



Top 100 Most-Cited Articles On Pancreatic Tumors: A Bibliometric Analysis

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Abstract

Background: A number of articles have been published on pancreatic tumor. Bibliometric analyses are helpful to identify the most influential studies in this field.

Objective: To identify the top 100 most-cited articles on pancreatic tumor and perform a bibliometric analysis.

Methods: We performed a title-specific search for the Thomson Reuters Web of Science on November 11th, 2019. Articles were listed in descending order by the Total Citations (TCs) number, and the most-cited articles on pancreatic tumor were identified and analyzed.

Results: The most-cited articles were published between 1955 and 2016, with 2007 the most prolific year. Pancreatic cancer was the most commonly studied tumor (85%). The average number of TCs was 1001.23 (543-4111), and the average Annual Citations (ACs) was 91.37 (15.22-374.75). Over the past decade, more and more high-citation articles have been published, and the average number of ACs in this decade is higher than in previous decades. The top 100 works were published in 37 journals; Nature published the most articles (11%). The largest numbers of articles (81%) were published in the United States. RH, Hruban wrote the largest number of publications and participated in more works as co-author.

Conclusion: We identified the top 100 most-cited articles on pancreatic tumors that may be considered influential and significant. This study identified research focuses and trends in pancreatic tumor and provides an important reference for researchers to guide future research.

Keywords: Pancreatic cancer; Bibliometric analysis; Citation

Introduction

The pancreas gives rise to several malignant and benign tumors. The Pancreatic Cancer (PC) usually refers to ductal adenocarcinoma, which represents 85 to 90 percent of all pancreatic neoplasms. Sadly, pancreatic cancer remains a lethal disease with poor prognosis [1]. Due to late onset of clinical symptoms, only 15 to 20 percent of patients are candidates for pancreatectomy which is the only potentially curative treatment. Even after a complete resection, the five-year survival of patients underwent margin-negative (R0) pancreaticoduodenectomy are approximately 30% for node-negative and 10% for node-positive disease [2]. As for advanced PC, the chemotherapy strategy of FOLFIRINOX makes a little improvement for survival [3,4]. Due to limited clinical options, the researchers pay more attention to the basic studies than before. Although the incidence of other pancreatic tumors is not high, such as Pancreatic Neuroendocrine Tumors (PNETs) are generally rare with an incidence of ≤ 1 case per 100,000 individuals per year and account for 1% to 2% of all pancreatic tumors [5,6], the quality of life of patients will be affected by varying degrees.

There are a large number of published articles in the field of pancreatic tumors. The research focuses of these published studies include clinical trials, options of different therapies (surgery, chemotherapy or immunotherapy), treatment outcomes, observation studies, and oncogenic gene research. Although difficult, it is beneficial to gain insight into the research focuses and future development of trends in the field of pancreatic tumors.

The citation times of publication provide a general indication of the popularity of the study and its contribution to the literature library. It also demonstrates the impact and significance of the article in a certain field. Although increased attention has been paid to this method, a bibliometric

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analysis for various pancreatic tumors has never been conducted.

Even though Li Q and Jiang Y conducted a preliminary bibliometric analysis in 2016 mainly about pancreatic cancer and most search keywords are same with ours [7], the number of articles published in this field (pancreatic tumors) increased year by year, more than 20,000 articles have been published during 2016-2019. The changing of the 100 most-cited articles and the changing number of citation times can roughly reflect the study's long-term contribution to this field and can provide changes in research hotspots.

In this study, we identified the top 100 most-cited published articles on pancreatic tumors and analyzed their characteristics using the bibliometric analysis method, thus providing more precise guidance to researchers in this field.

Materials and Methods

Search strategy

The Web of Science (WoS) database (Thomson Reuters, New York, USA) was used for the literature search on November 11th, 2019. The search subject was pancreatic tumor, and the index terms were specified according to the list of Medical Subject Headings as "(pancreatic or pancreas) and (adenoma or adenomas or adenocarcinoma or adenocarcinomas or carcinoma or carcinomas or cancer or cancers or neoplasm or neoplasms or tumor or tumors)". The publication period and language of the articles were not restricted in the search. Articles that meet these criteria were selected and preliminarily analyzed by the WoS analysis tool and our manual screening. Articles were then listed in a descending order based on their Total Citations (TCs), titles and abstracts (and, if necessary, the main text) were filtered, and the top 100 most-cited articles were identified.

Two researchers (X Hou and S Chen) performed the screening and reached a final agreement on the list of the top 100 most-cited articles. If there were different opinions, a third reviewer (Chen G) would be consulted, and consensus would therefore be reached through discussion. This study did not involve data collection or interventions with humans or animals, and therefore does not require the approval of the Ethics Committee.

Data extraction and bibliometric parameters

We followed the methods of Guo et al. 2018 [8]. Firstly, Article title, article type, research focus, article TCs, article Annual Citations (ACs), year of publication, authors, country of origin, institute of publication, publishing journal and journal impact factor (2018 edition of Journal Citation Reports) were recorded for the top 100 most-cited articles on pancreatic tumors. TCs represented the total number of times the article was cited from the release date to November 11th, 2019. ACs represented the number of times the article was cited per year and was calculated by the number of TCs divided by the total number of years since publication. The source of the citations was the Thomson Reuters WoS website. The corresponding author's country and institute were recognized as the country and institute of the article. Articles were roughly categorized into 3 types, including original articles concerning basic study on pancreatic tumor (pathogenic genes, gene expression, tumor pathology, etc.), original articles concerning clinical studies on patients with pancreatic tumor (epidemiology, clinical characteristics, radiological classifications, surgery, radiotherapy, chemotherapy, clinical trials, morbidity and mortality, risk factor analysis, etc.), and conclusive

articles (consensus, guideline and general review). Research focuses were also classified into 3 categories according to different types of pancreatic tumors, including Pancreatic Cancer (PC), Pancreatic Neuroendocrine Tumors (PNET) and other types.

Statistical analysis

Office 365 software was used for descriptive statistical analyses, including publication year, author, and author affiliation, and country, journal, and citation number.

The Student's t test was used to analyze the average number of TCs or ACs between groups. The Pearson χ^2 test or Fisher's exact test was used to analyze the relationship between article numbers and different groups. SPSS 15.0 software (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses and a p value <0.05 was considered significant.

VOS viewer 1.6.13 [9] was used to draw figures for keyword co-occurrence network and co-authored network for network visualization analysis. In network visualization, a labeled circle represented a keyword or researcher, and the size of circles represented the frequency of occurrence. The larger the circle was, the more frequently the circle-represented body appeared. Circles in different colors in the graph represented different clusters. The line between two circles indicated that two keywords or researchers appeared together. The thicker the lines were, the more frequently they appeared together. The more relevant two keywords or researchers were, the much closer two circles located. The minimum number of co-occurrences was adjusted according to the graphical results.

Results

Characteristics of included studies

A total of 75,784 articles were published in the field of pancreatic tumor according to the WoS, including 49,838 original articles, 25,033 abstract and other types of articles.

The number of articles published in this field increased year by year (Figure 1A). The most articles were published by five journals, i.e., The Pancreas (n=3412), Gastroenterology (n=3183), Cancer Research (n=3276), the Journal of Clinical Oncology (n=3200), Annals of Oncology (n=1363). The United States (n=25385), Japan (n=8716), China (n=6315), Germany (n=5668) and Italy (n=3842) were the countries with the most published articles in this field. English was the most frequently used language (n=51692), followed by Japanese (n=1194) and German (n=827). We then selected and analyzed the top 100 most-cited articles on pancreatic tumors.

Characteristics of the top 100 studies

The top 100 most-cited articles on pancreatic tumors were published over a 61-year period from 1955 to 2016. The largest number of articles published in a single year was 9, which occurred in year 2007. Take five years as a period; twenty-seven of the top 100 articles were published from 2010 to 2014, which is the most so far. The average number of ACs of the most-cited articles continuously increased every five years, whereas fluctuating trends in average TCs were detected (Figure 1B).

To look at it another way, the top 100 most-cited articles received a total number of 100,123 citations. The average number of TCs was 1001.23, and the median number of TCs was 777 (543-4111). The average number of ACs was 91.37, while the median number of ACs was 61 (15.22-374.75). The average number of ACs of articles

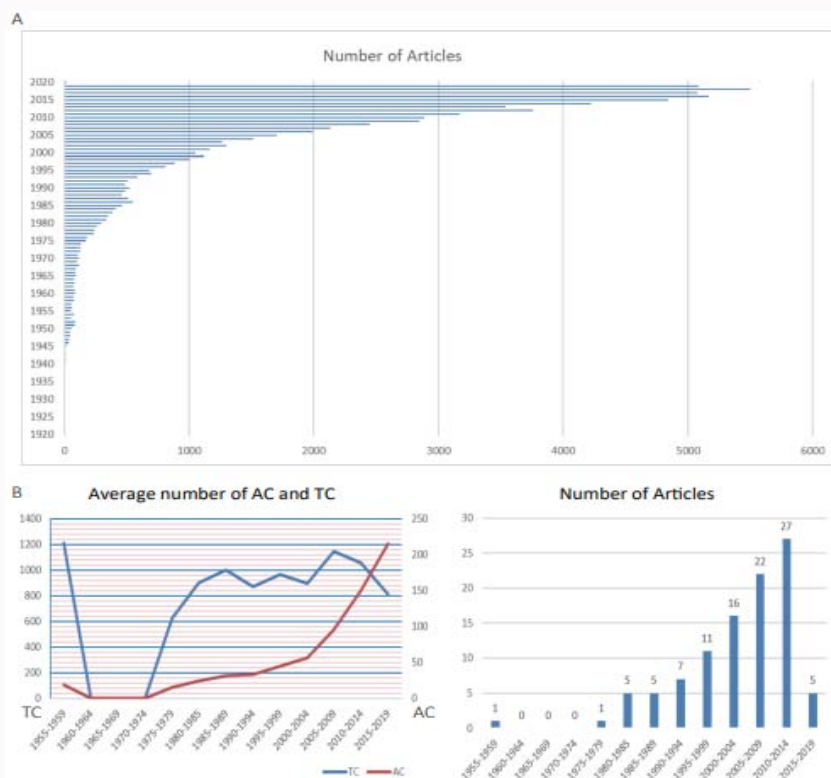


Figure 1: Year of publication. A): The total number of publications in this field at intervals of 5 years. B): The average number of ACs and TCs every five years, and the time distribution of the top 100 articles from 1955 to 2019.

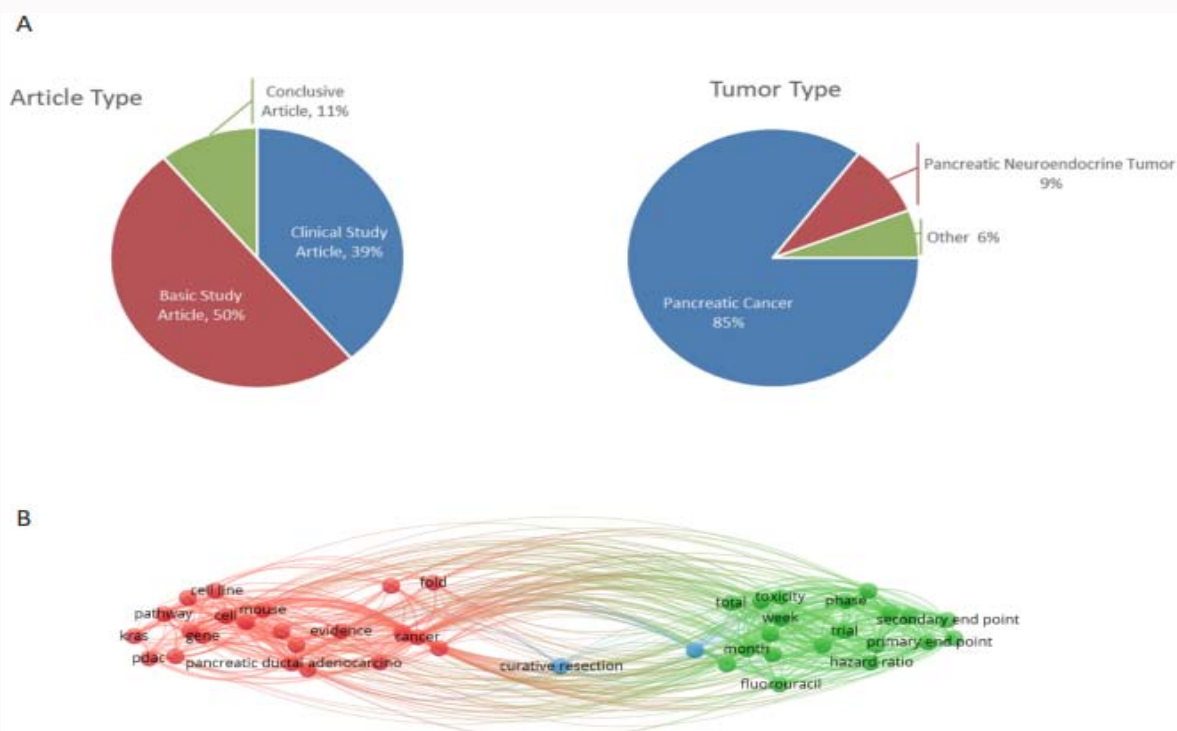


Figure 2: Article type, research focus and keywords co-occurrence of top 100 publications. A): Article type and concerned tumor type of these articles. B): The co-occurrence network for keywords.

published in the past 10 years ($n=159.97 \pm 83.67$) was significantly higher than the average number of ACs of other most-cited articles ($n=59.09 \pm 48.06$) ($p<0.001$). However, no difference in the average

number of TCs was found between articles published in the past decade and the other most-cited articles (1018.03 ± 547.20 vs. 993.32 ± 609.30 , $p=0.846$).

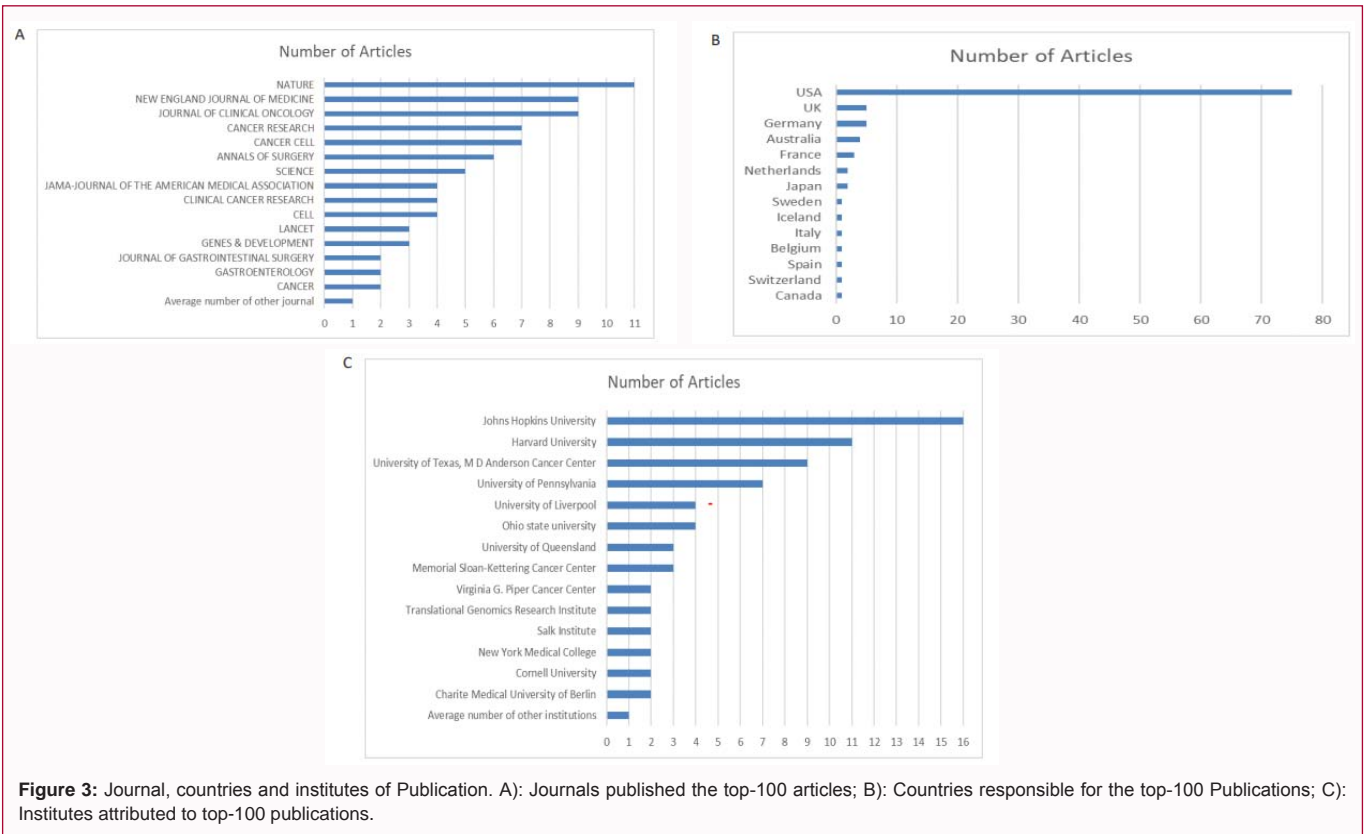


Figure 3: Journal, countries and institutes of Publication. A): Journals published the top-100 articles; B): Countries responsible for the top-100 Publications; C): Institutes attributed to top-100 publications.

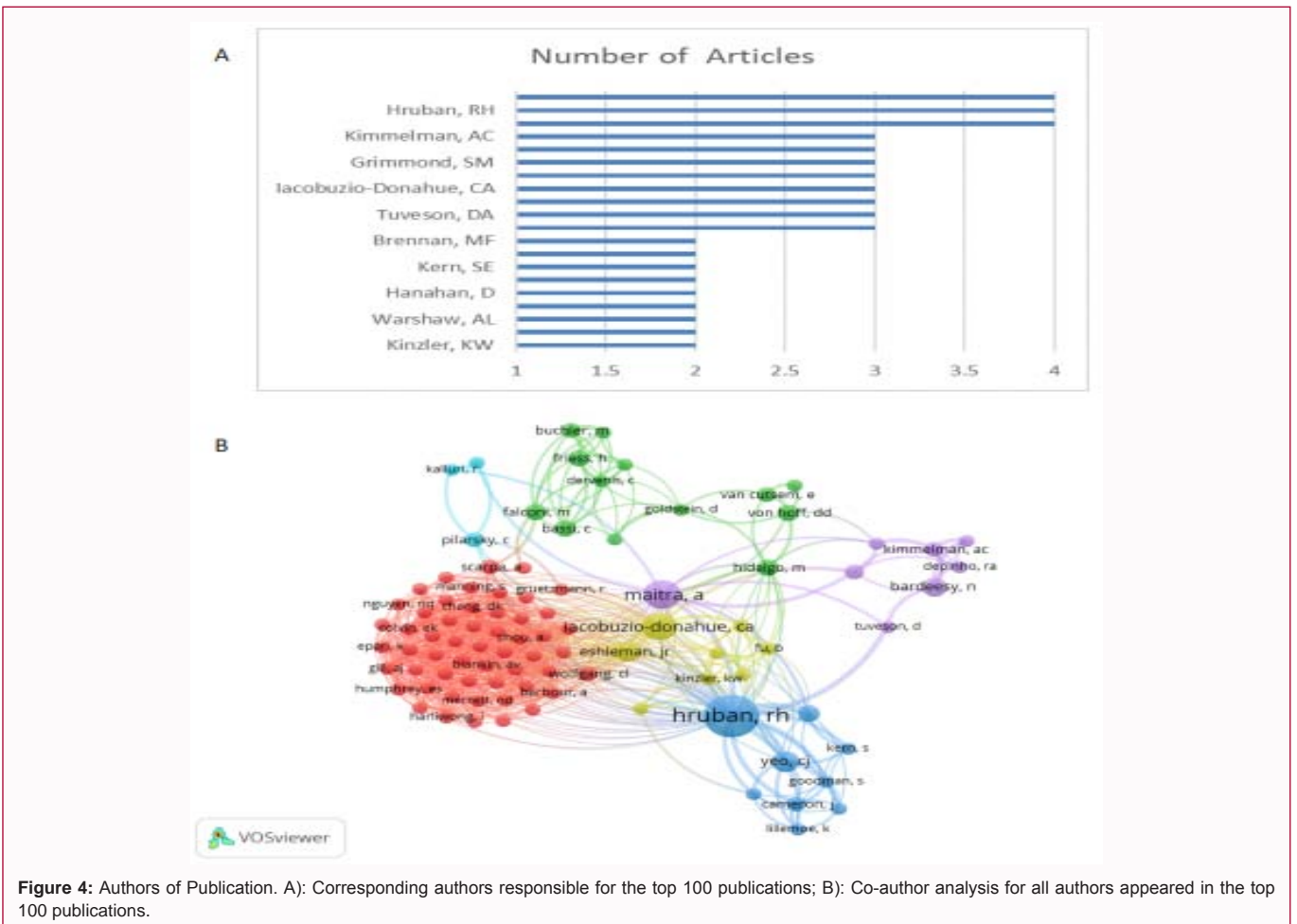


Figure 4: Authors of Publication. A): Corresponding authors responsible for the top 100 publications; B): Co-author analysis for all authors appeared in the top 100 publications.

Co-occurrence network visualization

Among the top 100 most-cited articles, the majority (90%) were original articles, followed by review articles (10%). There was no difference in the average number of TCs and ACs between the two types (1000.41 ± 605.25 vs. 1008.60 ± 417.17 , $p=0.967$; 91.38 ± 80.4 vs. 91.28 ± 50.66 , $p=0.997$) (Figure 2A). Among the original articles, basic studies were more common than clinical studies (48% vs. 39%).

The VOSviewer software was used to draw a figure for the keyword co-occurrence network, setting the minimum number of occurrences at 7 in both title and abstract. As shown in Figure 2B, circles accompanied by representing keywords, were mainly grouped into two clusters: highly-concentrated green cluster, with “toxicity” and similar keywords clearly representing for clinical study; and a relatively scattered red cluster which had “K-ras” and other allied keywords clearly representing for the basic research.

Journals, countries and institutes, and authors of publication

The top 100 most-cited articles were published in thirty-seven journals. Among the journals, the Nature published the largest number of articles (11%), followed by the New England Journal of Medicine (9%) and the Journal of Clinical Oncology (9%) (Figure 3A).

A total of 14 countries were responsible for the top 100 most-cited articles. Most of the 100 most-cited articles were published by the United States ($n=75$), the United Kingdom ($n=5$) and Germany ($n=5$) (Figure 3B).

A total of 57 institutes were responsible for the top 100 most-cited articles. The top 4 institutes or academies contributing to the top 100 most-cited articles included the Johns Hopkins University ($n=16$), the Harvard University ($n=11$), the University of Texas, M D Anderson Cancer Center ($n=9$), and the University of Pennsylvania ($n=7$) (Figure 3C).

As corresponding author, Yeo CJ, Hruban RH and DePinho RA contributed to the largest number of most-cited articles on pancreatic tumors ($n=4, 4, 4$). The authors with more than 2 articles are shown in Figure 4A. VOSviewer software was used to analyze co-authorship network of authors, with the minimum number of co-authors setting at 3. Of the total 1,069 authors, 97 participated in the co-authoring network (Figure 4B). Accordingly, circles representing Hruban RH, Maitra A, and Iacobuzio-Donahue CA are larger than others and had more dense connection lines to others, indicating that they contributed to more collaborative articles.

A detailed analysis of the top 10

Although it is very difficult to provide a detailed analysis of all the 100 top citations, there are some interesting observations of the top 10. We sorted the entire top-100 classic articles on 3 levels (TCs, ACs, and publication year). These 3 kinds of top 10 classic citations articles revealed major advances in research and some key stone studies of pancreatic tumors (Tables 1-4).

The most cited (TCs) top 10 articles, the newest top 10 articles and the most cited per year (ACs) top 10 articles are mostly focused on pancreatic cancer, with only one article focused on PNETs in the top 10 articles of the most cited per year (ACs). 70% of the newest top10 articles were basic research. It showed that researchers and clinicians are most concerned with pancreatic cancer, with a greater focus on basic research and translational medicine. Of the top 10

oldest, 50% involved PNETs (Pancreatic Neuroendocrine Tumors) and other pancreatic tumors, which was higher than the proportion of other pancreatic tumors excepting for pancreatic cancer in the whole top 100 (15%). This indicated that the research on PENTs and other pancreatic tumors was not very hot at present, compared with pancreatic cancer. To some extent, more attention needs to be paid to PNETs.

The leading article in TCs by HA. Burris reported the first large-size RCT (Random Control Trail) on gemcitabine therapy in advanced PC which may be the most important advance in the field of medical treatment of PC research in the past decades [10]. Gemcitabine remains the cornerstone of chemotherapy for pancreatic cancer up to now. Ranked 2nd in the TC rankings, with the highest average annual citation (374.75) and the highest average annual citation in the last three years (572), is an RCT led by Conroy et al. The outcome of this trial, which compared the clinical results of FOLFIRINOX versus gemcitabine, was that the PFS (progression-free survival) (6.4 months vs. 3.3 months; $p<0.001$) and OS (overall survival) (11.1 months vs. 6.8 months; $p<0.001$) were significantly prolonged in FOLFIRINOX group, despite the enhanced toxicity of chemotherapy [3]. This is one of the few chemotherapy strategies that have made breakthroughs in recent years. FOLFIRINOX is also currently a first-line chemotherapy regimen for pancreatic cancer recommended by guidelines. At position 3 of TCs ranking lists, it is another clinical trial conducted by Moore MJ et al. This is the first study to show that gemcitabine in combination with other drugs have a significantly longer survival time. The results showed that among patients with advanced pancreatic cancer, those treated by Erlotinib plus gemcitabine had a significantly prolonged survival time compared with those treated by gemcitabine alone [11]. The articles are basic research at position 4, 5 of TCs rank, which explained the mechanism of the occurrence and development of pancreatic cancer from the perspective of molecular signaling pathway level and pancreatic cancer stem cells respectively. Moreover, the 4th article involved a large number of researchers and carried out extensive joint work [12,13].

The oldest article was published by Mr. Zolinger in 1955, which was also the only one article left in the top 100 most cited articles from 1955 to 1977. In this article, the relationship between digestive tract ulcers and pancreas diseases was first proposed. It is also one of the earliest articles revealing the clinical symptoms of some PNETs and describing the feasible treatment options. So far it still keeps an AC number of 18.89 [14]. The only PNETs-related study in the top 10 ACs rank is also an RCT study, which was a clinical trial investigating the clinical effect of a targeted drug Everolimus for the treatment of advanced pancreatic endocrine tumors. The median progression-free survival was significantly prolonged in Everolimus group compared with placebo group (11.0 months vs. 4.6 months; $P<0.001$) [15].

Comparison with previous studies

The number of articles involving pancreatic tumors has increased dramatically year by year. Especially in recent years, the number of articles published has exploded, with more than 20,000 articles published from 2016 to 2019 alone. Q Li and Y Jiang published “the top 100 articles analysis” on pancreatic cancer in 2016 [7], which mainly covered the studies on pancreatic cancer and some PENTs studies. Although the search keywords are not totally identical, 63 articles have been overlapped compared with our study. Compare them with our research, we found that there was an obvious difference in the five-year proportion for most-cited articles, with the peak value

Table 1: Top 100 Articles on pancreatic tumors.

TCs	TCs Rank	TCs Rank Change	ACs	ACs Rank	First author(s)	Corresponding Author(s)	Title	Year	Journal
4111	1	0	186.86	14	Burris, HA	Von Hoff, DD	Improvements in survival and clinical benefit with gemcitabine as first-line therapy for patients with advanced pancreas cancer: A randomized trial	1997	JOURNAL OF CLINICAL ONCOLOGY
2998	2	15	374.75	1	Conroy, T	Conroy, T	FOLFIRINOX versus gemcitabine for metastatic pancreatic cancer	2011	NEW ENGLAND JOURNAL OF MEDICINE
2541	3	1	211.75	8	Moore, MJ	Moore, MJ	Erlotinib plus gemcitabine compared with gemcitabine alone in patients with advanced pancreatic cancer: a phase III trial of the National Cancer Institute of Canada Clinical Trials Group.	2007	JOURNAL OF CLINICAL ONCOLOGY
2435	4	1	221.36	5	Jones, S; Zhang, XS; Parsons, DW; Lin, JCH; Leary, RJ; Angenendt, P	Vogelstein, B; Velculescu, VE; Kinzler, KW	Core signaling pathways in human pancreatic cancers revealed by global genomic analyses	2008	SCIENCE
2344	5	1	195.33	10	Li, CW	Simeone, DM	Identification of pancreatic cancer stem cells	2007	CANCER RESEARCH
2227	6	19	371.17	2	Von Hoff, DD	Von Hoff, DD	Increased Survival in Pancreatic Cancer with nab-Paclitaxel plus Gemcitabine	2013	NEW ENGLAND JOURNAL OF MEDICINE
1881	7	2	156.75	18	Hermann, PC	Heeschen, C	Distinct populations of cancer stem cells determine tumor growth and metastatic activity in human pancreatic cancer	2007	CELL STEM CELL
1817	8		363.4	3	Rahib, L	Matrisian, LM	Projecting Cancer Incidence and Deaths to 2030: The Unexpected Burden of Thyroid, Liver, and Pancreas Cancers in the United States	2014	CANCER RESEARCH
1785	9	4	57.58	53	Almoguera, C	Almoguera, C	MOST HUMAN CARCINOMAS OF THE EXOCRINE PANCREAS CONTAIN MUTANT C-K-RAS GENES	1988	CELL
1766	10	1	176.6	16	Olive, KP	Tuveson, DA	Inhibition of Hedgehog Signaling Enhances Delivery of Chemotherapy in a Mouse Model of Pancreatic Cancer	2009	SCIENCE
1738	11	4	193.11	13	Hidalgo, M	Hidalgo, M	Pancreatic Cancer	2010	NEW ENGLAND JOURNAL OF MEDICINE
1668	12		208.5	9	Yao, JC	Yao, JC	Everolimus for Advanced Pancreatic Neuroendocrine Tumors.	2011	NEW ENGLAND JOURNAL OF MEDICINE
1653	13	3	110.2	29	Neoptolemos, JP	Neoptolemos, JP	A randomized trial of chemoradiotherapy and chemotherapy after resection of pancreatic cancer	2004	NEW ENGLAND JOURNAL OF MEDICINE
1520	14	0	126.67	25	Oettle, H	Oettle, H	Adjuvant chemotherapy with gemcitabine vs observation in patients undergoing curative-intent resection of pancreatic cancer - A Randomized controlled trial	2007	JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION
1449	15	3	96.6	35	Li, DH	Abbruzzese, JL	Pancreatic cancer	2004	LANCET
1432	16	15	159.11	17	Yachida, S; Jones, S	Iacobuzio-Donahue, CA	Distant metastasis occurs late during the genetic evolution of pancreatic cancer	2010	NATURE

1419	17		177.38	15	Raymond, E	Raymond, E	Sunitinib Malate for the Treatment of Pancreatic Neuroendocrine Tumors.	2011	NEW ENGLAND JOURNAL OF MEDICINE
1380	18	↓10	51.11	60	WARSHAW, AL	WARSHAW, AL	Pancreatic carcinoma.	1992	NEW ENGLAND JOURNAL OF MEDICINE
1333	19	↓1	83.31	39	Hingorani, SR	Tuveson, DA	Preinvasive and invasive ductal pancreatic cancer and its early detection in the mouse	2003	CANCER CELL
1328	20	↓14	35.89	75	GUILLEMIN, R	GUILLEMIN, R	GROWTH-HORMONE RELEASING-FACTOR FROM A HUMAN PANCREATIC TUMOR THAT CAUSED ACROMEGALY	1982	SCIENCE
1320	21		101.54	33	Tanaka, M	Tanaka, M	International consensus guidelines for management of intraductal papillary mucinous neoplasms and mucinous cystic neoplasms of the pancreas	2006	PANCREATOLOGY
1209	22		18.89	94	ZOLLINGER, RM	ZOLLINGER, RM	PRIMARY PEPTIC ULCERATIONS OF THE JEJUNUM ASSOCIATED WITH ISLET CELL TUMORS OF THE PANCREAS	1955	ANNALS OF SURGERY
1200	23	↓7	46.15	64	LOWENFELS, AB	LOWENFELS, AB	Pancreatitis and the risk of pancreatic cancer. International Pancreatitis Study Group.	1993	NEW ENGLAND JOURNAL OF MEDICINE
1157	24	↑13	144.63	21	Vincent, A	Goggins, M	Pancreatic cancer	2011	LANCET
1156	25		82.57	40	Casanovas, O	Hanahan, D	Drug resistance by evasion of antiangiogenic targeting of VEGF signaling in late-stage pancreatic islet tumors	2005	CANCER CELL
1153	26	↓9	72.06	47	Thayer, SP; di Magliano, MP	Hebrok, M	Hedgehog is an early and late mediator of pancreatic cancer tumorigenesis	2003	NATURE
1116	27		32.82	78	Hanahan, D	Hanahan, D	HERITABLE FORMATION OF PANCREATIC BETA-CELL TUMORS IN TRANSGENIC MICE EXPRESSING RECOMBINANT INSULIN SIMIAN VIRUS-40 ONCOGENES	1985	NATURE
1115	28	↓1	79.64	42	Hingorani, SR	Hingorani, SR; Tuveson, DA	Trp53(R172H) and KraS(G12D) cooperate to promote chromosomal instability and widely metastatic pancreatic ductal adenocarcinoma in mice	2005	CANCER CELL
1104	29	↓10	64.94	49	Liyanage, UK	Linehan, DC	Prevalence of regulatory T cells is increased in peripheral blood and tumor microenvironment of patients with pancreas or breast adenocarcinoma	2002	JOURNAL OF IMMUNOLOGY
1099	30	↓10	57.84	52	Sohn, TA	Yeo, CJ	Resected adenocarcinoma of the pancreas - 616 patients: Results, outcomes, and prognostic indicators	2000	JOURNAL OF GASTROINTESTINAL SURGERY
1095	31		29.59	83	RIVIER, J	RIVIER, J	CHARACTERIZATION OF A GROWTH HORMONE-RELEASING FACTOR FROM A HUMAN PANCREATIC-ISLET TUMOR	1982	NATURE
1051	32	↓19	42.04	70	CALDAS, C	KERN, SE	Frequent somatic mutations and homozygous deletions of the p16 (MTS1) gene in pancreatic adenocarcinoma	1994	NATURE GENETICS

995	33	↓4	76.54	45	Winter, JM	Yeo, CJ	1423 pancreaticoduodenectomies for pancreatic cancer: A single-institution experience	2006	JOURNAL OF GASTROINTESTINAL SURGERY
990	34	↑26	141.43	22	Rhim, AD	Stanger, BZ	EMT and Dissemination Precede Pancreatic Tumor Formation	2012	CELL
977	35		139.57	23	Biankin, AV	Grimmond, SM	Pancreatic cancer genomes reveal aberrations in axon guidance pathway genes	2012	NATURE
944	36	↓14	27.76	85	Kaiser MH	ELLENBERG, SS	Pancreatic cancer. Adjuvant combined radiation and chemotherapy following curative resection	1985	ARCHIVES OF SURGERY
919	37	↓9	76.58	44	Bloomston, M	Bloomston, M	MicroRNA expression patterns to differentiate pancreatic adenocarcinoma from normal pancreas and chronic pancreatitis	2007	JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION
890	38	↓12	44.5	68	Klinkenbijn, JH	Klinkenbijn, JH	Adjuvant radiotherapy and 5-fluorouracil after curative resection of cancer of the pancreas and periampullary region - Phase III trial of the EORTC Gastrointestinal Tract Cancer Cooperative Group	1999	ANNALS OF SURGERY
886	39		110.75	28	Jiao, YC; Shi, CJ	Kinzler, KW; Hruban, RH; Papadopoulos, N	DAXX/ATRAX, MEN1, and mTOR Pathway Genes Are Frequently Altered in Pancreatic Neuroendocrine Tumors	2011	SCIENCE
874	40		218.5	6	Waddell, N	Biankin, AV; Grimmond, SM	Whole genomes redefine the mutational landscape of pancreatic cancer	2015	NATURE
855	41		122.14	26	Provenzano, PP	Hingorani, SR	Enzymatic Targeting of the Stroma Ablates Physical Barriers to Treatment of Pancreatic Ductal Adenocarcinoma	2012	CANCER CELL
855	41		213.75	7	Melo, SA ; Luecke, LB ; Kahlert, C	Kalluri, R	Glypican-1 identifies cancer exosomes and detects early pancreatic cancer	2015	NATURE
834	43		55.6	56	Brugge, WR	Brugge, WR	Diagnosis of pancreatic cystic neoplasms: A report of the cooperative pancreatic cyst study Therapy of locally unresectable pancreatic carcinoma: a randomized comparison of high dose (6000 rads) radiation alone, moderate dose radiation (4000 rads+ 5-fluorouracil), and high doseradiation + 5-fluorouracil: The Gastrointestinal Tumor Study Group.	2004	GASTROENTEROLOGY
828	44	↓20	21.79	93	MOERTEL, CG	MOERTEL, CG	The patterns and dynamics of genomic instability in metastatic pancreatic cancer	1981	CANCER
819	45	↓5	91	37	Campbell, PJ; Yachida, S	Iacobuzio-Donahue, CA; Futreal, PA	The patterns and dynamics of genomic instability in metastatic pancreatic cancer	2010	NATURE
813	46	↓23	33.88	77	YEO, CJ	YEO, CJ	pancreaticoduodenectomy for Cancer of the Head of the Pancreas - 201 Patients	1995	ANNALS OF SURGERY
804	47	↑12	100.5	34	Beatty, GL	Vonderheide, RH	CD40 Agonists Alter Tumor Stroma and Show Efficacy Against Pancreatic Carcinoma in Mice and Humans	2011	SCIENCE

799	48	↓18	47	62	Bardeesy, N	DePinho, RA	Pancreatic cancer biology and genetics	2002	NATURE REVIEWS CANCER
779	49		194.75	11	Zheng, XF; Carstens, JL	Kalluri, R	Epithelial-to-mesenchymal transition is dispensable for metastasis but induces chemoresistance in pancreatic cancer	2015	NATURE
777	50	↓20	194.25	12	Costa-Silva, B	Stanger, BZ; Bromberg, J; Lyden, D	Pancreatic cancer exosomes initiate pre-metastatic niche formation in the liver	2015	NATURE CELL BIOLOGY
763	51		54.5	57	Louvet, C	Louvet, C	Gemcitabine in combination with oxaliplatin compared with gemcitabine alone in locally advanced or metastatic pancreatic cancer: Results of a GERCOR and GISCAD phase III trial	2005	JOURNAL OF CLINICAL ONCOLOGY
760	52	↓1	69.09	48	Dhillon, N	Kurzrock, R	Phase II trial of curcumin in patients with advanced pancreatic cancer	2008	CLINICAL CANCER RESEARCH
758	53		252.67	4	Bailey, P	Biankin, AV; Grimmond, SM	Genomic analyses identify molecular subtypes of pancreatic cancer	2016	NATURE
751	54		150.2	19	Ryan, DP	Ryan, DP	Pancreatic Adenocarcinoma	2014	NEW ENGLAND JOURNAL OF MEDICINE
744	55		106.29	31	Ying, HQ; Kimmelman, AC; Lyssiotis, CA	Kimmelman, AC; DePinho, RA	Oncogenic Kras Maintains Pancreatic Tumors through Regulation of Anabolic Glucose Metabolism	2012	CELL
736	56		147.2	20	Ozdemir, BC	Kalluri, R	Depletion of Carcinoma-Associated Fibroblasts and Fibrosis Induces Immunosuppression and Accelerates Pancreas Cancer with Reduced Survival	2014	CANCER CELL
735	57	↓23	61.25	50	Lee, EJ	Schmittgen, TD	Expression profiling identifies microRNA signature in pancreatic cancer	2007	INTERNATIONAL JOURNAL OF CANCER
724	58		80.44	41	Gillen, S	Kleeff, J	Preoperative/Neoadjuvant Therapy in Pancreatic Cancer: A Systematic Review and Meta-analysis of Response and Resection Percentages	2010	PLOS MEDICINE
715	59		79.44	43	Neoptolemos, JP	Neoptolemos, JP	Adjuvant Chemotherapy With Fluorouracil Plus Folinic Acid vs Gemcitabine Following Pancreatic Cancer Resection A Randomized Controlled Trial	2010	JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION
711	60		88.88	38	Yang, SH	Kimmelman, AC	Pancreatic cancers require autophagy for tumor growth	2011	GENES & DEVELOPMENT
708	61	↓14	54.46	58	Hezel, AF; Kimmelman, AC	DePinho, RA	Genetics and biology of pancreatic ductal adenocarcinoma	2006	GENES & DEVELOPMENT
705	62		117.5	27	Son, J; Lyssiotis, CA	Cantley, LC; Kimmelman, AC	Glutamine supports pancreatic cancer growth through a KRAS-regulated metabolic pathway	2013	NATURE
690	63	↓18	49.29	61	Huxley, R	Huxley, R	Type-II diabetes and pancreatic cancer: a meta-analysis of 36 studies	2005	BRITISH JOURNAL OF CANCER
683	64		136.6	24	Rhim, AD; Oberstein, PE; Thomas, DH	Olive, KP; Stanger, BZ	Stromal Elements Act to Restrain, Rather Than Support, Pancreatic Ductal Adenocarcinoma	2014	CANCER CELL
675	65	↓24	45	66	Hruban, RH; Takaori, K; Klimstra, DS	Hruban, RH	An illustrated consensus on the classification of pancreatic Intraepithelial neoplasia and intraductal papillary mucinous neoplasms	2004	AMERICAN JOURNAL OF SURGICAL PATHOLOGY

671	66		23.14	91	SANDGREN, EP	SANDGREN, EP	Overexpression of TGF alpha in transgenic mice: induction of epithelial hyperplasia, pancreaticmetaplasia, and carcinoma of the breast.	1990	CELL
659	67	↓19	36.61	74	Neoptolemos, JP	Neoptolemos, JP	Adjuvant chemoradiotherapy and chemotherapy in resectable pancreatic cancer: a randomised controlled trial	2001	LANCET
657	68		17.29	98	ZAPF, J	ZAPF, J	RADIOIMMUNOLOGICAL DETERMINATION OF INSULIN-LIKE GROWTH FACTORS-I AND FACTORS-II IN NORMAL SUBJECTS AND IN PATIENTS WITH GROWTH DISORDERS AND EXTRA-PANCREATIC TUMOR HYPOGLYCEMIA	1981	JOURNAL OF CLINICAL INVESTIGATION
655	69	↓34	25.19	88	GEER, RJ	BRENNAN, MF	Prognostic indicators for survival after resection of pancreatic adenocarcinoma.	1993	AMERICAN JOURNAL OF SURGERY
652	70	↓37	32.6	79	Tucker, ON	Fahey, TJ	Cyclooxygenase-2 expression is up-regulated in human pancreatic cancer	1999	CANCER RESEARCH
651	71		108.5	30	Yadav, D	Yadav, D	The Epidemiology of Pancreatitis and Pancreatic Cancer	2013	GASTROENTEROLOGY
640	72	↓23	42.67	69	Sohn, TA	Yeo, CJ	Intraductal papillary mucinous neoplasms of the pancreas - An updated experience	2004	ANNALS OF SURGERY
634	73	↓41	27.57	86	Cheng, JQ	Cheng, JQ	Amplification of AKT2 in human pancreatic cancer cells and inhibition of ATK2 expression and tumorigenicity by antisense RNA	1996	PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA
630	74	↑8	57.27	54	Hwang, RF	Hwang, RF	Cancer-associated stroma fibroblasts promote pancreatic tumor progression	2008	CANCER RESEARCH
627	75	↓21	39.19	71	Aguirre, AJ; Bardeesy, N	DePinho, RA; Bardeesy, N	Activated Kras and Ink4a/Arf deficiency cooperate to produce metastatic pancreatic ductaladenocarcinoma	2003	GENES & DEVELOPMENT
624	76		15.22	100	COMPAGNO, J	COMPAGNO, J	MUCINOUS CYSTIC NEOPLASMS OF PANCREAS WITH OVERT AND LATENT MALIGNANCY (CYSTADENOCARCINOMA AND CYSTADENOMA) - CLINICOPATHOLOGIC STUDY OF 41 CASES	1978	AMERICAN JOURNAL OF CLINICAL PATHOLOGY
624	76		52	59	Guerra, C	Guerra, C; Barbacid, M	Chronic pancreatitis is essential for induction of pancreatic ductal adenocarcinoma by k-Ras Oncogenes in adult mice	2007	CANCER CELL
621	78	↓35	28.23	84	Lowenfels, AB	Lowenfels, AB	Hereditary pancreatitis and the risk of pancreatic cancer	1997	JOURNAL OF THE NATIONAL CANCER INSTITUTE
621	78		103.5	32	Oettle, H	Oettle, H	Adjuvant Chemotherapy With Gemcitabine and Long-term Outcomes Among Patients With Resected Pancreatic Cancer The CONKO-001 Randomized Trial	2013	JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION
604	80	↓22	30.2	80	Sener, SF	Menck, HR	Pancreatic cancer: A report of treatment and survival trends for 100,313 patients diagnosed from 1985-1995, using the National Cancer Database	1999	JOURNAL OF THE AMERICAN COLLEGE OF SURGEONS

593	81	↓37	29.65	82	Wang, WX	Chiao, PJ	The nuclear factor-kappa B RelA transcription factor is constitutively activated in human pancreatic adenocarcinoma cells	1999	CLINICAL CANCER RESEARCH
592	82	↓29	34.82	76	Berlin, JD	Berlin, JD	Phase III study of gemcitabine in combination with fluorouracil versus gemcitabine alone in patients with advanced pancreatic carcinoma: Eastern Cooperative Oncology Group Trial E2297	2002	JOURNAL OF CLINICAL ONCOLOGY
592	82		74	46	Von Hoff, DD	Von Hoff, DD	Gemcitabine Plus nab-Paclitaxel Is an Active Regimen in Patients With Advanced Pancreatic Cancer: A Phase I/II Trial	2011	JOURNAL OF CLINICAL ONCOLOGY
587	84	↓14	39.13	72	Wagner, M	Buchler, MW	Curative resection is the single most important factor determining outcome in patients with pancreatic adenocarcinoma	2004	BRITISH JOURNAL OF SURGERY
586	85	↓21	39.07	73	Van Cutsem, E	Van Cutsem, E	Phase III trial of gemcitabine plus tipifarnib compared with gemcitabine plus placebo in advanced pancreatic cancer	2004	JOURNAL OF CLINICAL ONCOLOGY
585	86	↓24	45	67	Roldo, C; Missiaglia, E	Scarpa, A; Croce, CM	MicroRNA expression abnormalities in pancreatic endocrine and acinar tumors are associated with distinctive pathologic features and clinical behavior	2006	JOURNAL OF CLINICAL ONCOLOGY
584	87	↓51	16.22	99	Magnani JL				
Magnani JL									
Identification of the gastrointestinal and pancreatic cancer-associated antigen detected by monoclonal antibody 19-9 in the sera of patients as a mucin	1983	CANCER RESEARCH							
584	87	↓49	22.46	92	HRUBAN, RH	HRUBAN, RH	K-RAS ONCOGENE ACTIVATION IN ADENOCARCINOMA OF THE HUMAN PANCREAS - A STUDY OF 82 CARCINOMAS USING A COMBINATION OF MUTANT-ENRICHED POLYMERASE CHAIN-REACTION ANALYSIS AND ALLELE-SPECIFIC OLIGONUCLEOTIDE HYBRIDIZATION	1993	AMERICAN JOURNAL OF PATHOLOGY
579	89	↓51	18.09	97	GUDJONSSON, B		CANCER OF THE PANCREAS - 50 YEARS OF SURGERY	1987	CANCER
577	90	↓40	25.09	89	Glimelius, B	Glimelius, B	Chemotherapy improves survival and quality of life in advanced pancreatic and biliary cancer	1996	ANNALS OF ONCOLOGY
574	91	↓35	24.96	90	Conlon, KC	Brennan, MF	Long-term survival after curative resection for pancreatic ductal adenocarcinoma - Clinicopathologic analysis of 5-year survivors	1996	ANNALS OF SURGERY

572	92	↓50	18.45	96	SMIT, VTHBM	BOS, JL	KRAS codon 12 mutations occur very frequently in pancreatic adenocarcinomas.	1988	NUCLEIC ACIDS RESEARCH
566	93	↓26	29.79	81	Hruban, RH	Hruban, RH	Progression model for pancreatic cancer	2000	CLINICAL CANCER RESEARCH
565	94		56.5	55	Iacobuzio-Donahue, CA	Iacobuzio-Donahue, CA	DPC4 Gene Status of the Primary Carcinoma Correlates With Patterns of Failure in Patients With Pancreatic Cancer	2009	JOURNAL OF CLINICAL ONCOLOGY
565	94		94.17	36	Kim, K.	Safe, S	HOTAIR is a negative prognostic factor and exhibits pro-oncogenic activity in pancreatic cancer	2013	ONCOGENE
560	96		46.67	63	Nomi, T	Sho, M	Clinical significance and therapeutic potential of the programmed death-1 ligand/programmed death-1 pathway in human pancreatic cancer	2007	CLINICAL CANCER RESEARCH
559	97	↓45	25.41	87	Rozenblum, E	Kern, SE	Tumor-suppressive pathways in pancreatic carcinoma	1997	CANCER RESEARCH
549	98		61	51	Kindler, HL	Kindler, HL	Gemcitabine Plus Bevacizumab Compared With Gemcitabine Plus Placebo in Patients With Advanced Pancreatic Cancer: Phase III Trial of the Cancer and Leukemia Group B (CALGB 80303)	2010	JOURNAL OF CLINICAL ONCOLOGY
545	99		18.79	95	Warshaw, AL	Warshaw, AL	CYSTIC TUMORS OF THE PANCREAS - NEW CLINICAL, RADIOLOGIC, AND PATHOLOGICAL OBSERVATIONS IN 67 PATIENTS	1990	ANNALS OF SURGERY
543	100	↓32	45.25	65	Feldmann, G; Dhara, S	Feldmann, G	Blockade of hedgehog signaling inhibits pancreatic cancer invasion and metastases: A new paradigm for combination therapy in solid cancers	2007	CANCER RESEARCH

shifted to latest five-year, indicating that more attention was paid to the latest studies. Of particular note is, although the total number of TCs in the articles with the highest TC ranking in 2016 and in this study changed significantly, the ranking list did not change much: only 10 out of the 63 articles have improved their ranks (Table 5).

The highest rise article in the rankings is “EMT and dissemination precede pancreatic tumor formation”, with rank from 60 to 34 and citations from 456 to 990. According to this article, the background and pathological process of distant metastasis in pancreatic cancer were further understood through the mechanism of epithelial-to-mesenchymal transition [16].

The position 2 rank rising up article is “Increased survival in pancreatic cancer with nab-paclitaxel plus gemcitabine” with rank from 25 to 6 and TC from 691 to 2227. The last three years average annual citations reached 512, which was also the second highest. This is a clinical trial of phase 1-2 trial led by Von Hoff DD et al., which included 861 patients with pancreatic cancer and compared the difference between nab-paclitaxel plus gemcitabine and gemcitabine monotherapy. The results showed that the combined drug use was significantly improved overall survival (8.5 months vs. 6.7 months; $P < 0.001$), progression-free survival (5.5 months vs. 3.7 months; $P < 0.001$) [17]. The effectiveness of combined chemotherapy was further confirmed.

Discussion

The rapid increase in the number of studies on pancreatic tumors has created difficulties for researchers and clinicians, especially over the past decade. We performed a bibliometric analysis, a commonly accepted analytical method around the world, on the top 100 most-cited studies in the field of pancreatic tumor, aiming to systematically determine the focuses and current trends in pancreatic tumor research. Although it is difficult to prove the quality or impact of articles by bibliometric analysis, the number of article citations can reflect the value and significance of the article to some extent.

The database we applied in this study, the Thomson Reuters WoS, is the most commonly used database for bibliometric studies, with a multidisciplinary coverage of more than 9500 leading international peer-reviewed journals. By analyzing the top 100 most-cited articles in the literature, investigators can gain insights into the history and development of a given field. Additionally, such analyses can help researchers and clinicians maintain up-to-date knowledge of the changing landscape in clinical practice, the current trends in basic research; and find out the significant research directions in the future.

In this study, we found that the most-cited articles focused more on optional treatments in clinical research especially in chemotherapy strategy, clinical trials and on the pathogenesis of pancreatic tumors in basic research. The United States published most of the top 100

Table 2: Top 10 of TCs.

Citations	Author	Title	Year	Journal	Tumor Type
4111	Burris HA, et al	Improvements in survival and clinical benefit with gemcitabine as first-line therapy for patients with advanced pancreas cancer: A randomized trial	1997	JOURNAL OF CLINICAL ONCOLOGY	Pancreatic Cancer
2998	Conroy T, et al	FOLFIRINOX versus gemcitabine for metastatic pancreatic cancer	2011	NEW ENGLAND JOURNAL OF MEDICINE	Pancreatic Cancer
2541	Moore MJ, et al	Erlotinib plus gemcitabine compared with gemcitabine alone in patients with advanced pancreatic cancer: a phase III trial of the National Cancer Institute of Canada Clinical Trials Group.	2007	JOURNAL OF CLINICAL ONCOLOGY	Pancreatic Cancer
2435	Jones S, et al	Core signaling pathways in human pancreatic cancers revealed by global genomic analyses	2008	SCIENCE	Pancreatic Cancer
2344	Li CW, et al	Identification of pancreatic cancer stem cells	2007	CANCER RESEARCH	Pancreatic Cancer
2227	Von Hoff DD, et al	Increased Survival in Pancreatic Cancer with nab-Paclitaxel plus Gemcitabine	2013	NEW ENGLAND JOURNAL OF MEDICINE	Pancreatic Cancer
1881	Hermann PC, et al	Distinct populations of cancer stem cells determine tumor growth and metastatic activity in human pancreatic cancer	2007	CELL STEM CELL	Pancreatic Cancer
1817	Rahib L et al	Projecting Cancer Incidence and Deaths to 2030: The Unexpected Burden of Thyroid, Liver, and Pancreas Cancers in the United States	2014	CANCER RESEARCH	Pancreatic Cancer
1785	Almoguera C, et al	MOST HUMAN CARCINOMAS OF THE EXOCRINE PANCREAS CONTAIN MUTANT C-K-RAS GENES	1988	CELL	Pancreatic Cancer
1766	Olive KP, et al	Inhibition of Hedgehog Signaling Enhances Delivery of Chemotherapy in a Mouse Model of Pancreatic Cancer	2009	SCIENCE	Pancreatic Cancer

Table 3: Top 10 of ACs.

Citations Per Year	First Author	Title	Year	Journal	Tumor Type
374.75	Conroy, Thierry	FOLFIRINOX versus gemcitabine for metastatic pancreatic cancer	2011	NEW ENGLAND JOURNAL OF MEDICINE	Pancreatic Cancer
371.17	Von Hoff, Daniel D	Increased Survival in Pancreatic Cancer with nab-Paclitaxel plus Gemcitabine	2013	NEW ENGLAND JOURNAL OF MEDICINE	Pancreatic Cancer
363.4	Rahib, L	Projecting Cancer Incidence and Deaths to 2030: The Unexpected Burden of Thyroid, Liver, and Pancreas Cancers in the United States	2014	CANCER RESEARCH	Pancreatic Cancer
252.67	Bailey, Peter	Genomic analyses identify molecular subtypes of pancreatic cancer	2016	NATURE	Pancreatic Cancer
221.36	Jones, Sian	Core signaling pathways in human pancreatic cancers revealed by global genomic analyses	2008	SCIENCE	Pancreatic Cancer
218.5	Waddell, Nicola	Whole genomes redefine the mutational landscape of pancreatic cancer	2015	NATURE	Pancreatic Cancer
213.75	Melo, Sonia A	Glypican-1 identifies cancer exosomes and detects early pancreatic cancer	2015	NATURE	Pancreatic Cancer
211.75	Moore, Malcolm J	Erlotinib plus gemcitabine compared with gemcitabine alone in patients with advanced pancreatic cancer: a phase III trial of the National Cancer Institute of Canada Clinical Trials Group.	2007	JOURNAL OF CLINICAL ONCOLOGY	Pancreatic Cancer

208.5	Yao, JC	Everolimus for Advanced Pancreatic Neuroendocrine Tumors.	2011	NEW ENGLAND JOURNAL OF MEDICINE	Pancreatic Neuroendocrine Tumor
195.33	Li, Chenwei	Identification of pancreatic cancer stem cells	2007	CANCER RESEARCH	Pancreatic Cancer

Table 4: The 10 newest articles.

Citations	First Author	Title	Year	Journal	Article Type	Tumor Type
758	Bailey, Peter	Genomic analyses identify molecular subtypes of pancreatic cancer	2016	NATURE	Basic Study	Pancreatic Cancer
874	Waddell, Nicola	Whole genomes redefine the mutational landscape of pancreatic cancer	2015	NATURE	Basic Study	Pancreatic Cancer
855	Melo, Sonia A	Glypican-1 identifies cancer exosomes and detects early pancreatic cancer	2015	NATURE	Basic Study	Pancreatic Cancer
779	Zheng, Xiaofeng	Epithelial-to-mesenchymal transition is dispensable for metastasis but induces chemoresistance in pancreatic cancer	2015	NATURE	Basic Study	Pancreatic Cancer
777	Bruno Costa-Silva	Pancreatic cancer exosomes initiate pre-metastatic niche formation in the liver	2015	NATURE CELL BIOLOGY	Basic Study	Pancreatic Cancer
1817	Rahib, L	Projecting Cancer Incidence and Deaths to 2030: The Unexpected Burden of Thyroid, Liver, and Pancreas Cancers in the United States	2014	CANCER RESEARCH	Clinical Study	Pancreatic Cancer
751	Ryan, DP	Pancreatic Adenocarcinoma	2014	NEW ENGLAND JOURNAL OF MEDICINE	Conclusive Study	Pancreatic Cancer
736	Ozdemir, BC	Depletion of Carcinoma-Associated Fibroblasts and Fibrosis Induces Immunosuppression and Accelerates Pancreas Cancer with Reduced Survival	2014	CANCER CELL	Basic Study	Pancreatic Cancer
683	Rhim, Andrew D.	Stromal Elements Act to Restrain, Rather Than Support, Pancreatic Ductal Adenocarcinoma	2014	CANCER CELL	Basic Study	Pancreatic Cancer
2227	Von Hoff, Daniel D	Increased Survival in Pancreatic Cancer with nab-Paclitaxel plus Gemcitabine	2013	NEW ENGLAND JOURNAL OF MEDICINE	Clinical Study	Pancreatic Cancer

articles, and studies by the Johns Hopkins University were the most commonly cited among the studies conducted at different institutes. Nature was the journal that published the most articles. Hruban RH from the Johns Hopkins University was one of the authors with the most publications and carried out highest volume of co-authorship works. Co-authorship map reflects extensive team works. In clinical studies, highly cited articles are mainly large clinical trials, and the researches focus on the effectiveness of adjuvant systemic therapy strategies. Basic research, on the other hand, explores various aspects and levels from microRNA, EMT, and pancreatic cancer signaling pathways to explore the mechanism of the occurrence and development of pancreatic cancer, in more diversified ways and ideas. As the number of articles on the basics increases, the link between the clinical and the foundational becomes more apparent in the keyword map.

Some limitations of our study must be mentioned. First, WoS was the only database used for the literature search in our study; although WoS is the most commonly used search engine, a small number of articles might not have been included in this analysis. Second, following the TC index might create bias in the most-cited article ranking. Articles published recently are expected to have fewer TCs than previously published articles with the same

impact, and therefore, so ranking by ACs may render the list more accuracy. Third, inappropriate citations, such as self-citations, in-house citations and the irrelevant citations only because of the high IF (Impact Factor), might also influence the results of the analysis [18]. Fourth, the number of articles in this field is still increasing year by year, especially in the last five years, the number of articles showed explosive growth. As research trends and hot spots change very quickly, some research trends suggested in this paper may lag behind. However, we fortunately have an article in 2016, which could serve as a comparison for the key point of the explosively increased articles. Finally, reviews and guidelines were not excluded in this study; we believe that the reviews and guidelines representing the latest research developments and trends at the time of publication have had a significant impact on the literature.

Conclusion

In conclusion, we performed a bibliometric analysis of the top 100 most-cited articles in the field of pancreatic tumors, identified the most common contributing authors, institutes, and countries; and also made an in-depth interpretation of the included literature from the aspects of the co-occurrence of research authors, article type, research focus and keywords, and performed cluster map

Table 5: The 10 oldest articles.

Citations Per Year	First Author	Title	Year	Journal	Tumor Type
18.89	ZOLLINGER, RM	PRIMARY PEPTIC ULCERATIONS OF THE JEJUNUM ASSOCIATED WITH ISLET CELL TUMORS OF THE PANCREAS	1955	ANNALS OF SURGERY	Pancreatic Neuroendocrine Tumor
15.22	COMPAGNO, J	MUCINOUS CYSTIC NEOPLASMS OF PANCREAS WITH OVERT AND LATENT MALIGNANCY (CYSTADENOCARCINOMA AND CYSTADENOMA) - CLINICOPATHOLOGIC STUDY OF 41 CASES	1978	AMERICAN JOURNAL OF CLINICAL PATHOLOGY	Other
21.79	Moertel CG	Therapy of locally unresectable pancreatic carcinoma: a randomized comparison of high dose (6000 rads) radiation alone, moderate dose radiation (4000 rads + 5-fluorouracil), and high dose radiation + 5-fluorouracil: The Gastrointestinal Tumor Study Group.	1981	CANCER	Pancreatic Cancer
17.29	ZAPF, J	RADIOIMMUNOLOGICAL DETERMINATION OF INSULIN-LIKE GROWTH FACTORS-I AND FACTORS-II IN NORMAL SUBJECTS AND IN PATIENTS WITH GROWTH DISORDERS AND EXTRA-PANCREATIC TUMOR HYPOGLYCEMIA	1981	JOURNAL OF CLINICAL INVESTIGATION	Pancreatic Neuroendocrine Tumor
35.89	GUILLEMIN, R	GROWTH-HORMONE RELEASING-FACTOR FROM A HUMAN PANCREATIC TUMOR THAT CAUSED ACROMEGALY	1982	SCIENCE	Pancreatic Cancer
29.59	RIVIER, J	CHARACTERIZATION OF A GROWTH HORMONE-RELEASING FACTOR FROM A HUMAN PANCREATIC-ISLET TUMOR	1982	NATURE	Pancreatic Neuroendocrine Tumor
16.22	Magnani JL	Identification of the gastrointestinal and pancreatic cancer-associated antigen detected by monoclonal antibody 19-9 in the sera of patients as a mucin	1983	CANCER RESEARCH	Pancreatic Cancer
32.82	HANAHAN, D	HERITABLE FORMATION OF PANCREATIC BETA-CELL TUMORS IN TRANSGENIC MICE EXPRESSING RECOMBINANT INSULIN SIMIAN VIRUS-40 ONCOGENES	1985	NATURE	Pancreatic Neuroendocrine Tumor
27.76	Kaiser MH	Pancreatic cancer. Adjuvant combined radiation and chemotherapy following curative resection	1985	ARCHIVES OF SURGERY	Pancreatic Cancer
18.09	GUDJONSSON, B	CANCER OF THE PANCREAS - 50 YEARS OF SURGERY	1987	CANCER	Pancreatic Cancer

analysis. Our results highlight the focuses and trends in the field of pancreatic tumors research and emphasize the significant role of clinical and basic studies in this area, especially for pancreatic cancer. This analysis provides an understanding of the important progress of pancreatic tumor research and can provide important reference and guidance for future research.

References

- Siegel RL, Miller KD, Jemal A. Cancer statistics, 2019. *CA Cancer J Clin*. 2019;69(1):7-34.
- Allen PJ, Kuk D, Castillo CFD, Basturk O, Wolfgang CL, Cameron JL, et al. Multi-institutional validation study of the American joint commission on cancer (8th Ed) changes for T and N staging in patients with pancreatic adenocarcinoma. *Ann Surg*. 2017;265(1):185-91.
- Conroy T, Desseigne F, Ychou M, Bouché O, Guimbaud R, Bécouarn Y, et al. FOLFIRINOX versus gemcitabine for metastatic pancreatic cancer. *N Engl J Med*. 2011;364(19):1817-25.
- Gourgou-Bourgade S, Bascoul-Mollevi C, Desseigne F, Ychou M, Bouché O, Guimbaud R, et al. Conroy, Impact of FOLFIRINOX compared with gemcitabine on quality of life in patients with metastatic pancreatic cancer: Results from the PRODIGE 4/ACCORD 11 randomized trial. *J Clin Oncol*. 2013;31(1):23-9.
- Julie Hallet J, Law CHL, Cukier M, Saskin R, Liu N, Singh S. Exploring the rising incidence of neuroendocrine tumors: A population-based analysis of epidemiology, metastatic presentation, and outcomes. *Cancer*. 2015;121(4):589-97.
- Dasari A, Shen C, Halperin D, Zhao B, Zhou S, Xu Y, et al. Trends in the incidence, prevalence, and survival outcomes in patients with neuroendocrine tumors in the United States. *JAMA Oncol*. 2017;3(10):1335-42.
- Li Q, Jiang Y. Top classic citations in pancreatic cancer research. *World J Surg Oncol*. 2016;14(1):298.
- Guo X, ao L, Wang Z, Feng C, Xing B. Top 100 most-cited articles on pituitary adenoma: A bibliometric analysis. *World Neurosurg*. 2018;116:e1153-67.

9. Eck NJV, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*. 2010;84:523-38.
10. Burris 3rd HA, Moore MJ, Andersen J, Green MR, Rothenberg ML, Modiano MR, et al. Improvements in survival and clinical benefit with gemcitabine as first-line therapy for patients with advanced pancreas cancer: A randomized trial. *J Clin Oncol*. 1997;15(6):2403-13.
11. Moore MJ, Goldstein D, Hamm J, Figer A, Hecht JR, Gallinger S, et al. Erlotinib plus gemcitabine compared with gemcitabine alone in patients with advanced pancreatic cancer: A phase III trial of the National Cancer Institute of Canada Clinical Trials Group. *J Clin Oncol*. 2007;25(15):1960-6.
12. Jones S, Zhang X, Parsons DW, Lin JCH, Leary RJ, Angenendt P, et al. Core signaling pathways in human pancreatic cancers revealed by global genomic analyses. *Science*. 2008;321(5897):1801-6.
13. Li C, Heidt DG, Dalerba P, Burant CF, Zhang L, Adsay V, et al. Identification of pancreatic cancer stem cells. *Cancer Res*. 2007;67(3):1030-7.
14. Zollinger RM, Ellison EH. Primary peptic ulcerations of the jejunum associated with islet cell tumors of the pancreas. *Ann Surg*. 1955;142(4):709-23; discussion,724-8.
15. Yao JC, Shah MH, Ito T, Bohas CL, Wolin EM, Cutsem EV, et al. Oberg, Everolimus for advanced pancreatic neuroendocrine tumors. *N Engl J Med*. 2011;364(6):514-23
16. Rhim AD, Mirek ET, Aiello NM, Maitra A, Bailey JM, McAllister F, et al. EMT and dissemination precede pancreatic tumor formation. *Cell*. 2012;148:349-61.
17. Hoff DDV, Ervin T, Arena FP, Chiorean EG, Infante J, Moore M, et al. Increased survival in pancreatic cancer with nab-paclitaxel plus gemcitabine. *N Engl J Med*. 2013;369(18):1691-703.
18. Ioannidis JPA, Boyack KW, Small H, Sorensen AA, Klavans R. Bibliometrics: Is your most cited work your best? *Nature*. 2014;514:561-2.