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Mapping the contribution in research productivity of Colleges of Applied Medical Sciences affiliated with universities of Saudi Arabia published in PubMed indexed journals during the period 2009 - 2018.

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**Key words:** Bibliometric, colleges of applied medical sciences, and biomedical research.

**Abstract:**

**Aim:** The aim of this study is, to calculate the publications published in PubMed Indexed journals by authors participated as the first or as a participatory author associated with Colleges of Applied Medical Sciences, affiliated with universities of Saudi Arabia.

**Methods:** The data was retrieved and collected from the PubMed/Medline database to tabulate in Microsoft Excel 2010 year and subject wise, annual growth of publications, a pattern of authorship and frequency of journals from the period 2009 - 2018.

**Results:** This study showed that n=1652; 165.2 per annum and 75 articles per university were published during the period of 2009 - 2018. The year 2018 produced n=431; 183.4% higher than the year 2009. King Saud University place its share in research and produced n=785; 47.5% articles followed by Qassim University with n=109; 6.6% articles. While eight universities contributed in n=460; 27.8% articles as minimum 53 and maximum 80 articles as a participator in research productivity. A multi-authorship is visible in this study as a majority, which contributes n=1519; 92% articles. Subject Physiotherapy takes attention of researcher and they produced n=209; 12.6% articles. Another 12 subjects participated in n=1130; 68.6% articles. Saudi Journal of Biological Sciences facilitated in the publication of n=36; 2.1% articles out of 1151 journals which indexed in PubMed database.

**Conclusion:** Significant participation of authors and institutes in the production of publications published in PubMed Indexed journals reveals the culture of research pertained in the colleges affiliated with 22 universities of Saudi Arabia. Every year they produced qualitative and quantitative manuscripts which strengthen the objectives of policymakers in the development of the research environment among academics.

**Introduction:**

The colleges of applied medical sciences provide knowledge to understand the theory of medical science, methods to diagnose and treat ailments, and mechanism of diseases in terms to support medics and patients in regards prevention and cure them of diseases.

Minimum two and maximum ten departments or programs work to award graduation level degrees to students with state of art facilities and association of fine faculty members under the domain of college of applied medical sciences affiliated with universities of Saudi Arabia. Every academic organization form academic outlooks, spirits and ethics in its environment as a culture. These three aspects create material, institutional and spiritual culture. Environment and facilities are the general names of material culture. The adoption and operating the rules and regulations in system calls institutional culture and the connectivity of person with ideology, value and vision refer to the spiritual culture of the institute. An academic culture characterized by intellectual innovation, talent cultivation and scientific research. <sup>1</sup>

It is impossible for an author, researcher, and scientist to read every published article which is relevant to their study and provide such reference. Researchers store the papers which can find them interesting and can be useful and valuable to the rest of the field.<sup>2</sup> Publishing research as not easy as a pancake; the uniqueness of the topic, appropriateness of the content, originality of statistics, and fluency of the language are the main parts to write the manuscript in the first phase. For peer review; internal reviewer evaluates the archival and statistical position of an article for accepting to send external opinion from the expert in the field or not. An interesting study was conducted on Reviewers' Responses to Medical Research Articles by Department of Publications, College of Physicians and Surgeons Pakistan (CPSP) on external reviewer response, their promptness of reply, and duration of reply. Department contacted 598 reviewers for reviewing 50 articles, n=470; 78.5% reviewers were not replied at all, n=18; 3% regretted and n=110; 18.3% answered timely.<sup>3</sup> Three indicators used as bibliometric indicators; a) Quantity, b) Performance, and c) Journal performance indicators by institutes to gauge the productivity of an author or particular research group in submission of articles for publications in qualitative journals for specific community.<sup>4</sup>

A bibliometric analysis was conducted to know the active participatory institute, journal and country on the topic of global research on the rehabilitation of spinal cord injury in twenty years in China, the data of study during the years 1997 – 2016 was downloaded

from the Web of Science (WOS). This study revealed that 5,607 articles were published on above-said topic. The University of Washington as the institute, The Archives of Physical Medicine and Rehabilitation as a journal and United States of America (USA) found to be most active participators.<sup>5</sup> The similar study with the same objective was conducted on research trends on global obesity, because obesity is harmful to public health and their economy. The data explore and retrieved from Science Citation Index Expanded (SCI-E) for the period of 1999 – 2017. The total 50, 246 articles were published with an average of 2644.5% articles per annum. As expected the year 2017 produced 6456 articles. Total 153 countries participated in the research, among these countries, United States of America, Japan, Italy, The United Kingdom and Turkey were seen on top five slot.<sup>6</sup> The culture of research in professional colleges spark the minds of students to develop attitudes for thinking critically and creativity towards research. Undergraduate research facilitates fellow students in the engagement of encouragement to explore new answers for challenges in resources, services and incentives.<sup>7</sup>

### **Material & Methods:**

The data of authors, they wrote manuscript as first or participatory author with address of Colleges of Applied Medical Sciences affiliated with Universities of Kingdome of Saudi Arabia published in the PubMed indexed journals download and tabulate in MS Office Excel Sheet 2010 from the PubMed/Medline database in the library of college of applied medical sciences King Saud bin Abdulaziz University for Health Sciences, Riyadh Kingdome of Saudi Arabia. The advanced searching technique was used in PubMed, typed “College of Applied Medical Sciences” and “Faculty of College of Applied Medical Sciences” in all field menu, Boolean operator AND appears by default, typed “Kingdome of Saudi Arabia” select as “Affiliation” in the second menu. Therefore Comma-separated value (CSV) file format, Abstract on Note-paid was downloaded with a custom date range from January 1<sup>st</sup> 2009 to 31<sup>st</sup> December 2018. The concise objectives with clear thought were set to discover; a) to determine the year-wise growth, b) to estimate the authorship pattern, c) to review the subject-wise distribution of publications and d) to evaluate research published in journals.

## RESULTS

Table 1 and figure 1: Shows that the total 2183 original, review articles and case reports were downloaded from the PubMed database. Searching technics of Boolean operator was used “College of Applied Medical Sciences” with inverted comma’s AND typed affiliation “Saudi Arabia” and “Kingdome of Saudi Arabia” by default to set as excluded criteria. Total n=1652; 75.6% articles were selected for study out of 2183 articles.

**Table 1: Finding the applicability’s of contribution in research productivity published in PubMed indexed journals during the period 2009 – 2018**

S. No	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Article download to review	13	27	43	51	101	229	328	428	396	567	2183
Articles excluded after review	2	11	11	8	18	57	66	116	111	131	531
Articles included to analyzed	11	16	32	43	83	172	262	312	285	436	1652

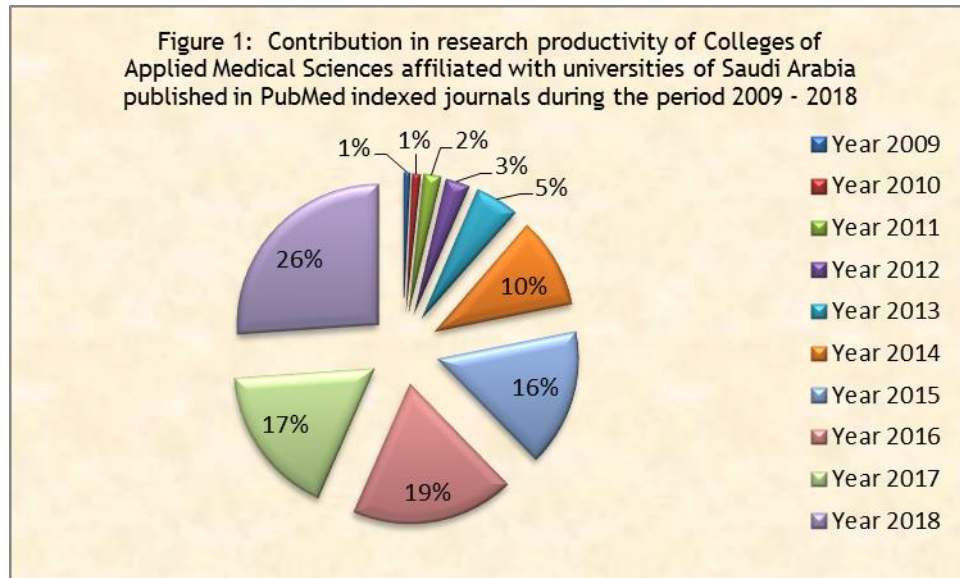


Table 2 described the annual growth rate. The 20.3% average has been reported an annual growth rate of the studied period of 2009-2018. Below formula utilized to have been used to evaluate the growth rate of research productivity published in PubMed indexed journals produced by universities of Saudi Arabia. It interesting to know that the year 2018 produced n=431; 183.4% higher than the year 2009.

$$= (1/\text{Numbers of Years}) * \text{LN}(\text{Last Amount} / \text{Initial Amount}) * 100$$

**Table – 2; Year wise distribution of Publications (n=1652) and annual growth rate.**

Years	Publications	Annual Growth
Year 2009	11	
Year 2010	16	18.7
Year 2011	33	36.1
Year 2012	46	16.6
Year 2013	83	29.5
Year 2014	172	36.4
Year 2015	262	21
Year 2016	312	8.7
Year 2017	286	-4.3
Year 2018	431	20.5

Collaborative writings improve vocabulary related to the quality of text and fluency and learner's attitude towards the creation of an academic environment.<sup>8</sup> The Internet is the basic component of information and communication technologies (ICT) to contact and share the ideas in the joint text as co-authorship or collaboratively.<sup>9</sup> Table 3 presents the year-wise breakdown of publications produced by colleges of applied medical sciences affiliated with 22 universities existing in Kingdom of Saudi Arabia in alphabetical order. The total articles n=1652; 165.2 average per annum were published in PubMed indexed journals during the years 2009 – 2018. Minimum n=11; 0.67% articles were published in 2009 and maximum n=431; 26% visible in 2018 out of 1652 articles. Study finds that King Saud University grasp top position n= 785; 47.5 followed by Qassim University n=109; 6.6% out of 1652 articles.

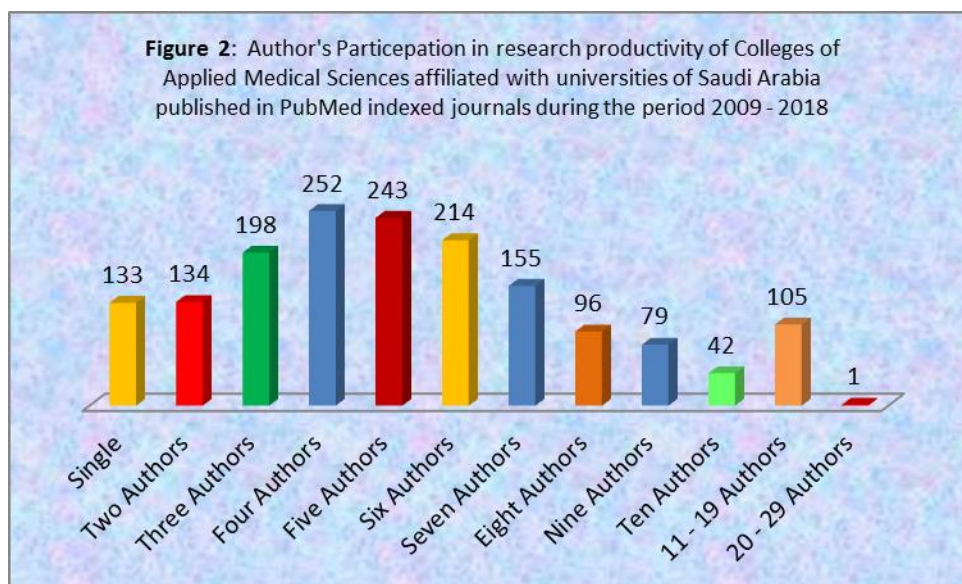
**Table 3: Research productivity of Colleges of Applied Medical Sciences affiliated with universities of Saudi Arabia during the period 2009 - 2018**

	Name of University (In Alphabetical Order)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	%
1	Albaha University						2		3	4	10	19	1.1%
2	Aljouf University			3	1	1	2	8	3	6	15	39	2.3%
3	Imam Abdulrahman Bin Faisal University of Dammam			5	5	4	6	14	13	11	20	78	4.7%
4	Jazan University						4	2	7	6	20	39	2.3%
5	King Abdul Aziz University						1	5	14	6	8	34	2%
6	King Faisal University, AlAhsa	3							3	4	3	13	0.7%
7	King Khalid University, Abha					2	4	9	11	14	15	55	3.3%
8	King Saud Bin Abdulaziz University for Health Sciences, Riyadh				1	5	5	9	14	18	20	72	4.3%
9	King Saud University, Riyadh	8	10	21	29	55	104	126	142	129	161	785	47.5%
10	Majmaah University							9	9	14	29	61	3.6%
11	Najran University					1	3	3				7	0.4%
12	Northern Border University, Arar							5	2	2	1	10	0.6%
13	Prince Sattam bin Abdulaziz University Al-Kharj		5	1	2		2	11	5	10	17	53	3.2%



14	Qassim University		1		3	11	20	22	11	16	25	109	6.6%
15	Shaqra University			1			3		13	8	16	41	2.4%
16	Taibah University			1	1	2	7	13	17	14	25	80	4.8%
17	Taif University				1	2	5	10	16	5	10	49	2.9%
18	Umm Al-Qura University			1	1				8	3	10	23	1.3%
19	University of Bisha										6	6	0.3%
20	University of Hafr Albatin								2			2	0.1%
21	University of Hail				2		4	14	11	14	16	61	3.6%
22	University of Tabuk							2	8	2	4	16	0.9%
	<b>Total</b>		<b>11</b>	<b>16</b>	<b>33</b>	<b>46</b>	<b>83</b>	<b>172</b>	<b>262</b>	<b>312</b>	<b>286</b>	<b>431</b>	<b>1652</b>

Figure 2 and Table 4 displays the pattern of authorship. It is revealed that majority research n=1519; 92% of authors were collaboratively written and produced by multi-authors. Only n=133; 8% of articles were submitted to publishing by single or solo authors out of 1652 articles. Four authors n=252; 15.2% was in majority followed by n=243; 14.7% three authors as collaborative and participative authorship pattern. It is also revealed that n=105; 6.3% of articles were written by 11 – 19 authors in cooperative manners. A further breakdown of authorship can be shown in table 4.



**Table 4:**

Pattern of authorship in research productivity published in PubMed indexed journals contributed by universities of

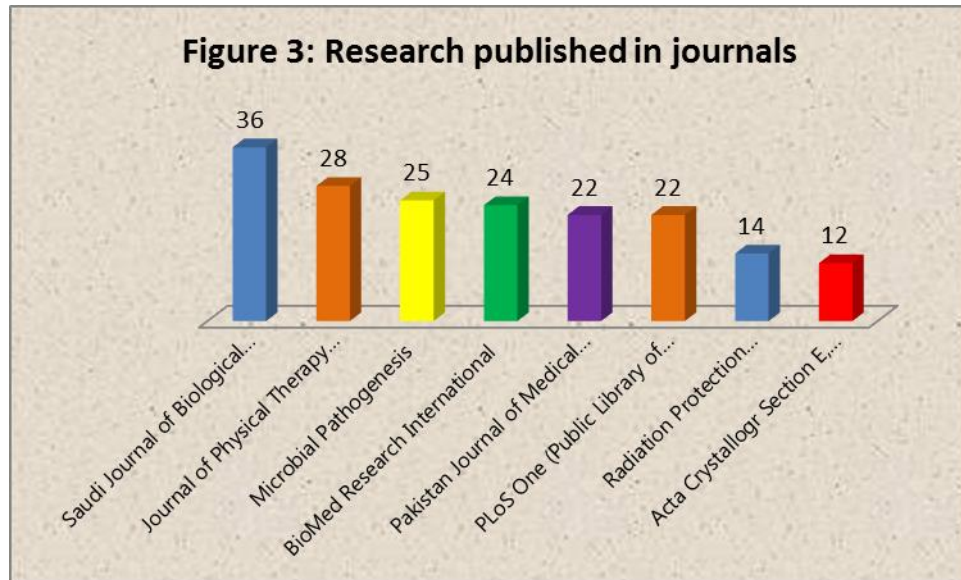
Saudi Arabia during the period 2009 – 2018.												
Authors	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	%
Single	6	3	8	8	10	19	24	22	13	20	133	8%
Two Authors		3	11	3	14	10	20	25	20	28	134	8.1%
Three Authors	1	3	5	8	15	31	40	38	31	26	198	12%
Four Authors	1	1	4	6	14	30	40	48	43	65	252	15.2%
Five Authors	1	1	1	9	13	30	45	37	38	68	243	14.7%
Six Authors	2	2	3	7	8	20	27	39	47	59	214	13%
Seven Authors		1		1	3	11	24	33	25	57	155	9.3%
Eight Authors		2		1	1	7	16	18	20	31	96	5.8%
Nine Authors					2	7	3	25	18	24	79	4.7%
Ten Authors					1	6		9	14	12	42	2.5%
11 - 19 Authors					1	1	23	18	16	46	105	6.3%
20 - 29 Authors					1						1	0.06%
<b>Total</b>	<b>11</b>	<b>16</b>	<b>32</b>	<b>43</b>	<b>83</b>	<b>172</b>	<b>262</b>	<b>312</b>	<b>285</b>	<b>436</b>	<b>1652</b>	

Reported universities work with approximately forty departments (Annexure A, is attached). Some departments are very new others working and supports since the year 2002 to their affiliated universities. Table 5, appraised the amount of research produced as subject-wise. A study shows that n=975; 59% of articles were produced in seven subjects and rest of n=677; 41% of publications produced by authors affiliated with other subjects.

S. No	Table-5; Subject-wise distribution of publications (Largest to smallest, n=1652)	Publications with %
1	Physiotherapy	209 (12.6%)
2	Chemistry	165 (10%)
3	Genetics	145 (8.7%)
4	Dentistry	129 (7.8%)
5	Ophthalmology	119 (7.2%)
6	Community Medicine	107 (6.4%)
7	Radiology	101 (6.1%)
8	Microbiology	97 (5.8%)
9	Oncology	71 (4.3%)
10	Pharmacology & Therapeutics	63 (3.8%)
11	Infectious Diseases	48 (2.9%)
12	Biochemistry	43 (2.6%)
13	Biomedical Technology	42 (2.5%)

14	Nutrition	35 (2.1%)
15	Hematology	27 (1.6%)
16	Respiratory Care	26 (1.5%)
17	Nursing	25 (1.5%)
18	Endocrinology	24 (1.4%)
19	Gastroenterology	23 (1.3%)
20	Bacteriology & Medical Education	21 (1.2%)
21	Cardiology	16 (0.9%)
22	Immunology	15 (0.9%)
23	Parasitology	11 (0.6%)
24	Hepatology	10 (0.6%)
25	Virology	9 (0.5%)
26	Epidemiology, Occupational Therapy, Psychiatry and Toxicology (8 Articles on Each)	8 (0.4%)
27	Pathology	7 (0.4%)
28	Emergency Medical Services	5 (0.3%)
29	Health Informatics	4 (0.2%)
30	Urology	2 (0.1%)
	<b>Total</b>	<b>1652</b>

Total 1151 journals were published 1652 articles during the period 2009 – 2018 as attached with a PubMed database. Figure 3 explained that n=183; 11%, articles were published in eight journals out of 1652 articles. Maximum n=36; 2.1% articles were published by Saudi Journal of Biological Sciences and minimum n=12; 0.7% produced in Acta Crystallogr Section E, Structure reports online journal.



**Discussion & Conclusion:** This study displayed the deep involvement of institutes in research publishes in qualitative protocols. After the year of 2014, the ratio of publications rise significantly and produced n=1291; 78.1% articles in departments of colleges of applied medical sciences attached to the universities of Saudi Arabia. The amount of collaborative participation of authors was also increased as n=1216; 73.6% out of 1295 authors in the last four years. The departments of colleges of applied medical sciences have produced enormous research in various fields. The majority research papers are linked with laboratories. A few portions of publications reflect the importance of technologies in terms of information and innovations.

**Disclaimer:** This study presents only numbers and not inclined or declined growth of any organization, city, country and standards.

**Conflict of Interest:** None to declare.

**Funding Disclosure:** None to declare

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<b>Annexure – A:</b>	
S. No	The name of various departments existing in universities of Kingdom of Saudi Arabia (In-Alphabetical Order).
1	Department of Anesthesia Technology
2	Department of Audiology & Speech Pathology
3	Department of Basic Health Sciences
4	Department of Biomedical Technology
5	Department of Clinical Laboratory Sciences,
6	Department of Clinical Nutrition
7	Department of Clinical Technology
8	Department of Community Health

9	Department of Community Health Sciences
10	Department of Dentistry
11	Department of Dental Health
12	Department of Diagnostic Radiology
13	Department of Emergency Medical Services
14	Department of Environmental Health
15	Department of Health Information Management
16	Department of Health Information Management and Technology
17	Department of Health Rehabilitation Science
18	Department of Human Health
19	Department of Medical Equipment Technology
20	Department of Medical Laboratories
21	Department of Medical Laboratory Science
22	Department of Medical Laboratory Technology
23	Department of Medical Rehabilitation
24	Department of Medical Rehabilitation Sciences
25	Department of Medical Technology
26	Department of Nursing
27	Department of Occupational Therapy
28	Department of Optometry
29	Department of Optometry & Vision Sciences
30	Department of Physical Therapy
31	Department of Physical Therapy and Health Rehabilitation
32	Department of Physiotherapy
33	Department of Public Health
34	Department of Radiologic Technology
35	Department of Radiological Sciences
36	Department of Radiological Sciences & Medical Imaging
37	Department of Radiology
38	Department of Radiology and Medical Imaging
39	Department of Respiratory Therapy
40	Department of Technology of Medical Instrument