

Bibliometric Analysis of the top 50 Most-cited Articles of Esophagus Cancer

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ABSTRACT

A wealth of articles were published on Esophagus Cancer (EC) indexed in many databases in the world. But there is no comprehensive bibliometric analysis to summarized EC research. The study aimed to identify and provide a practical summary of the 50 most influential articles written on EC. Top 50 article search was conducted in July 2020 using MesH database of medical subject headings of the US National Library of Medicine. Data were evaluated based on the title, trends, citations report, authorship, countries/regions, organizations, and journals. The retrieved data

were analyzed using, HistCite, VOSviewer 1.6.10 and R-package. The top 50 articles include 31(62%) full research paper, 10(20%) proceedings, and 9 (18%) review articles. The most cited articles were published between 1961 and 2019, with citation ranging from 329 to 2283. The majority of articles originated from the United States (60%), Germany (21%), Japan (10%), and China (10%). The National Cancer Institute and the University of Washington were the most productive institutions. Blot WJ, and Vaughan TL, were the most prolific author. Most articles were published by the New England Journal of Medicine, followed by Gastroenterology and Journal of Clinical Oncology. The top three co-cited journals were the Gastroenterology, Cancer Research and American Journal of Gastroenterology, and International Journal of Cancer. We identified the top 50 most-cited articles and hosted keywords used in EC, in addition to the most productive authors, institution, and countries that provided a systematic overview of research and information that may offer deep insights into the study in the medical field and policymaker to prioritizing future research efforts in EC research.

Key words: Esophagus; Oesophag; Cancer; Bibliometric analysis

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INTRODUCTION

The Esophageal Cancer (EC) is one of the eighth most common causes of cancer death worldwide. Moreover, it is considered the public health issues due to it is incredibly aggressive nature and have a poor survival rate^[1]. It is known by two major types, including a histologic subtype of Squamous cell carcinomas (SCC) and Adenocarcinomas (AC)^[2-4]. Epidemiologically Squamous Cell Carcinomas (SCC) is more common in the developing world, while Adenocarcinomas (AC) is more common in the developed country^[4]. Risk factors vary between countries and cultures, but in general, it is

a disease of poor nutrition, poor oral hygiene, and social deprivation. Smoking and alcohol consumption have strong associations with EC^[5,6]. In the last 30 years, the incidence of esophageal and gastric cardia adenocarcinoma has steadily increased in the world. The increase in incidence rate is approximately seven-fold compare with other types it is substantial increase than that of several malignancies, including melanoma, prostate cancer, and breast cancer^[6-8]. On the other hands, the side effect of EC has been reported that affects more than 450000 people worldwide which needed argment management^[7].

Due to the limited published bibliometric studies on EC globally. There is no bibliometric analysis has been performed for the top 50 influence papers in EC to provide researchers or scientist with a practical guide. Many bibliometric analyses has to be done to draw attention to valuable articles that are most cited. The bibliometric review is the analysis of the publications that have been widely used across diverse fields^[8], to evaluate and estimate the importance of published articles or trends on a unique topic of scientific literature which issued by many scholars institutions of a specific place at a certain period and on a specific topic^[9-11].

This is the first bibliometric study to be conducted showing the output of the previous work performed by a scientific researcher. Therefore, biometrics is a quantitative study of various aspects of the literature on a topic and is used to identify the pattern of publication, authorship, and secondary journal coverage to gain insight into the dynamics of growth of knowledge in the areas under consideration for better understanding the growth and development of the research output in the Esophageal Cancer.

METHODS

A comprehensive literature search of EC was conducted on July 15, 2020, the citation search was performed using the Science Citation Index Expanded (SCI-E) and Social Science citation index (SSCI) of the ISI Web of Science as follows: Using the entry Terms of the MesH database (Medical Subject Headings) of the US National Library of Medicine (National Institutes of Health) [24]. Using the search query is guaranteed. The used search term was: Title:(esophag* AND oesophag* carcinom*OR Cancer of Esophagus* OR Cancer of the Esophagus* OR Esophageal Cancer* OR Esophagus Cancer* OR Esophagus Neoplasm* OR Neoplasms, Esophageal*) Refined by [excluding] PUBLICATION YEARS: (2020), for all documents of esophagus cancer indexes: (SCI-EXPANDED, SSCI) Web of Science Core Collection. Finally, 9,021 publications were identified in both original articles and review paper.

Data were extracted within the single day by two researchers (IHM and THM), respectively, to avoid the update of WOS databases. They read the extracted documents and screened the relevant articles according to the inclusion and exclusion criterion. Finally, the top 50 cited articles were analysed according to the annual trend of publication, a total number of global citations journals, authorship, countries, institutions, study design, study field using the bibliometric analysis software. There is no ethical approval required because we used WOS public databases which is publically available and did not involve any human subjects.

Data analysis

Data were analysed based on the title, trends of the most cited articles, a number of citations, authorship, countries/regions, organizations, and productive journals. Data were retrieved and analyzed by using, HistCite^[12], R-package^[13], and VOSviewer 1.6.10^[14].

RESULTS

Top 50 cited article on Esophagus Cancer

The basic information of retrieved documents on EC is listed in (Table 1). The top 50 documents include, 31 (62%) full research articles, 10 (20%) proceedings article, and 9 (18%) review articles. The top-cited article highlighted the use of preoperative chemoradiotherapy to improved survival among patients with potentially curable esophageal or esophagogastric-junction cancer^[15]. The number of citations ranges from 329 to 2283 (Table 2). The top 50 cited article in EC has received 29374 citations, and a majority of articles were published in the 1991-2000 accounting 23 (46%), followed by 2001-2010 accounting 16 (32%) (Table 3).

Top journals

The top 50 cited articles were published in 28 high ranking Journal as shown in Table 4. The 50 articles which were published in journals ranked into Quartiles- Q1, Q2, and Q3. The New England Journal of Medicine with (IF;74.699) were published six articles with total citations 8371 times, followed by Gastroenterology and Journal of Clinical Oncology (If;17.373) which published five articles. The impact factors for journals with the top 50 cited articles ranged from 2.234 to 74.699 (IF, 2020). The higher frequency citations scores of the number of articles are six articles has been published in the New England Journal of Medicine.

Top institutions

The 50 articles were originated from 147 different institutions. The National Cancer Institute and the University of Washington, which is situated in the United States were the first rank institute with (6 articles), followed by the Chinese Academy of Medical Sciences located in China, and New York University and the University of North Carolina, each with four articles (Table 6).

Table 1 Main Information on top 50 cited paper in EC.

Description	Results
Timespan	1961:2014
Sources (Journals)	28
Documents	50
Average years from publication	21.4
Average citations per documents	587.5
Average citations per year per doc	32.75
Document types n(%)	
Article	31 (62.0)
Article; proceedings paper	10 (20.0)
Review	9 (18.0)
Document contents	
Keywords Plus	228
Author's Keywords	50
Authors	
Authors	316
Author appearances	367
Authors of single-authored documents	4
Authors of multi-authored documents	312
Authors collaboration	
Single-authored documents	4
Documents per Author	0.158
Authors per document	6.32
Co-Authors per documents	7.34
Collaboration index	6.78

Table 2 The top 50 cited article on Esophagus Cancer.

Rank	First Author , Article	TGS	GCS/t
1	Van Hagen P, et al. Preoperative Chemoradiotherapy for Esophageal or Junctional Cancer. <i>New England Journal of Medicine</i> . 2012; 366 (22): 2074-2084	2283	761
2	Enzinger PC, Mayer RJ. Medical progress-Esophageal cancer. <i>New England Journal of Medicine</i> . 2003; 349 (23): 2241-2252	2010	167.5
3	Herskovic A, et al. Combined Chemotherapy And Radiotherapy Compared With Radiotherapy Alone In Patients With cancer of The Esophagus. <i>New England Journal of Medicine</i> . 1992; 326 (24): 1593-1598	1493	64.91
4	Cooper JS, et al. Chemoradiotherapy of locally advanced esophageal cancer - Long-term follow-up of a prospective randomized trial (RTOG 85-01). <i>Jama-Journal of The American Medical Association</i> .1999; 281 (17): 1623-1627	1162	72.63
5	Bosset JF, et al. Chemoradiotherapy followed by surgery compared with surgery alone in squamous-cell cancer of the esophagus. <i>New England Journal Of Medicine</i> . 1997; 337(3): 161-167	1016	56.44
6	Kelsen DP, et al. Chemotherapy followed by surgery compared with surgery alone for localized esophageal cancer. <i>New England Journal of Medicine</i> . 1998; 339 (27): 1979-1984.	953	56.06
7	Minsky BD, et al. INT 0123 (radiation therapy oncology group 94-05) phase III trial of combined-modality therapy for esophageal cancer: High-dose versus standard-dose radiation therapy. <i>Journal of Clinical Oncology</i> . 2002; 20 (5): 1167-1174.	910	70
8	Tepper J, et al. Phase III trial of trimodality therapy with cisplatin, fluorouracil, radiotherapy, and surgery compared with surgery alone for esophageal cancer: Calgb 9781. <i>Journal of Clinical Oncology</i> . 2008; 26(7): 1086-1092	834	119.14
9	Bedenne L, et al. Chemoradiation followed by surgery compared with chemoradiation alone in squamous cancer of the esophagus: FFCD 9102. <i>Journal of Clinical Oncology</i> . 2007: 1160-1168.	728	91
10	Akiyama H, et al. Radical Lymph-Node Dissection for Cancer of the Thoracic Esophagus. <i>Annals of Surgery</i> . 1994; 220(3): 364-373	676	32.19
11	Yang CS. Research on Esophageal Cancer in China-A Review. <i>Cancer Research</i> . 1980; 40(8): 2633-2644.	659	18.83
12	Mirvish SS. Role of N-Nitroso Compounds (NOC) And N-Nitrosation in Etiology of Gastric, Esophageal, Nasopharyngeal and Bladder-Cancer And Contribution to Cancer of Known Exposures to NOC. <i>Cancer Letters</i> . 1995; 93 (1): 17-48.	632	31.6
13	Knyrim K, et al. A Controlled trial of an expansile Metal Stent for palliation of Esophageal obstruction due to Inoperable Cancer. <i>New England Journal of Medicine</i> . 1993; 329 (18): 1302-1307.	616	28
14	Shaheen NJ, et al. Is there publication bias in the reporting of cancer risk in Barrett's esophagus?. <i>Gastroenterology</i> . 2000; 119 (2): 333-338.	592	39.47
15	Rheeder JP, et al. Fusarium-Moniliforme and Fumonisin in Corn I Relation to Human Esophageal Cancer In Transkei. <i>Phytopathology</i> . 1992; 82 (3): 353-357.	575	25
16	Allum WH, et al. Long-Term Results of a Randomized Trial of Surgery With or Without Preoperative Chemotherapy in Esophageal Cancer. <i>Journal of Clinical Oncology</i> . 2009; 27 (30): 5062-5067.	535	89.17
17	Ell C, et al. Endoscopic mucosal resection of early cancer and high-grade dysplasia in Barrett's esophagus. <i>Gastroenterology</i> . 2000 APR; 118(4): 670-677.	512	34.13
18	Ohigashi Y, et al. Clinical significance of programmed death-1 ligand-1 and programmed death-1 ligand-2 expression in human esophageal cancer. <i>Clinical Cancer Research</i> . 2005; 11(8): 2947-2953.	508	50.8
19	AlSarraf M, et al. Progress report of combined chemoradiotherapy versus radiotherapy alone in patients with esophageal cancer: An intergroup study. <i>Journal of Clinical Oncology</i> . 1997; 15 (1): 277-284.	502	27.89
20	Reid BJ, et al. Predictors of progression to cancer in Barrett's esophagus: Baseline histology and flow Cytometry identify low- and high-risk patient subsets. <i>American Journal of Gastroenterology</i> . 2000; 95(7): 1669-1676.	493	32.87
21	Zhang YW. Epidemiology of esophageal cancer. <i>World Journal of Gastroenterology</i> . 2013; 19 (34):5598-5606.	477	238.5
22	Urschel JD, et al. A meta-analysis of randomized controlled trials that compared neoadjuvant chemoradiation and surgery to surgery alone for respectable esophageal cancer. <i>American Journal of Surgery</i> . 2003;185 (6): 538-543.	461	38.42
23	Chu FS, LI GY . Simultaneous Occurrence of Fumonisin B-1 And Other Mycotoxins In Moldy Corn Collected from the Peoples-Republic-of-China In Regions with high incidences of Esophageal Cancerc. <i>Applied and Environmental Microbiology</i> . 1994 ; 60(3): 847-852.	446	21.24
24	Nygaard K, et al. Preoperative Radiotherapy Prolongs Survival in Operable Esophageal-Carcinoma -A Randomized, multicenter study of preoperative Radiotherapy And Chemotherapy-The 2nd Scandinavian Trial in Esophageal Cancer. <i>World journal of surgery</i> . 1992; 16(6): 1104-1110.	443	19.26
25	Engel LS, et al. Population attributable risks of esophageal and gastric cancers. <i>Journal Of The National Cancer Institute</i> . 2003; 95(18): 1404-1413.	438	36.5
26	W Thiel PG, et al. Natural Occurrence of some Fusarium Mycotoxins In Corn from Low and High Esophageal Cancer Prevalence Areas of The Transkei, Southern Africa. <i>Journal of Agricultural and Food Chemistry</i> . 1990; 38 (10): 1900-1903.	436	17.44
27	Hollstein MC, et al. Frequent mutation of the p53 gene in human esophageal cancer. <i>Proceedings of the national academy of sciences of the united states of America</i> . 1990; 87(24): 9958-9961.	425	17
28	Franceschi S, et al. Smoking And Drinking In Relation to Cancers of The Oral Cavity, Pharynx, Larynx, And Esophagus In Northern Italy. <i>Cancer</i> . 1990; 50 (20): 6502-6507.	417	16.68
29	Tixier F, et al. Intratumor Heterogeneity characterized by Textural Features on Baseline F-18-Fdg Pet images Predicts Response to Concomitant Radio chemotherapy in Esophageal Cancer. <i>Journal of Nuclear Medicine</i> . 2011; 52 (3): 369-378.	417	104.25
30	Tran GD, et al. Prospective study of risk factors for esophageal and gastric cancers in the Linxian General Population Trial cohort in China. <i>International Journal Of Cancer</i> . 2005; 113(3): 456-463.	415	41.5
31	Shimada Y., et al. Characterization of 21 newly established esophageal cancer cell-lines. <i>Cancer</i> . 1992; 69 (2):277-284	397	17.26
32	Wynder EL, et al. A Study of Etiological factors In Cancer of Esophagus. <i>Cancer</i> . 1961; 14(2): 389	396	7.33
33	Vaughan TL, et al. Obesity, Alcohol, And Tobacco as Risk-Factors for Cancers of The Esophagus And Gastric Cardia - Adenocarcinoma Versus Squamous-Cell Carcinoma. <i>Cancer Epidemiology Biomarkers & Prevention</i> . 1995; 4 (2): 85-92	395	19.75
34	Jiang W, et al. Altered Expression of The Cyclin D1 And Retinoblastoma Genes In Human Esophageal Cancer. <i>Proceedings of The National Academy of Sciences of The United States of America</i> . 1993; 90 (19): 9026-9030	391	17.77
35	Isono K, et al. Results of A Nationwide study on The 3-Field Lymph-Node Dissection of Esophageal Cancer. <i>Oncology</i> . 1991; 48(5): 411-420	385	16.04
36	Holmes RS, Vaughan TL.Epidemiology and pathogenesis of esophageal cancer. <i>Seminars In Radiation Oncology</i> . 2007; 17 (1): 2-9.	384	48
37	Blot WJ, et al. The changing epidemiology of esophageal cancer. <i>Seminars In Oncology</i> . 1999;26 (5): 2-8	382	23.88
38	Ell C, et al. Curative endoscopic resection of early esophageal adenocarcinomas (Barrett's cancer). <i>Gastrointestinal Endoscopy</i> . 2007;65 (1): 3-10	377	47.13

39	Ichihara F, et al. Increased populations of regulatory T cells in peripheral blood and tumor-infiltrating lymphocytes in patients with gastric and esophageal cancers. <i>Clinical Cancer Research</i> . 2003; 9 (12): 4404-4408	374	31.17
40	Hirota WK, et al. Specialized intestinal metaplasia, dysplasia, and cancer of the esophagus and esophagogastric junction: Prevalence and clinical data. <i>Gastroenterology</i> . 1999; 116(2): 277-285	364	22.75
41	Siewert JR, et al. Histologic tumor type is an independent prognostic parameter in esophageal cancer: Lessons from more than 1,000 consecutive resections at a single center in the Western world. <i>Annals of surgery</i> . 2001; 234(3): 360-367	363	25.93
42	Corley DA, et al. Protective association of aspirin/NSAIDs and esophageal cancer: A systematic review and meta-analysis. <i>Gastroenterology</i> . 2003; 124 (1): 47-56.	359	29.92
43	Gossner L, et al. Photodynamic ablation of high-grade dysplasia and early cancer in Barrett's esophagus by means of 5-aminolevulinic acid. <i>Gastroenterology</i> . 1998; 114(3): 448-455	350	20.59
44	Peyre CG, et al. The Number of Lymph Nodes removed predicts survival in Esophageal Cancer: An International study on the impact of extent of surgical Resection. <i>Annals of Surgery</i> . 2008; 248 (4): 549-554.	350	50
45	Gabittas RF, et al. Elevated myeloid-derived suppressor cells in pancreatic, esophageal and gastric cancer are an independent prognostic factor and are associated with significant elevation of the Th2 cytokine interleukin-13. <i>Cancer Immunology Immunotherapy</i> . 2011; 60(10): 1419-1430	350	87.5
46	Napier KJ, Scheerer M, Misra S. Esophageal cancer: A Review of epidemiology, pathogenesis, staging workup and treatment modalities. <i>World Journal of Gastrointestinal Oncology</i> . 2014; 6 (5): 112-120.	347	347
47	Farrow DC, et al. Use of aspirin and other nonsteroidal anti-inflammatory drugs and risk of esophageal and gastric cancer. <i>Cancer Epidemiology Biomarkers & Prevention</i> . 1998; 7(2): 97-102.	346	20.35
48	Shaheen N, et al. Gastroesophageal reflux, Barrett esophagus, and esophageal cancer - Scientific review. <i>Jama-Journal of The American Medical Association</i> . 2002; 287 (15):1972-1981	336	25.85
49	Skinner DB. Enbloc Resection For Neoplasms of The Esophagus And Cardia. <i>Journal of Thoracic And Cardiovascular Surgery</i> . 1983; 85 (1): 59-71.	335	10.47
50	Li JY, et al. Nutrition Intervention Trials in Linxian, China - Multiple Vitamin Mineral Supplementation, Cancer Incidence, And Disease-Specific Mortality Among Adults with Esophageal Dysplasia. <i>Journal of the national cancer institute</i> .1993; 85(18):1492-1498.	329	14.95

TGC: Total global citations; GCS/t : Global Cited Score per year.

Table 3 Frequency distribution and trend in 50 top-cited articles in EC.

Period	Number of articles	Percent	GCS
1961 to 1990	6	12	2668
1991 to 2000	23	46	13450
2001 to 2010	16	32	9382
2011 to 2014	5	10	3874
Total	50	100	29374

GCS: Global Citations Score.

Top countries contributed in top 50 EC articles

Most EC articles were from the USA (60%), followed by Germany (12%), Japan (10%), and China (10%) as shown in Figure 1. The collaboration of countries/regions involved in EC research is shown in Figure 2.

Co-occurrence of authors keywords

Minimum one of occurrence of keywords was selected. Of the 48 keywords, 84 meet the threshold, and only 21 were shown in the figure within 5 clusters with total link strength 51 scores. Among the occur keywords esophageal cancer occurrence was five times with (TLS;20), followed by the antineoplastic agent, esophageal neoplasms/surgery, meta-analysis, prospective complications, prospective studies and randomized controlled trial with each occurs one time and with (TLS;6) for each (Table 7). The Co-occurrence of most cited keywords within the top 50 cited articles based on the total citation and h-index was reported in Figure 3.

Co-citation analysis of cited sources

Of the 1766 cited reference, minimum of 4 cited reference was selected, which resulted in 40 meet the threshold. Those cited references were visualized into the 3 clusters with (TLS;718) (Figure 4).

Co-citation analysis

Of the total cited source, minimum of 25 references were selected which presented into the 2 clusters with TLS=13453. The journal of Gastroenterology reported with high TLS=2652, followed by cancer

Table 4 Journal in which the top 50 articles on EC were published.

Journal (n=28)	Recs	GCS	IF (2020)	Q*
New England Journal of Medicine	6 (12)	8371	74.699	Q1
Gastroenterology	5 (10)	2177	17.373	Q1
Journal of Clinical Oncology	5 (10)	3509	32.956	Q1
Annals of Surgery	3 (6)	1389	10.13	Q1
Cancer	2 (4)	793	6.126	Q1
Cancer Epidemiology Biomarkers & Prevention	2 (4)	741	4.344	Q2
Cancer Research	2 (4)	1076	9.727	Q1
Clinical Cancer Research	2 (4)	882	10.107	Q1
Jama-journal of the American Medical Association	2 (4)	1498	45.54	Q1
Journal of the National Cancer Institute	2 (4)	767	11.577	Q1
Proceedings of the National Academy of Sciences of the United States of America	2 (4)	816	9.412	Q1
American Journal of Gastroenterology	1 (2)	493	10.171	Q1
American Journal of Surgery	1 (2)	461	2.125	Q2
Applied and Environmental Microbiology	1 (2)	446	4.016	Q1
Cancer Immunology Immunotherapy	1 (2)	350	5.442	Q1
Cancer letters	1 (2)	632	7.36	Q1
Gastrointestinal Endoscopy	1 (2)	377	6.89	Q1
International Journal of Cancer	1 (2)	415	5.145	Q1
Journal of Agricultural and Food Chemistry	1 (2)	436	4.192	Q1
Journal of Nuclear Medicine	1 (2)	417	7.887	Q1
Journal of Thoracic and Cardiovascular Surgery	1 (2)	335	4.451	Q1
Oncology Report	1 (2)	385	3.417	Q2
Phytopathology	1 (2)	575	3.234	Q1
Seminars in Oncology	1 (2)	382	4.213	Q2
Seminars in Radiation Oncology	1 (2)	384	4.076	Q2
World Journal of Gastroenterology	1 (2)	477	3.665	Q2
World Journal of Gastrointestinal Oncology	1 (2)	347	2.898	Q3
World Journal of Surgery	1 (2)	443	2.234	Q2
Total	50	29374	313.407	

*: Journals are ranked into four Quartiles- Q1, Q2, Q3, and Q4 (Q1 being the highest) by Scimago.

research with TLS=2491, American Journal of Gastroenterology with TLS= 2285, and International Journal of Cancer with TLS=2048, and new England Journal of Medicine with TLS=1736 among others (Figure 5).

DISCUSSIONS

This is the first bibliometric analysis of the top 50 cited article in EC. Many significant findings can be drawn from this analysis of the top 50 most cited papers published on EC using bibliometric indicators on assessing characteristics and main outcome of the top-cited article in addition to the citations, publication year, country of origin, institution, journal, publication type of article and authorship.

Table 5 Authors with three or more top 50 cited article on EC.

Rank	Authors (n=316)			Authors Rank			TGCS	List Span
	Author	Recs	Percent	First	Second	Last		
1st	Blot WJ	4	8	1	0	3	1495	1993-2003
2nd	Vaughan TL	4	8	1	2	1	1563	1995-2007
3rd	Byhardt R	3	6	0	0	3	3157	1992-1999
4th	Ell C	3	6	2	0	1	1239	1998-2007
5th	Gossner L	3	6	1	0	1	1239	1998-2007
6th	Herskovic A	3	6	1	0	2	3157	1992-1999
7th	May A	3	6	0	2	1	1239	1998-2007
8th	Stolte M	3	6	0	1	2	1239	1998-2007

Table 6 Institution of origin with three or more top-cited articles on EC.

Rank	Institution (n= 147)	Recs	Percent	TGCS
1st	The National Cancer Institute	6	12	2344
2nd	University of Washington	6	12	2558
3rd	Chinese Academy of Medical Sciences	4	8	1581
4th	New York University	4	8	3595
5th	The University of North Carolina	4	8	2200
6th	Fred Hutchinson Cancer Research Center	3	6	1223
7th	International Epidemiology Institute	3	6	1166
8th	Mayo Clinic's, Minnesota	3	6	3025
9th	University of Southern California	3	6	2345
10th	University of Washington	3	6	3608
11th	Wayne State University	3	6	3157

Table 7 Co-occurrence of most cited keywords within the top 50 cited articles on EC.

Word (n= 269)	h-index	Percent	TCS	Word	h-index	Percent	TCS
Cancer	44	88	27000	Epidemiology	4	8	1590
Esophageal	37	74	21607	Human	4	8	1899
Esophagus	14	28	8103	Radiotherapy	4	8	3272
Ggastric	7	14	2950	Randomized	4	8	2601
Trial	7	14	4915	Resection	4	8	1574
Barrett	6	12	2660	Review	4	8	1701
Compared	6	12	5485	Cell	3	6	1808
High	6	12	3147	Combined	3	6	2905
Surgery	6	12	4527	Corn	3	6	1457
Cancers	5	10	2039	Early	3	6	1239
Risk	5	10	2241	Factors	3	6	1206
Chemoradiotherapy	4	8	4963	Followed	3	6	2697
Chemotherapy	4	8	3424	Lymph	3	6	1411
China	4	8	1849	Patients	3	6	2369
Dysplasia	4	8	1555	Preoperative	3	6	3261

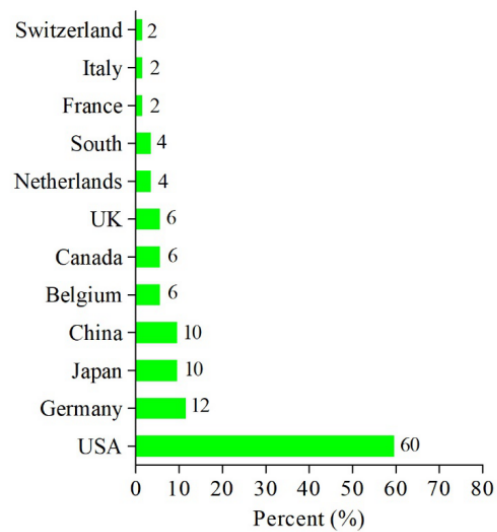


Figure 1 Top countries contributed in the top 50 articles (n=12).

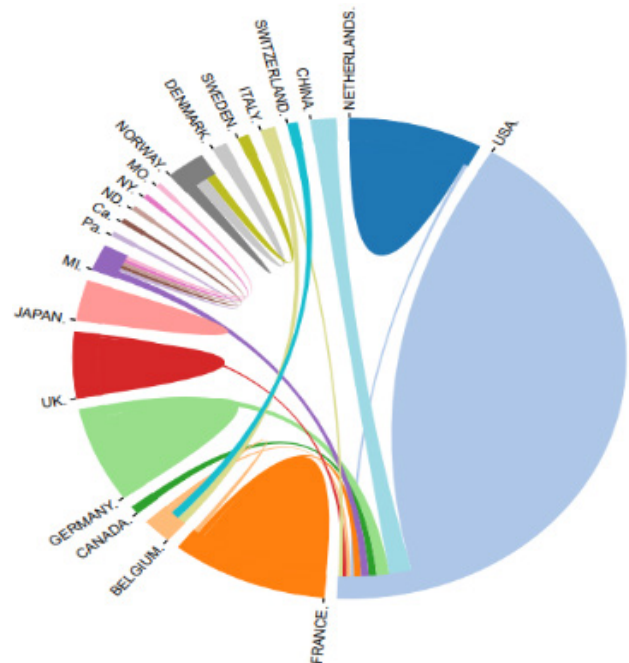


Figure 2 The collaboration of countries or regions involved in EC research.

Our findings show that article published by Van Hagen P, 2012 in the New England Journal of Medicine has offer information on the prospective chemoradiotherapy improved survival among patients with potentially treatable esophageal or esophagogastric junction cancer, this article is the most cited articles and it a research hotspot among the top 50 most cited papers^[15].

The majority of the 50 top-cited articles were published from 1991 to 2010, representing 39 (78%) of published 50 top-cited articles. The regional distribution of articles revealed that 13 countries were contributed in the top 50 cited articles in EC research. Most of the articles have been created in the USA, followed by Germany, Japan, and China. It was found that there is a scientific collaboration of countries/regions during the study period. The underlying reasons might be due to its higher gross national product and fund used for research in well-developed countries like the United States. Besides the top institution are located in the United States and China. The United States shows a strong collaboration between the listed institutions or countries that can promote the development and progress of research.

Our findings aim to provides quantitative information for published documents in EC and highlighted the trend distribution between the most productive authors, countries, institutions, authors, journals, co-cited sources, authors keywords that helps the medical doctor and experts understand and design future research related to EC during it first published paper up-to-date. Therefore, it is similar to previous published bibliometric studies which have been used to provide essential knowledge and annual trend of the publication as well as academic achievements in a specific research field^[16-18].

The list of the most active journals and the institution was skewed towards the United States where china has less contribution in term of the top-cited article which highlighted the issue of a huge prevalence of EC disease in China, especially in the Taihang Mountain range areas in the north since 1980^[19], followed by EC article which reported in 1994 in 31 corn samples collected from households in the counties of Cixian and Linxian of the People’s Republic of China, which indicates a high incidence of esophageal cancer^[20], wherein year 2005 study published by Tran G, reported that EC incidence and mortality rates in Linxian, China is among the highest in the world. Moreover, the study highlighted the risk factors of EC among Chinese living in Linxian, China is due to the protective factors for ESCC included formal education of the families, water piped into the home, increased consumption of meat, eggs and fresh fruits and alcohol consumption, and increased weight and BMI. In addition to the general socioeconomic status of families are common denominator factors for EC in Linxian^[21]. Among the top 50 listed article published by Li JY *et al.*, 1993 highlighted the fact that diets high in fruits and vegetables are associated with a reduced risk of several cancers, including cancers of the esophagus and stomach^[22], which further indicate that vitamin and mineral supplementation of the diet of Linxian adults, particularly with the combination of beta carotene, vitamin E, and selenium, may effect a reduction in cancer risk^[22].

Even though we carried out a comprehensive search on ES published documents in WOS, nevertheless our analysis it also has some limitations. We only used WOS (SCI-E and SCI) databases, not PubMed, Scopus, Medline, or Google scholar databases that can provide greater transparency with regard to coverage than WOS itself. Analyzing the top 50 documents that may lead to several high-quality articles in EC being excluded from our analysis due to it is citations reports.

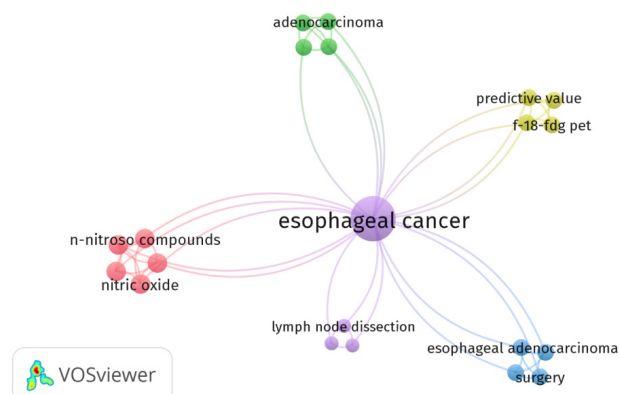


Figure 3 Network visualization map of author keywords of top 50 cited articles on EC (1961-2019).

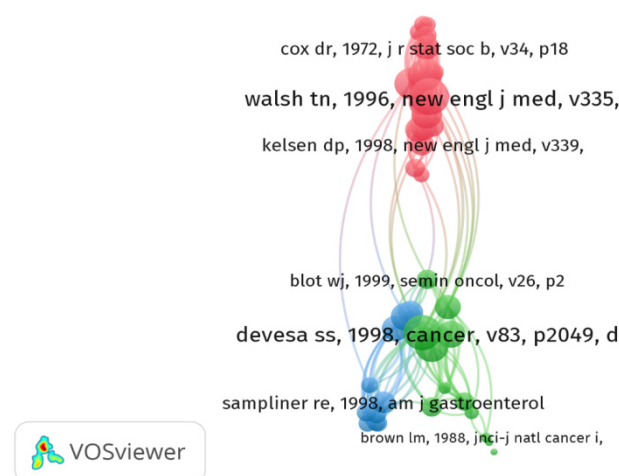


Figure 4 Network visualization map of co-cited reference on EC (1961-2019).

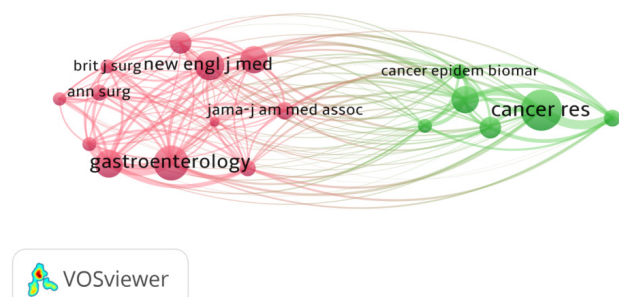


Figure 5 Network visualization map of co-cited sources among the top 50 cited articles on EC (1961-2019).

CONCLUSIONS

The study identified the top 50 most-cited articles which includes (62% full research paper, 20% proceedings, and 18% review articles) and hosted keywords used in EC, in addition to the most productive authors (Blot WJ, and Vaughan TL), institution (National Cancer Institute and the University of Washington), and countries (United States, Germany, Japan and China) that provided a systematic overview of research and information that may offer deep insights into the study in the medical field and policymaker to prioritizing future research efforts in EC research

REFERENCES

1. Abbas G, Krasna M. Overview of esophageal cancer. *Ann*

- Cardiothorac Surg.*2017; <https://doi.org/10.21037/acs.2017.03.03>.
2. Kollarova H, Machova L, Horakova D, Janoutova G, Janout V. Epidemiology of esophageal cancer--an overview article. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub.*2007. [DOI: 10.5507/bp.2007.003].
 3. Pourhoseingholi MA, Vahedi M, Baghestani AR. Burden of gastrointestinal cancer in Asia; an overview. *Gastroenterol Hepatol from Bed to Bench.* 2015. [DOI: 10.22037/ghfbb.v1i1.608].
 4. Yousefi MS, Sharifi-Esfahani M, Pourgholam-Amiji N, Afshar M, Sadeghi-Gandomani H, Otroshi O, et al. Esophageal cancer in the world: incidence, mortality and risk factors. *Biomed Res Ther.*2018. [DOI: 10.15419/bmrat.v5i7.460].
 5. Carr JS, Zafar SF, Saba N, Khuri FR, El-Rayes BF. Risk factors for rising incidence of esophageal and gastric cardia adenocarcinoma. *J Gastrointest Cancer.* 2013. [DOI: 10.1007/s12029-013-9480-z].
 6. Yoshida N, Watanabe M, Baba Y, Iwagami S, Ishimoto T, Iwatsuki M, et al. Risk factors for pulmonary complications after esophagectomy for esophageal cancer. *Surg Today.*2014. [DOI: 10.1007/s00595-013-0577-6].
 7. Hammoud GM. Endoscopic assessment and management of early esophageal adenocarcinoma. *World J Gastrointest Oncol.* 2014. [DOI: 10.4251/wjgo.v6.i8.275].
 8. Guler AT, Waaijer CJF, Palmblad M. Scientific workflows for bibliometrics. *Scientometrics.* 2016. [DOI: 10.1007/s11192-016-1885-6].
 9. Seriwala HM, Khan MS, Shuaib W, Shah SR. Bibliometric analysis of the top 50 cited respiratory articles. *Expert Rev Respir Med* 2015. [DOI: 10.1586/17476348.2015.1103649].
 10. Alfaifi A, AlMutairi O, Allhaidan M, Alsaleh S, Ajlan A. The Top 50 Most-Cited Articles on Acoustic Neuroma. *World Neurosurg.* 2018. [DOI: 10.1016/j.wneu.2017.12.090].
 11. Malik AT, Noordin S. The top 50 most-cited articles on total ankle arthroplasty: A bibliometric analysis. *Orthop Rev (Pavia)* 2018. [DOI: 10.4081/or.2018.7498].
 12. Garfield E, Paris SW, Stock WG. HistCite™: A software tool for informetric analysis of citation linkage. *Information-Wiss Und Prax* 2006.
 13. Dervis H. Bibliometric analysis using bibliometrix an R package. *J Scientometr Res.*2019. [DOI: 10.5530/JSCIRES.8.3.32].
 14. Van Eck NJ, Waltman L. Manual for VOSviewer version 1.6.10. CWTS Meaningful Metrics 2019.
 15. Van Hagen P, Hulshof MCCM, Van Lanschot JJB, Steyerberg EW, Van Berge Henegouwen MI, Wijnhoven BPL, et al. Preoperative chemoradiotherapy for esophageal or junctional cancer. *N Engl J Med.*2012. [DOI: 10.1056/NEJMoa1112088].
 16. Tao T, Zhao X, Lou J, Bo L, Wang F, Li J, Deng X. The top cited clinical research articles on sepsis: A bibliometric analysis. *Crit Care.* 2012. [DOI: 10.1186/cc11401].
 17. Shuaib W, Khan MS, Shahid H, Valdes EA, Alweis R. Bibliometric Analysis of the Top 100 Cited Cardiovascular Articles. *Am J Cardiol.* 2015. [DOI: 10.1016/j.amjcard.2015.01.029].
 18. Lefavre KA, Shadgan B, O'Brien PJ. 100 Most cited articles in orthopaedic surgery. *Clin Orthop Relat Res.* 2011. [DOI: 10.1007/s11999-010-1604-1].
 19. Yang CS. Research on esophageal cancer in china: A review. *Cancer Res.* 1980;40(8 Pt 1):2633-2644.
 20. Chu FS, Li GY. Simultaneous occurrence of fumonisin B1 and other mycotoxins in moldy corn collected from the People's Republic of China in regions with high incidences of esophageal cancer. *Appl Environ Microbiol* 1994. [DOI: 10.1128/aem.60.3.847-852.1994].
 21. Tran GD, Sun X Di, Abnet CC, Fan JH, Dawsey SM, Dong ZW, et al. Prospective study of risk factors for esophageal and gastric cancers in the Linxian General Population Trial cohort in China. *Int J Cancer* 2005. [DOI: 10.1002/ijc.20616]; [PMID: 6992989]
 22. Blot WJ, Li JY, Taylor PR, Guo W, Dawsey S, Wang GQ, Yang CS, Gail SFM, Li GY. Nutrition intervention trials in linxian, China: Supplementation with specific vitamin/mineral combinations, cancer incidence, and disease-specific mortality in the general population. *J Natl Cancer Inst.*1993. [DOI: 10.1093/jnci/85.18.1483].