Interdisciplinary		Intra-disciplinary		Total
	No. of Publications	Percentage	No. of Publications	Percentage	
General Medicine	38	41.76	53	58.24	91
Pharmacology	63	91.30	6	8.70	69
Surgery	16	37.21	27	62.79	43
ENT	14	43.75	18	56.25	32
Pathology	24	75.00	8	25.00	32
Pediatrics	6	20.69	23	79.31	29
Gynaecology and Obstetrics	8	34.78	15	65.22	23
Anaesthesiology	0	0.00	19	100.00	19
Radiology	12	66.67	6	33.33	18
Ophthalmology	7	41.18	10	58.82	17
Orthopaedics	3	17.65	14	82.35	17
Internal Medicine	0	0.00	15	100.00	15
Neurology	5	45.45	6	54.55	11
Physiology	3	30.00	7	70.00	10

Document Type

As is evident from Table 6 Research publications in the form of Articles are highest in number that account for 325 (63.23%) of the total. Reviews, Letters, Editorials and Notes follow this with 84 (16.34%), 29 (5.64%), 24 (4.66%), 22 (4.28) respectively. The least form of publications published by different authors were short surveys and conference papers that accounted for 5 (0.97%) and 1 respectively. However, nature of 24 (4.66) publications could not be determined and are captioned under Unknown.

Table 6 Output in terms of Document Type

Rank	Document Type	No of Publications
1	Articles	325 (63.23)
2	Reviews	84 (16.34)
3	Letters	29 (5.64)
4	Editorials	24 (4.66)
5	Notes	22 (4.28)
6	Short surveys	5 (0.97)
7	Conference papers	1 (0.19)
	Unknown	24 (4.66)

Figures in parentheses indicate percentage

Collaboration pattern adopted by Departments

Collaboration patterns followed by various departments have been analyzed under regional, National and international collaborations to identify the most chosen trend of collaboration. Table 7 reveals that GMC-J authors have worked with individuals affiliated with 59 different institutions. Majority of the institutions (31) are situated in other states of the country, 27 institutions are located within the state. It is clear from the table that among the different departments of the institution the contribution of national collaboration is highest for Department of Anaesthesiology followed by Pharmacology. At State level, Department of ENT is the only department that has worked with a maximum of 7 institutions. At International level department of Department of Physiology is the only department wherein authors have collaborated with individuals that were working outside India.

Table 7: Institutional Collaboration

Department	Regional	National	International
Anatomy	0	0	0
Anaesthesiology	2	7	0
Chest Disease and Tuberculosis	0	2	0
Dermatology	1	2	0
ENT	7	0	0

Forensic Medicine	0	0	0
General Medicine	3	1	0
Neurology	1	1	0
Ophthalmology	0	1	0
Orthopaedics	0	1	0
Pathology	2	0	0
Pediatrics	2	3	0
Pharmacology	2	6	0
Psychiatry	0	1	0
Radiology	1	0	0
Surgery	2	1	0
Social and Preventive Medicine (SPM)	2	1	0
Cardiology	0	1	0
Community Medicine	1	0	0
Cardiovascular and Thoracic Surgery	0	0	0
Gynaecology and Obstetrics	0	0	0
Physiology	1	1	1

Citation Profile (Quality of Research)

With an average per article citations of 0.94, 514 publications have received a total of 485 citations. Maximum citations are received by the publications from *Department of Pediatrics* (167, 32.49%), followed by *Departments of Pharmacology* (119, 23.15%) and *Department of Surgery* (59, 11.48%) respectively. Since publication count across the departments vary significantly, as such average citation count will be better to judge the departmental impact. From Table 8, it is clear that *Department of Pediatrics* again ranked first here with 4.28 average citations. *Department of Endocrinology* which contributed a mere 7 publications gets 3.50 average citations. Similarly *Department of Dermatology* received 3.38 average citations to a total of 8 publications. Though *Department of Pharmacology* occupies the second position in terms of total citations, it fetches only 1.72 average citations.

Table 8: Citation Profile of Departmental Publications

Department	No. of publications	Citations Received	Average Citation
Pediatrics	39	167 (32.49)	4.28
Endocrinology	2	7 (1.36)	3.5
Dermatology	8	27 (5.25)	3.38
Pharmacology	69	119 (23.15)	1.72
Gynaecology and Obstetrics	23	31 (6.03)	1.35
Surgery	46	59 (11.48)	1.28
Psychiatry	4	5 (0.97)	1.25
Social and Preventive Medicine (SPM)	10	12 (2.33)	1.2
Internal Medicine	15	9 (1.75)	0.6
Ophthalmology	19	9 (1.75)	0.47
Neurology	11	4 (0.78)	0.36
Community Medicine	3	1 (0.19)	0.33

ENT	36	8 (1.56)	0.22
Physiology	10	2 (0.38)	0.2
General Medicine	97	18 (3.50)	0.19
Orthopaedics	23	4 (0.82)	0.17
Radiology	18	2 (0.38)	0.11
Anaesthesiology	23	1 (0.19)	0.04
Pathology	35	-	-
Blood Transfusion	2	-	-
Cardiology	5	-	-
Cardiovascular and Thoracic Surgery	4	-	-
Chest Disease and Tuberculosis	2	-	-
Forensic Medicine	2	-	-
Microbiology	2	-	-
Nephrology	1	-	-
Neurosurgery	3	-	-
Anatomy	2	-	-

Findings and conclusion

The above analysis illustrates the following points:

In all, Government Medical College Jammu (GMC- J) published a total of 514 research publications during the study period (1973- May 2011), as seen from the Scopus database. **Falagas, Michalopoulos, Bliziotis, and Soteriades (2006)** based on their findings reveal that the developing regions of the world contribute a very small amount of research to the worldwide biomedical research output. Over a 39 years' time span the research activities in Government Medical College Jammu have shown a considerable fluctuation. Out of 514 publications maximum number of 423 (82.30%) publications are published during 2003-2011 followed by 1973-1982 (8.17%) respectively. The range of papers published during the period under study is in between 42- 423. Results of the present study shows that the period during 1983-1992 has witnessed decreased literature output. This may be explained by the fact that the state was hit by the major turbulence. A widespread insurgency started in Jammu and Kashmir State during this Period. We can propose that unrest have brought about a reduction in the quantity of publications. However, during 1993- 2011 the publication count rose continuously. The reasons could be attributed to normalcy, access to internet and quality resources. Of various Departments the maximum contribution of (97publications) has been observed from the Department of General medicine and least contribution of (one paper) from Nephrology Department. However, Department of Dermatology, blood transfusion, Forensic medicine, Microbiology Psychiatry contribute in the range of 2- 8 publications. This can be elucidated by the fact that post graduate courses have been started in the aforementioned disciplines few years back.

One of the interesting findings of our analysis demonstrates that team work appears to be a driving force for authors to pursue research activities. This is in line with study of **Nwagwu**

(2007) that reveals the trends in authorship pattern of biomedical literature on Nigeria, covering a time period 1967-2002. The results indicate that out of the total 6820 papers indexed in Medline, 23% of the papers had single authors while 77% had multiple authors. The author concludes that that in biomedical field, multi authorship is extensively practiced.

Biomedical science has entered a new era where interdisciplinary collaborations are becoming critical to rapid progress. The history of medicine demonstrates that many important advances have come from an interdisciplinary approach, for example, laser surgery involved ophthalmologists, anatomists, and physicists; and gene discovery, such as the cloning of the gene associated with Huntington disease, required the input of epidemiologists, neurologists, psychologists, sociologists, and geneticists. Most scientists are recognizing that the variables of interest and the tools of other disciplines might be useful in their own work (**Committee on the Organizational Structure of the National Institutes of Health, National Research Council, 2003**). The results of the interdisciplinary research show that of 470 publications which were done in collaboration, 254 publications (54.04%) were result of intra-disciplinary team work and 216 publications (45.96%) of interdisciplinary cooperation. Our result, however, differs from that of **Bordons, Zulueta, Romero and Barrigon (1999)** who have measured interdisciplinary collaboration within a university of Spain namely, Universidad complutense de Madrid (UCM), one of the largest universities in the country, comprising of many schools and institutions including biomedicine. According to the authors interdisciplinary collaboration within the UCM shows an upward trend over time. This difference might be accounted for reasons that Researchers and Practioners in Government Medical College Jammu are stuck in their own disciplines. They may not be willing to pool their approaches or, crossing the boundaries. Other reasons might be lack of training and difficulty in getting funds. However, authors from the Department of Pharmacology and Department of Pathology have more tendencies of interdisciplinary collaboration as 91.30% and 75 % of their contributions are result of interdisciplinary research. It simply signifies that the need for interdisciplinary research is likely to grow in the aforementioned departments.

The level of collaboration involved in the publication of biomedical research articles, as determined by the addresses listed on these articles reveals that majority of publications is the result of collaboration between several institutions of the same country (national collaboration) followed by regional and international collaboration. Similar results have been found by **Garg and Padhi (2001)** in their study on collaboration in Laser Science and technology. Authors reveal that of total 3174 publications in journals of laser science and technology the number of papers written in national collaboration is higher for Japan, USA, France and India as compared to papers written in international collaboration. Frame and carpenter (**as cited in Subramanyam, 1983**) finds that degree of international collaboration is higher in basic fields of science (such as physics Mathematics and Physics) than in applied field (such as biomedical research and clinical medicine). Furthermore, various scientific factors such as geography, language, politics plays a major role in determining who collaborates with whom in the scientific community.

Publishing in journals especially international journals require good standards of research and the publications produced need to be competitive in the scientific community. Scientists who publish in these journals are of high calibre from both the developed and

developing countries (**Jacobs & Ingwersen, 2000**). Our analyses also reveal that researchers prefer to publish the results of their research in form of articles that account for 324 (63.23%) of the total. This is followed by reviews 84 (16.34%), letters 29 (5.64%), editorials 24 (4.66%).

Citations offer one of few quantitative indicators of scientific quality that easily can be compiled with access to an appropriate database (**Karlsson & Persson, 2012**). Considering the quality of papers published by the college in terms of average citation per paper, which varies from 4.28 - 0.04, the highest citation impact is recorded by the department of Paediatrics with 4.26 citations per paper, followed by endocrinology (3.5) Dermatology (3.38) and pharmacology (1.72), respectively. While least citations of 0.21 (0.04, average citation) are received by the papers contributed from the Department of Anaesthesiology. Further, Department of Pathology with 35 publications in total have not received any citations to their publications. Shifts in citation pattern among different departments could be attributed to several factors. High quality work by a scientist will trigger more responses (citations) from scientific colleagues than low quality work (Van Raan et al; Cawkell **as cited in Bornmann & Daniel, 2006**). Highly cited publications are known to maintain a more stable citation rate than normal papers (**Department of science and technology, 2012**). **Lawrence (2001)** finds that free online availability of publications significantly increases a papers impact.

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