ECRONICON OPEN ACCESS

EC GASTROENTEROLOGY AND DIGESTIVE SYSTEM
Literature Review

Pancreatitis Research in India: A Scientometric Assessment of Publications during 2007-16

BM Gupta[1]* and KK Mueen Ahmed[2]

[1]*National Institute of Science, Technology and Development Studies, CSIR, New Delhi, India*

[2]*Phcog.Net and SciBiolMed.Org, Bengaluru, Karnataka, India*

***Corresponding Author:** BM Gupta, National Institute of Science, Technology and Development Studies, CSIR, New Delhi, India.

Received: December 29, 2017; **Published:** January 17, 2018

Abstract

The present study examined 3858 Indian pancreas research publications, as indexed in Scopus database during 2007-16, with a view to understand their growth rate, global share, citation impact, international collaborative papers share, distribution of publications by broad subjects, productivity and citation profile of top organizations and authors, preferred media of communication and characteristics of high cited papers. The Indian publications registered an annual average growth rate of 75.05%, global share of 3.06%, international collaborative publications share of 16.14% and its citation impact averaged to 12.45 citations per paper. Among broad subjects, medicine contributed the largest publications share of 73.27%, followed by biochemistry, genetics and molecular biology (31.76%), pharmacology, toxicology and pharmaceutics (19.91%), agricultural and biological sciences (4.07%) and immunology and microbiology (2.58%) during 2007-16. Among various organizations and authors contributing to India's acute pancreatitis research, the top 15 organizations and authors together contributed 38.0% and 21.53% respectively as their share of global publication output and 55.49% and 23.98% respectively as their share of global citation output during 2007-16. Among 3891 journal papers in Indian pancreas research, the top 20 most productive journals contributed 25.31% share of total journal publication output during 2007-16, which decreased from 25.82% to 25.02% from 2007-11 and 2012-16. There were only top 56 highly cited publications, which registered citations from 101 to 4474 during 2007-16 and they together received 15095 citations, which averaged to 269.55 citations per paper. Indicate that pancreas disorders research have been a neglected subspecialty in India and as a result there is a need to develop a national policy on pancreas research, where identification, screening, diagnosis and treatment of patients can be undertaken at affordable rates.

Keywords: *Pancreas Research; Indian Publications; Scientometrics; Bibliometrics*

Introduction

The pancreas is a large gland behind the stomach and close to the first part of the small intestine (duodenum). It is responsible for exocrine and endocrine functions. It contains exocrine glands that secrete powerful digestive enzymes and hormones that enter the small intestine through duct. These enzymes help digestion fats, proteins and carbohydrates in the form of food. As an endocrine function, It releases the hormones - insulin and glucagon into the bloodstream. These hormones pay an important role in maintaining the glucose level in the blood [1,2].

As with all organs in our bodies, the pancreas is susceptible to several disorders that can affect its functionality to varying degrees. Some of the most common pancreatic disorders are described below: (i) Pancreatitis is an inflammation of the pancreas. This disorder is associated with early activation of the digestive enzymes that are released into the small intestine during the digestive process. Rather

than activating at the appropriate time to digest food, these enzymes attack the pancreatic tissue instead causing damage. Pancreatitis - There are several different levels of pancreatitis, all resulting from different things and exhibiting their own symptoms: (a) Acute Pancreatitis - Usually accompanying severe upper abdominal pain, this form of pancreatitis is a sudden attack that causes inflammation of the pancreas. Other symptoms include nausea, vomiting, fever, and an increase in heart rate. This can be a single or recurring event and is often caused by things such as: chronic alcohol consumption, hereditary conditions, trauma, medications, infections, and hormonal abnormalities. In the United States the most common cause of acute pancreatitis is the formation of gallstones and (b) Chronic Pancreatitis - This disorder is a progressive disease that eventually alters the pancreas' normal structure and functionality. Having similar symptoms as acute pancreatitis, this disorder often goes misdiagnosed for some time. In addition, chronic pancreatitis causes irreversible damage to the pancreas. The most common cause for chronic pancreatitis is alcoholism. It is suggested that up to 70% of all cases are somehow related to alcohol consumption. However, several bouts of acute inflammation of the pancreas can result in a chronic pancreatitis diagnoses as well [3]; (ii) Pancreatic cysts - are collections (pools) of fluid that can form within the head, body, and tail of the pancreas. Some pancreatic cysts are true cysts (non-inflammatory cysts), that is, they are lined by a special layer of cells that are responsible for secreting fluid into the cysts. Other cysts are pseudocysts (inflammatory cysts) and do not contain specialized lining cells. Often these pseudocysts contain pancreatic digestive juices because they are connected to the pancreatic ducts. Pancreatic cysts can range in size from several millimeters to several centimeters [4] and (iii) Pancreatic cancer - It arises when cells in the pancreas, a glandular organ behind the stomach, begin to multiply out of control and form a mass. These cancerous cells have the ability to invade other parts of the body. There are a number of types of pancreatic cancer. The most common, pancreatic adenocarcinoma, accounts for about 85% of cases. These adenocarcinomas start within the part of the pancreas which makes digestive enzymes. Several other types of cancer, which collectively represent the majority of the non-adenocarcinomas, can also arise from these cells. One to two percent of cases of pancreatic cancer are neuroendocrine tumors, which arise from the hormone-producing cells of the pancreas. These are generally less aggressive than pancreatic adenocarcinoma [5].

Literature Review

No bibliometric study had been published so far focusing on pancreas research, both at national and international level. Few bibliometric studies have been carried in the past, however, in area of gastro- related research. Amongst such studies, Loomes [6] undertook a bibliometric analysis of high cited clinical articles in digestive disease, with focus on country and authorship. It also examined the characteristics, such as citation ranking, year of publication; publishing journal, study design. Chou [7] studied the MEDLINE-indexed publications (81 561 articles) published in 91 gastroenterology journals from 2001 to 2007. Special attention was paid to specific types of articles (randomized controlled trials). Only 12 journals had more than 2000 articles indexed in MEDLINE. The "World Journal of Gastroenterology" had the largest number of publications (5684 articles), followed by "Hepato-Gastroenterology" (3036) and "Gastrointestinal Endoscopy". Among 141 741 author names appearing in the articles of gastroenterology journals, 92429 had published only in one journal, 22 585 in two journals, 9996 in three journals, and 16 731 in more than three journals. Lewison [8] examined the volume and potential citation impact of gastroenterology research outputs from 1985 to 1998 from 14 developed countries; the overlap with research in cancer, infectious diseases, and genetics; and the funding sources for this research. It also determined if countries' research outputs correlated with their burden of corresponding diseases and inputs to their research.

Objectives

The present manuscript aims to study the various dimensions of India's pancreas research in terms of various bibliometric indicators based on publications and citation data, derived from Scopus database during 2007-16. In particular, the study analyzed overall annual and cumulative growth of Indian publications, its global share among top 10 most productive countries, its citation impact, its international collaborative papers share, publication output distribution by broad sub-fields, productivity and citation impact of most productive organizations and authors, leading media of communications and characteristics of top highly cited papers.

Methodology

The publication data on India's pancreas research during 2007-16 was retrieved and downloaded for the present study from the Scopus international multidisciplinary database (http://www.scopus.com). A main search strategy for global output was formulated, where the keyword such as "pancrea*" is searched in the "keyword tag" or ''Article Title Tag'' or "Source Title tag" and further limited the search output to period '2007-16' within "date range tag". This search strategy generated 129229 global publications on global pancreas research from the Scopus database. This main search strategy was later refined by ''Country Name Tag'' to get pancreas research output of individual top 10 most productive countries, including India one by one. Detailed analysis was carried out on 3958 Indian publications data using the analytical provisions or tags existing in Scopus database such as "subject area tag", "country tag", "source title tag", "journal title name" and "affiliation tag", to get data distribution by subject, collaborating countries, author-wise, organization-wise and journal-wise, etc. For citation data, citations to publications were also collected from date of publication till 28 September 2017. A series of raw and relative bibliometric indicators were used by authors to understand the dynamics of India's acute pancreas research from different perspective

(KEY(pancrea*) OR TITLE(pancrea*)OR SRCTITLE(pancrea*)) AND PUBYEAR > 2006 AND PUBYEAR < 2017

KEY(pancrea*) OR TITLE(pancrea*)OR SRCTITLE(pancrea*)) AND PUBYEAR > 2006 AND PUBYEAR < 2017 AND (LIMIT-TO (AFFILCOUNTRY, "India")).

Analysis

The global and Indian research output in pancreas research cumulated to 129239 and 3958 publications in 10 years during 2007-16 and they increased from 10331 and 186 in the year 2007 to 13998 and 480 publications in the year 2016, registering 3.51% and 11.19% growth per annum. Their five-year cumulative output increased from 57916 and 1439 to 71323 and 2519 publications from 2007-11 to 2012-16, registering 23.15% and 75.05% growth respectively. The share of Indian publications in global output was 3.06% during 2007-16, which increased from 2.48% to 3.53% from 2007-11 to 2012-16. Amongst Indian publications on pancreas research, 72.03% (2851) was published as articles, 14.30% (566) as reviews, 6.24% (247) as letters, 2.78% (110) as notes, 1.49% (59) as editorials, 1.26% (50) as conference papers, 1.06% (42) as book chapters, 0.45% (18) as short surveys, 0.18% (7) each as erratum's and articles in press and 0.03% (1) as book. The research impact as measured by citations per paper registered by Indian publications in pancreas research averaged to 12.45 citations per publication (CPP) during 2007-16; five-yearly impact averaged to 18.18 CPP for the period 2007-11 which declined to 9.18 CPP in the succeeding five-year 2012-16 (Table 1).

Publication Period	World	India					
	TP	TP	TC	CPP	ICP	%ICP	%TP
2007	10331	196	6270	31.99	32	16.33	1.90
2008	11022	244	3774	15.47	33	13.52	2.21
2009	11793	279	5279	18.92	41	14.70	2.37
2010	12237	304	5062	16.65	44	14.47	2.48
2011	12533	416	5772	13.88	75	18.03	3.32
2012	13750	475	5411	11.39	73	15.37	3.45
2013	14354	510	5151	10.10	90	17.65	3.55
2014	14533	522	3268	6.26	80	15.33	3.59
2015	14688	532	8386	15.76	103	19.36	3.62
2016	13998	480	920	1.92	68	14.17	3.43
2007-11	57916	1439	26157	18.18	225	15.64	2.48
2012-16	71323	2519	23136	9.18	414	16.44	3.53
2007-16	129239	3958	49293	12.45	639	16.14	3.06

Table 1: *World and India's Output in Pancreas Research, 2007-16.*

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper; ICP: International Collaborative Papers

Top 10 Most Productive Countries in Pancreas Research

The global pancreas research originated from 100 + countries during 2007-16. However, 84.82% of global publication share was contributed by 10 most productive countries in global pancreas research in 10 years during 2007-16; their 5-year global publication share was 82.94% in 2007-11 which increased to 86.35% in 2012-16. The global publication share of 10 top countries ranged between 3.06% and 31.88% with USA accounting for the highest publication share (31.88%), followed by China (10.31% share),Japan (9.75%), Germany (7.08%), U.K. (6.74%), Italy (5.43%), France (4.03%), Canada (3.44%), Spain (3.09%) and India (3.06%) during 2007-16. China, India and Italy registered rise in their 5-year global publication share by 5.16%, 1.05% and 0.62%, whereas countries like Germany, U.K., Japan, USA, Spain and France witnessed marginal decline in their global publication share by 0.02% to 1.28% during the period from 2007-11 to 2012-16 (Table 2).

S. No	Country Name	Number of Publications			Global Share of Publications		
		2007-11	2012-16	2007-16	2007-11	2012-16	2007-16
1	USA	18644	22563	41207	32.19	31.63	31.88
2	China	4322	9004	13326	7.46	12.62	10.31
3	Japan	5846	6760	12606	10.09	9.48	9.75
4	Germany	4507	4637	9144	7.78	6.50	7.08
5	U.K.	4133	4582	8715	7.14	6.42	6.74
6	Italy	2946	4072	7018	5.09	5.71	5.43
7	France	2341	2867	5208	4.04	4.02	4.03
8	Canada	1989	2452	4441	3.43	3.44	3.44
9	Spain	1866	2131	3997	3.22	2.99	3.09
10	India	1439	2519	3958	2.48	3.53	3.06
	Total of 10 countries	48033	61587	109620	82.94	86.35	84.82
	Total of India	57916	71323	129239			
	Share of top 10 countries in world total	82.94	86.35	84.82			

Table 2: *Publication Output and Global Publication Share of Top 10 Most Productive Countries in Pancreas Research during 2007-16.*

India's International Collaboration

The share of India's international collaborative publications (ICP) in its national output in pancreas research was 16.14% during 2007-16, which increased from 15.64% during 2007-11 to 16.44% during 2012-16. About 59 foreign countries collaborated with India in 639 pancreas research papers during 2007-16. These 639 papers together registered 21607 citations, with 33.81 citations per paper.

Subject-Wise Distribution of Indian Research Output

As per the Scopus database classification, India's acute pancreatitis research output is distributed across five sub-fields during 2007-16. Among sub-fields, medicine registered the highest publications share (73.27%), followed by biochemistry, genetics and molecular biology (31.76%), pharmacology, toxicology and pharmaceutics (19.91%), agricultural and biological sciences (4.07%) and immunology and microbiology (2.58%) during 2007-16. The publication activity, as seen through activity index from 2007-11 to 2012-16, witnessed increase in medicine (from 99.49 to 100.29), biochemistry, genetics and molecular biology (from 93.22 to 103.88) and pharmacology, toxicology and pharmaceutics (from 98.43 to 100.9), as against decrease in agricultural and biological sciences (from 116.17 to 90.76) and immunology and microbiology (from 107.86 to 95.51) from 2007-11 to 2012-16. In terms of citation impact per paper, immunology and

microbiology, among sub-fields, registered the highest CPP of 18.25, followed biochemistry, genetics and molecular biology (17.88), agricultural and biological sciences (16.52), pharmacology, toxicology and pharmaceutics (14.03), and medicine (11.45) during 2007-16 (Table 3).

S. No	Subject*	Number of Papers (TP)			Activity Index		TC	CPP	%TP
		2007-11	2012-16	2007-16	2007-11	2012-16	2007-16	2007-16	2007-16
1	Medicine	1049	1851	2900	99.49	100.29	33192	11.45	73.27
2	Biochemistry, Genetics and Molecular Biology	426	831	1257	93.22	103.88	22476	17.88	31.76
3	Pharmacology, Toxicology and Pharmaceutics	282	506	788	98.43	100.90	11056	14.03	19.91
4	Agricultural and Biological Sciences	68	93	161	116.17	90.76	2659	16.52	4.07
5	Immunology and Microbiology	40	62	102	107.86	95.51	1861	18.25	2.58
	Indian Output	1439	2519	3958					
• There is overlapping of literature covered under various subjects									

Table 3: *Subject-Wise Breakup of Indian Publications in Indian Pancreas Research during 2007-16.*

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper

Different Types of Pancreas Disorders

On classifying Indian pancreas disorders, it was observed that pancreatic cancer contributed the largest share (29.91%) of publications, followed by acute pancreatitis (14.688%), chronic pancreatitis (10.69%) and pancreatic cyst (3.74%) during 2007-16. In terms of global share, Indian chronic pancreatitis research output received the highest global share of 5.47%, followed by acute pancreatitis (4.28%), pancreatic cyst (3.33%) and pancreatic cancer (2.04%) during 2007-16. In terms of citation impact per paper, Indian pancreatic cancer research output registered the largest impact (19.09), followed by chronic pancreatitis (11.02), acute pancreatitis (9.18) and pancreatic cyst (6.73) during 2007-16 (Table 4).

S. No	Type of Pancreas Disorder	World	India				
		GTP	TP	TC	CPP	%GTP	%TP
1	Acute Pancreatitis	13569	581	5331	9.18	4.28	14.68
2	Chronic Pancreatitis	7733	423	4662	11.02	5.47	10.69
3	Pancreatic Cyst	4598	148	996	6.73	3.22	3.74
4	Pancreatic Cancer	58079	1184	22599	19.09	2.04	29.91
	Indian Output	129239	3958				

Table 4: *India's Research by Type of Pancreas Disorders during 2007-16.*

GTP: Global Total Papers; TP: Total Papers; TC: Total Citations; GTP: India's share in Global Total Papers

Significant Keywords

Around 59 significant keywords have been identified from the literature, which highlight possible research trends in Indian pancreas research. These keywords are listed in table 5 in the decreasing order of their frequency of occurrence in 10 years during 2007-16.

S. No	Keyword	Frequency	S. No	Keyword	Frequency
1	Pancreatitis	673	31	Breast cancer	201
2	Computer-Assisted tomography	651	32	Immunohistochemistry	201
3	Insulin	651	33	Pancreas tumor	197
4	Glucose	596	34	Antineoplastic activity	195
5	Histopathology	571	35	Streptozocin	196
6	Diabetes mellitus	540	36	Insulin resistance	193
7	Abdominal pain	479	37	Diabetes	192
8	Pancreas cancer	477	38	Glibenclamide	192
9	Acute pancreatitis	435	39	Insulin release	192
10	Pancreatic neoplasm	385			
11	Human tissues	366	40	Triacy glycerol	191
12	Chronic pancreatitis	348	41	Signal transduction	189
13	Non-insulin dependent diabetes mellitus	323	42	Endoscopic echography	188
14	Pathology	318	43	Diabetes mellitus, Type 2	171
15	Ecography	303	44	Genetics	165
16	Drug efficacy	280	45	NMR Imaging	152
17	Amylase	264	46	Pancreas resection	152
18	Plant extract	263	47	Prognosis	151
19	Anti-diabetic activity	258	48	Laparotomy	150
20	Vomiting	257	49	Gene expression	148
21	Blood glucose oxidative stress	244	50	Neoplasm	148
22	Hyperglycemia	239	51	Prostate cancer	146
23	Apoptosis	234	52	Obesity	146
24	Enzyme activity	230	53	Pancreas disease	145
25	Liver	217	54	Drug safety	144
26	Pancreaticoduodenectomy 214		55	Streptozocin diabetes	144
27	Drug mechanism	210	56	Antioxidants	137
28	Drug severity	205	57	Lung cancer	135
29	Drug effect	203	58	Pancreas Islet	134
30	Triacylglycerol lipase	202	59	Diarrhea	133

Table 5: *List of Significant Keywords in Literature on Indian Pancreas Research during 2007-16.*

Profile of Top 20 Most Productive Indian Organizations

988 organizations participated in Indian pancreas research, of which 692 organizations contributed each 1 - 5 papers, 171 organizations each 6 - 10 papers, 77 organizations each 11 - 20 papers, 38 organizations each 21 - 50 papers, 6 organizations each 51 - 100 papers and 4 organizations each more than 100 papers. The top 20 Indian organizations contribution to pancreas research varied from 36 to 278 publications and they together accounted for 38.0% (1504) publication share and 55.49% (27354) citation share to its cumulative publications output during 2007-16. Table 6 presents a scientometric profile of these 15 India organizations.

S. No	Name of the Organization	TP	TC	CPP	HI	ICP	%ICP	RCI
1	Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh	278	3675	13.22	24	20	7.19	1.06
2	All India Institute of Medical Sciences (AIIMS), New Delhi	210	3905	18.60	27	24	11.43	1.49
3	Tata Memorial Hospital (TMH), Bombay	102	5887	57.72	16	35	34.31	4.64
4	Asian Institute of Gastroenterology, Hyderabad	101	1553	15.38	22	31	30.69	1.24
5	Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow	95	1059	11.15	15	13	13.68	0.90
6	Christian Medical College (CMC), Vellore	73	710	9.73	14	21	28.77	0.78
7	Manipal University	61	534	8.75	11	11	18.03	0.70
8	National Center for Cell Science (NCCS), Pune	54	1358	25.15	21	13	24.07	2.02
9	Institute of Liver and Biliary Sciences, New Delhi	53	652	12.30	13	21	39.62	0.99
10	University of Delhi	50	1447	28.94	14	10	20.00	2.32
11	Amrita Institute of Medical Sciences, Coimbatore	48	411	8.56	10	5	10.42	0.69
12	Banaras Hindu University, Varanasi	48	1382	28.79	12	7	14.58	2.31
13	Kasturba Medical College (KMC), Manipal	48	220	4.58	8	2	4.17	0.37
14	Maulana Azad Medical College (MAMC), Delhi	44	273	6.20	9	5	11.36	0.50
15	GB Pant Hospital, Delhi	43	416	9.67	10	1	2.33	0.78
16	University of Madras, Chennai	43	1367	31.79	19	25	58.14	2.55
17	National Institute of Pharmaceutical Education and Research (NIPER), Mohali	40	1330	33.25	15	7	17.50	2.67
18	Sir Ganga Ram Hospital, New Delhi	40	260	6.50	8	5	12.50	0.52
19	Aligarh Muslim University, Aligarh	37	398	10.76	11	8	21.62	0.86
20	Annamalai University	36	517	14.36	13	5	13.89	1.15
	Total of 20 organizations	1504	27354	18.19	14.6	269	17.89	1.46
	Total of India	3958	49293	12.45				
	Share of top 20 organizations in Indian total output	38.00	55.49					

Table 6: *Scientometric Profile of Top 20 Most Productive Indian Organizations in Pancreas Research during 2007-16.*

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper; HI: h-index; ICP: International Collaborative Papers; RCI: Relative Citation Index

- Five organizations registered higher productivity than the group average of 75.2: PGIMER-Chandigarh (278 papers), AIIMS-New Delhi (210 papers), TMH- Bombay (102 papers), Asian Institute of Gastroenterology, Hyderabad (101 papers) and SGPGIMS-Lucknow (95 papers) during 2007-16.

- Seven organizations registered higher citation impact than group average of 18.19 citations per publication: TMH-Bombay (57.72), NIPER-Mohali (33.25), University of Madras, Chennai (31.79), University of Delhi (28.94), Banaras Hindu University, Varanasi (28.79), National Center for Cell Science (NCCS), Pune (25.15) and AIIMS-New Delhi (18.60) during 2007-16.

- Eight organizations registered higher h-index than group average of 14.06: AIIMS-New Delhi (27), PGIMER-Chandigarh (24), Asian Institute of Gastroenterology, Hyderabad (22), National Center for Cell Science, Pune (21), University of Madras, Chennai (19), TMH-Bombay (16), NIPER-Mohali and SGPGIMS-Lucknow (15 each) during 2007-16.

- Nine organizations achieved higher international collaborative publications share than group average of 17.89%: University of Madras, Chennai (58.14%), Institute of Liver and Biliary Sciences, New Delhi (39.62%), TMH-Bombay (34.31%), Asian Institute of Gastroenterology, Hyderabad(30.69%), CMC- Vellore (28.77%), NCCS-Pune (24.07%), Aligarh Muslim University, Aligarh (21.62%), University of Delhi (32.0%) and Manipal University (18.03%) DURING 2007-16.

- Seven organizations registered higher relative citation index than group average (1.46): TMH-Bombay (4.64), NIPER-Mohali (2.67), University of Madras, Chennai(2.55), University of Delhi (2.32), Banaras Hindu University, Varanasi (2.31), National Center for Cell Science (NCCS), Pune (2.02) and AIIMS-New Delhi (1.49) during 2007-16.

Profile of Top 20 Most Productive Authors

1244 authors participated in Indian pancreas research, of which 855 authors contributed each 1 - 5 papers, 291 authors each 6 - 10 papers, 71 authors each 11 - 20 papers, 24 authors each 21 - 50 papers, 2 authors each 51 - 100 papers and 1 author more than 100 papers. The top 20 Indian author's contribution to pancreas research varied from 24 to 103 publications and they together accounted for 21.53% (852) publication share and 23.98% (11818) citation share to its cumulative publications output during 2007-16. Table 7 presents a scientometric profile of these 20 India authors.

S. No	Name	Affiliation	TP	TC	CPP	HI	ICP	%ICP	RCI
1	D.K. Bhasin	PGIMER-Chandigarh	103	668	6.49	13	4	3.88	0.52
2	S.S. Rana	PGIMER-Chandigarh	100	603	6.03	13	5	5.00	0.48
3	R. Gupta	Asian Institute of Gastroenterology, Hyderabad	65	851	13.09	17	3	4.62	1.05
4	S.V. Shrikhande	TMH-Bombay	55	1082	19.67	13	21	38.18	1.58
5	K. Singh	PGIMER-Chandigarh	47	383	8.15	11	1	2.13	0.65
6	V. Sharma	PGIMER-Chandigarh	44	98	2.23	6	0	0.00	0.18
7	D.N. Reddy	Asian Institute of Gastroenterology, Hyderabad	43	634	14.74	12	8	18.60	1.18
8	S.G. Barreto	TMH-Bombay	39	330	8.46	10	13	33.33	0.68
9	V. Bhatia	AIIMS-New Delhi	34	788	23.18	14	23	67.65	1.86
10	S. Lakhatia	Asian Institute of Gastroenterology, Hyderabad	34	712	20.94	13	10	29.41	1.68
11	R. Talukdar	Pushpawati Singhania Research Institute, Delhi	33	306	9.27	10	7	21.21	0.74
12	J.D. Wig	PGIMER-Chandigarh	31	452	14.58	14	4	12.90	1.17
13	R.R. Bhonde	University of Pune	30	751	25.03	14	7	23.33	2.01
14	P.K. Garg	AIIMS-New Delhi	39	628	16.10	12	8	20.51	1.29
15	G.V. Rao	Asian Institute of Gastroenterology, Hyderabad	27	657	24.33	14	2	7.41	1.95
16	P.J. Shukla	TMH-Bombay	27	308	11.41	11	11	40.74	0.92
17	S. Padhye	Dr DY Patil University, Pimri, Pune	27	1524	56.44	18	26	96.30	4.53
18	R. Kochhar	PGIMER-Chandigarh	25	262	10.48	10	0	0.00	0.84
19	V. Mohan	Madras Diabetic Research Foundation	25	514	20.56	9	9	36.00	1.65
20	V. Balakrishnan	Amrita Institute of Medical Sciences, Coimbatore	24	267	11.13	8	2	8.33	0.89
		Total of 20 authors	852	11818	13.87	12.1	164	19.25	1.11
		Total of India	3958	49293	12.45				
		Share of top 20 authors in Indian total output	21.53	23.98					

Table 7: *Scientometric Profile of Top 20 Most Productive Authors in Pancreatitis Research during 2007-16.*

TP: Total Papers; TC: Total Citations; CPP: Citations Per Paper; HI: h-index; ICP: International Collaborative Papers; RCI: Relative Citation Index

- Seven authors registered higher publications productivity than group average of 42.6: D.K. Bhasin (103 papers), S.S. Rana (100 papers), R. Gupta (65 papers), S.V. Shrikhande (55 papers), K. Singh (47 papers), V. Sharma (44 papers) and D.N. Reddy (43 papers) during 2007-16.

- Ten authors registered higher citation impact than the group average of 10.02 citations per publication: M. Kang (16.5), T.D. Yadav (16.3), J.D. Wig (14.8), P.K. Garg (13.8), R. Kochhar (12.74), R. Gupta (12.5), U. Datta (12.44), S.K. Sinha (11.3), K. Singh (10.91) and B. Negi (10.78) during 2007-16.

- Ten authors registered higher h-index than group average of 12.10: S. Padhye (18), R. Gupta (17), R.R. Bhonde, G.V. Rao, V. Bhatia, J.D. Wig (14 each), S. Lakhatia, S.V. Shrikhande, D.K.Bhasin and S.S. Rana (13 each) during 2007-1.

- Ten authors achieved higher international collaborative publications share than the group average of 19.25% of all authors; S. Padhye (96.30%), V. Bhatia (67.65%), P.J. Shukla (40.74%), S.V. Shrikhande (38.18%), V. Mohan (36.0%), S.G. Barreto (33.33%), S. Lakhatia (29.41%), R.R. Bhonde (23.33%), R. Talukdar (21.21%) and P.K. Garg (20.51%) during 2007-16.

- Ten authors registered higher relative citation index than the group average of 1.11: S. Padhye (4.53), R.R. Bhonde (2.01), G.V. Rao (1.95), V.Bhatia (1.86), S. Lakhatia (1.68), V. Mohan (1.65), S.V. Shrikhande (!.58), P.K. Garg (1.29), D.N. Reddy (1.18) and J.D. Wig(!.17) during 2007-16.

Medium of Communication

782 journals contributed to Indian pancreas research, of which 655 journals each contributed 1 - 5 papers each, 63 journals each 6 - 10 papers, 37 journals each 11 - 20 papers, 22 journals each 21 - 50 papers, 3 journals each 51 - 100 papers and 2 journals each more than 100 papers.

Among India's pancreas research output consisting of 3891 papers in journals (constituting 98.31% of total Indian output), the top 20 most productive journals accounted for 16 to 125 papers. These 20 journals together accounted for 25.31% share (985 papers) of total Indian journal publication output during 2007-16, decreasing from 25.82% during 2007-11 to 25.02% during 2012-16. *Journal of the Pancreas* was the most productive journals with 125 papers each, followed by *Indian Journal of Gastroenterology* (103 papers), *Journal of Clinical and Diagnostic Research* (84 papers), *Indian Journal of Surgery* (65 papers), etc. during 2007-16 (Table 8).

S. No	Name of the Journal	Number of Papers		
		2007-11	2012-16	2007-16
1	Journal of the Pancreas	69	56	125
2	Indian Journal of Gastroenterology	39	64	103
3	Journal of Clinical and Diagnostic Research	10	74	84
4	Indian Journal of Surgery	13	52	65
5	Gastrointestinal Endoscopy	17	35	52
6	BMJ Case Reports	5	45	50
7	PLOS One	10	40	50
8	Journal of Gastroenterology and Hepatology Australia	30	19	49
9	Hepato-billary and Pancreatic Disorders	36	10	46
10	International Journal of Pharmacy and Pharmaceutical Sciences	9	34	43
11	Pancreatology	8	35	43
12	Pancreas	22	20	42
13	Indian Journal of Medical Research	22	14	36
14	Endoscopy	10	24	34
15	Research Journal of Pharmaceutical Biological and Chemical Sciences	5	24	29
16	World Journal of Gastroenterology	17	11	28
17	Gastroenterology	10	17	27
18	Journal of Association of Physicians of India	12	15	27
19	Indian Journal of Cancer	13	13	26
20	International Journal of Pharma Sciences Research and Review	11	15	26
	Total of 20 journals	368	617	985
	Total global journal output	1425	2466	3891
	Share of top 20 journals in Indian journal output	25.82	25.02	25.31

Table 8: *Productivity of Top 20 Most Productive Journals in Indian Pancreatitis Research during 2007-16.*

Characteristics of Highly Cited Papers

Fifty-six papers received 100 or more citations and they were assumed as high cited papers.

- These 56 papers received citations from 101 to 4474 (with 43 papers in citation range from 101 - 185, 7 papers in citation range from 202 - 296, 2 papers in citation range from 310-326 and 4 papers in citation range from 570 - 4474 during 2007-16 and together registered 15095 citations, which averaged to 269.55 citations per paper.
- Amongst 56 high cited papers, 35 were articles, 19 reviews, 1 each as conference paper and short survey;
- Among 56 high cited papers, 21 do not involve any collaboration and 35 involve collaboration (2 national collaborative and 33 international collaborative);
- Among 50 foreign countries participating in these 568 high cited papers, USA contributed the largest number of papers (21 papers), followed by Japan and Germany (7 papers each), Switzerland (6 papers) France, Australia and Spain (5 papers), Netherlands (4 papers), China, Singapore and South Korea (3 papers each), etc.
- The 56 high cited papers involve the participation of 1287 authors and 786 organizations.
- Fifty Indian organizations are participating in these 56 high cited papers, with 4 papers each by Tata Memorial Hospital, Mumbai and All India Institute of Medical Sciences, New Delhi, 3 papers by National Institute of Pharmaceutical Education and Research, Mohali, 2 papers each by Dr D.Y. Patil University, Pune, Institute of Bioinformatics, Bangalore, University of Delhi, and 1 paper each by other Indian institutions. Some of the important Indian authors participating in these high cited papers were A. Maitra and S. Padhye (4 papers each), S.V. Shrikhande (3 papers), V. Bhatia and R. Srinivisan (2 papers each), etc.
- The 566 highly cited papers were published in 47 journals, with 2 papers each in *Cancer Research, Endoscopy, Medicinal Research Review, Nature Reviews in Microbiology* and *Pancreas* and 1 paper each in 42 other journals.

Discussion and Conclusion

3858 Indian publications in pancreas research, as indexed in Scopus database, were published during 2007-16 and they increased from 186 during 2007 to 480 in the year to the year 2016, registering 11.19% growth per annum. Their cumulative Indian output increased from 1439 to 2519, witnessing 75.05% growth from 2007-11 to 2012-16. India's global published share in pancreas research was only 3.06% during 2007-16, witnessing increase from 2.48% to 3.53% from 2007-11 to 2012-16. The citation impact per paper of Indian publications in pancreas research was averaged to 12.45 citations, however, decreasing from 18.18 during 2006-11 to 9.18 during 2012-16. The share of India's international collaborative publications in pancreas research was 16.14% during 2007-16, showing increase from 15.64% during 2007-11 to 16.44% during 2012-16.

Medicine, among sub-fields contributed the highest publications share (73.27%), followed by biochemistry, genetics and molecular biology (31.76%), pharmacology, toxicology and pharmaceutics (19.91%), agricultural and biological sciences (4.07%) and immunology and microbiology (2.58%) during 2007-16. The research activities, as reflected in activity index, showed increase in medicine, biochemistry, genetics and molecular biology and pharmacology, toxicology and pharmaceutics, as against decrease in agricultural and biological sciences and immunology and microbiology from 2007-11 to 2012-16.

Amongst Indian pancreas disorders, pancreatic cancer contributed the largest share (29.91%) of publications, followed by acute pancreatitis (14.688%), chronic pancreatitis (10.69%) and pancreatic cyst (3.74%) during 2007-16.

Among leading organizations and authors participating in India's pancreas research, the 20 most productive Indian organizations and authors together contributed 38.0% and 21.53% respectively as their share of global publication output and 55.49% and 23.98% respectively as their share of global citation output during 2007-16. The leading organizations in research productivity were: PGIMER-Chandigarh (278 papers), AIIMS-New Delhi (210 papers), TMH- Bombay (102 papers), Asian Institute of Gastroenterology, Hyderabad (101 papers) and SGPGIMS- Lucknow (95 papers) during 2007-16. The leading Indian organizations in terms of citation impact per paper were: TMH-Bombay (57.72), NIPER-Mohali (33.25), University of Madras, Chennai (31.79), University of Delhi (28.94), Banaras Hindu University, Varanasi (28.79), National Center for Cell Science (NCCS), Pune (25.15) and AIIMS-New Delhi (18.60) during 2007-16.

The leading authors in publication productivity were: D.K. Bhasin (103 papers), S.S. Rana (100 papers), R. Gupta (65 papers), S.V. Shrikhande (55 papers), K. Singh (47 papers), V. Sharma (44 papers) and D.N. Reddy (43 papers) during 2007-16.The leading authors in terms of research impact were: M. Kang (16.5), T.D. Yadav (16.3), J.D. Wig (14.8), P.K. Garg (13.8), R. Kochhar (12.74), R. Gupta (12.5), U. Datta (12.44), S.K. Sinha (11.3), K. Singh (10.91) and B. Negi (10.78) during 2007-16.

Among the total journal output of 3891 papers in Indian pancreas research, the top 20 most productive journals contributed 25.31% share of total journal publication output during 2007-16, which decreased from 25.82% to 25.02% from 2007-11 and 2012-16. *Journal of the Pancreas* was the most productive journals with 125 papers each, followed by *Indian Journal of Gastroenterology* (103 papers), *Journal of Clinical and Diagnostic Research* (84 papers), *Indian Journal of Surgery* (65 papers), etc. during 2007-16.

The 56 highly cited publications individually received citations varying from 101 to 4474 in Indian pancreas research and together these papers received 15095 citations, with 269.55 citations per paper. Around 1287 authors and 786 organizations participated in these 56 high cited papers and were published in47 journals, with 2 papers each in *Cancer Research, Endoscopy, Medicinal Research Review, Nature Reviews in Microbiology* and *Pancreas* and 1 paper each in 42 other journals.

Concludes that pancreas disorders research have been a neglected subspecialty in India. There is a need to develop a national policy on pancreas research, where identification, screening, diagnosis and treatment of patients can be undertaken at affordable rates. In view of shortage of pancreas specialist in India, there is need for curricular reforms, besides capacity building, patient education and political support and increased funding support from Indian government are needed.

Bibliography

1. Pancreatic cancer India. Know the pancreas. n.d. www.pancreaticcancerindia.com/ files/pc/patient-and-caregivers.html (Accessed on 28 December 2017)

2. Pancreatic disorders. n.d. http://www.thegastrosurgeon.com/pancreatic-disorders/(Accessed on 28 December 2017)

3. Fraiman Mark. "Common pancreatic disorders" (2015). 28 November, 2015. 2014-2017. https://liverandpancreassurgeon.com/common-pancreatic-disorders/(Accessed on 28 December 2017)

4. What are pancreatic cysts? 1996-2017. https://www.medicinenet.com/pancreatic_cysts/article.htm (Accessed on 28 December 2017)

5. Pancreatic cancer (2017). https://en.wikipedia.org/wiki/Pancreatic_cancer#cite_note-NCI2014Def-10 (Accessed on 28 December 2017)

6. Loomes Dustin Edward., *et al*. "Bibliometrics of the top in digestive 100 Clinical Articles Disease". *Gastroenterology* 144.4 (2013): 673-676.e5.

7. Chou LI-Fang. "Medline-based bibliometric analysis of gastroenterology journals between 2001 and 2007". *World Journal of Gastroenterology* 15.23 (2009): 2933-2939.

8. Lewison G., *et al*. "International gastroenterology research: subject areas, impact, and funding". *Gut* 49.2 (2001): 295-302.

Volume 5 Issue 2 February 2018