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Cancer patients in the emergency department or intensive care unit: a 20-year bibliometric analysis of research progress and prospects

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Abstract

Background An increasing number of cancer patients may require emergency and intensive care at diagnosis and throughout their disease course. This study aimed to explore the progress, prospects, collaboration and network of research in the field of emergency and intensive care for cancer patients using bibliometric analysis.

Methods A search of the Web of Science (WOS) database was conducted to identify relevant articles in English published between 2000 and 2022. Bibliometric analysis platform and R-studio software were used for data analysis, which included cluster analysis, word cloud matrix, trend topics, and thematic maps based on author keywords and keywords plus.

Results A total of 630 articles were included, with an average annual growth rate of 17.1%. The most active country in terms of productivity and collaboration was the United States. Trend topics evolved over time, with COVID-19 and epidemiology among the most recent hot topics. General topics such as palliative care, intensive care, emergency department, chemotherapy, management, and outcomes were identified, as well as specialized topics relating to the most common cancer types, and cancer- or treatment-related complications such as brain metastasis, hyperviscosity syndrome, spinal cord compression, pericardial tamponade, hemorrhage, respiratory failure, septic shock, venous thromboembolism, and malnutrition.

Conclusion There has been a increasing and evolving interest in emergency and intensive care for cancer patients over time.

Keywords Bibliometric analysis, Cancer, Emergency, Intensive care unit, Emergency oncology

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Introduction

Cancer is the leading cause of death and a significant burden of disease globally [1]. Estimates from the GLOBOCAN 2020 showed that 19.3 million new cancer cases occurred in 2020, and the global cancer burden is expected to rise by 47% from 2020 to 2040 due to population growth and aging [2, 3]. The need for emergency or intensive care for cancer patients, particularly those with advanced cancer, have grown substantially, backed by improved cancer treatment and survival rates [4–6]. In the United States, cancer-related complaints accounted for around 4% of all adult emergency department (ED) visits, which is comparable to the proportion of ED visits attributed to common chronic conditions such as diabetes, congestive heart failure and cerebrovascular diseases [7, 8]. Additionally, patients with cancer have a higher likelihood of being admitted in the intensive care unit (ICU) than the general population [8].

Cancer patients presenting to the ED or ICU often constitute a heterogeneous population, who may visit the hospital throughout the course of their disease due to malignancy, treatment-related complications, or exacerbation of underlying comorbidities [5, 6, 9]. Since 2014, the National Cancer Institute (NCI) and the Office of Emergency Care (OECR) have been collaborating to support research and set the research agenda on cancer-related emergency care [10]. Moreover, in 2017, experts strove to set out the intensive care medicine research agenda for critically ill cancer patients [11]. Subsequently, research studies within these topics have been accelerated, covering such topics as epidemiology, risk stratification, intervention strategies and outcomes [11–13]. Despite this progress, knowledge gaps persist due to the rapid advances in the fields of oncology, emergency care and critical care medicine. It is vital to comprehend the current literature and identify recent trends in scientific publications.

Using bibliometric analysis, this study quantitatively evaluated heterogeneous literatures related to emergency and intensive care for cancer. This method enabled us to identify multiple perspectives, such as different regions, institutions, journals, authors, and co-cited networks, and to illustrate the contributions in this field, as well as research trends and hot spots [14]. Furthermore, it helped us to review the historical record of research output in this particular field and identify potential future research paths, as well as collaborative relationships [14]. To the best of our knowledge, no bibliometric research papers have ever been published concerning emergency and intensive care for cancer. Thus, the current study aimed to evaluate this topic with a focus on research progress and prospects.

Materials and methods

Data source and search strategies

Publications were screened through the Web of Science (WOS, <https://wos.webofknowledge.com>) Core Collection database on January 30, 2023. The search strategy employed was as follows: TI=(“cancer” or “tum*r” or “carcinoma” or “neoplasm”) AND TI=(“emergency department” or “emergency room” or “emergency visit” or “critical care” or “urgent care” or “intensive care” or “acute care”) NOT TI=(“non-cancer”), OR TI=(“oncologic emergenc*”), further refined by a time span from January 1st, 2000 to December 31st, 2022, document type (article) and language (English). After the initial data search, two researchers individually screened all manuscripts to ensure their relevance to the subject of this study. The flowchart of bibliometric review is displayed in Supplementary Fig. 1.

Data collection and extraction

Bibliographic attributes of selected publications, including year of publication, journal, title, author names, affiliation, country, keywords, abstract and citation count were downloaded in BibTex format and analyzed using Bibliometrix package in R on R-Studio (version 4.0.4) [15]. Additionally, TXT format bibliographic metadata were downloaded and analyzed using the online Bibliometrics platform (<http://bibliometric.com/>).

Bibliometric measurement

Bibliometric characteristics such as co-authorship, co-occurrence, co-citation, and themes were analyzed, in addition to basic descriptive data such as authors, countries, journals, keywords, number of citations, and WOS field category. The annual growth rate was used to describe the ratio of scientific production progression over time.

During the process of bibliometric analysis of research hotspots and trends, we first performed cluster analyses of Author Keywords and Keywords Plus based on the recurrence of the words used and their co-occurrence. We then created a word cloud matrix to present the bibliometric characteristics of the data, and identified the trend topics. The size of each word in the matrix signifies the frequency of its occurrence in the academic paper. Subsequently, a thematic map was constructed that showed clusters and the Keywords/Keywords Plus identified by the co-occurrence network [15]. The X-axis represents the centrality, which measures the degree of interaction between clusters in comparison to other clusters, and provides insight into the importance of each theme. The Y-axis displays the density, which measures the internal strength of a cluster network, and provides information regarding the development of each theme.

The thematic map was divided into four quadrants: Motor, Niche, Emerging/Declining, and Basic themes. The basic themes refer to essential topics that are transversal to different research areas of the field while the Niche themes are highly specialized and isolated themes that are only connected internally with weak associations among them. The Emerging/Declining themes cover peripheral and undeveloped topics that have low density and minimal centrality. The Motor themes stand for the most intensely studied subjects, which are linked to other topics [14]. Each bubble on the thematic map symbolizes a network cluster. The bubble's name was based on the Keywords/Keywords Plus with highest occurrence value, while its size was proportional to the cluster word occurrence. Its position was established depending on the cluster centrality and density. Entries shown in each cluster were set to a minimum frequency of 5 for the Keywords and 10 for Keywords Plus while the number of representative labels for each topic was set at 4. While the word cloud map portrays the frequency of Keywords/Keyword Plus demonstrating a general overview of the research themes, the thematic map is a representation of the themes' geographic distribution. Unlike the thematic map, the word cloud map does not provide any information regarding the relationship between spatial distribution and the data.

Sankey diagrams were used to demonstrate the interactions among the most relevant affiliations, countries, and author keywords. Thicker rectangles indicated a greater frequency, while the connecting nodes, inflows, and outflows depicted the interconnections.

Definitions

Author Keywords are the keywords provided by the original authors in articles. Keywords Plus are semi-automatically assigned by the WOS editorial team and defined as words or phrases that appear frequently in the titles of the cited references, but not necessarily in the title of the article [16]. Local citation (LC) is a metric used in bibliometric analysis to measure the number of citations of a particular article by other authors or publications within the same geographical area. Global citation (GC), on the other hand, measures the total number of citations of an article across all fields and institutions. LC is used to assess the influence and reach of different authors or publications within a specific field or region. For measuring the impact of the work within a specific field or region, the normalized LC metric is used, which measures the proportion of citations within a specific field or region relative to the total number of citations. LC per year measures the average number of LC over a given period of time. Likewise, normalized GC which measures the proportion of citations of an article that come

from outside of a specific field or region, and GC per year which measures the average number of GC over a given period of time, are used to assess the overall impact of the article.

Results

Publication output, growth trend and WOS categories

A total of 630 articles were included in the analyses. The number of annual publications increased from 8 in 2000 to 79 in 2022, with an average annual growth rate of 17.1% and a rapid increase in the last decade. The average citations per article were 17.85. The United States of America (USA) published the most articles, followed by China and Canada (Fig. 1A). The number of journals increased from 7 in 2000 to 66 in 2022, representing an average annual growth rate of 16.8% over the last two decades (Fig. 1B).

The most frequent relevant WOS field categories were oncology (37.6%), health care sciences services (19.8%), medicine general internal (10.5%), emergency medicine (9.7%) and critical care medicine (7.9%). Some publications are involved in multiple categories (Fig. 1C).

Keywords and trend topics

A total of 1,215 authors' Keywords and 1,363 Keywords Plus reflecting the general scopes of research were identified.

Co-occurrence network analysis identified four thematic clusters, with "cancer" (frequency of co-occurrence: 145), "palliative care" (71), and "intensive care unit" (55) as the main centers. The red cluster deals with closely related topics such as cancer, emergency department, oncology, chemotherapy, neutropenia, and pain. In the green cluster, topics such as mortality, prognosis, outcome, sepsis, survival, mechanical ventilation, and lung cancer are highly connected with the term "intensive care unit". The blue cluster, focusing on palliative care, is frequently associated with conceptions of emergency service, hospice, end-of-life care, supportive care, and hospitalization. Scattered themes such as emergency, COVID-19, and surgery are categorized into the purple cluster. Likewise, three clusters with "outcomes" (frequency of co-occurrence: 93), "mortality" (80), "survival" (72), and "management" (72) centrally to the co-occurrence network were identified (Fig. 2A, B). The word cloud further visually presents the most prevalent Keywords and Keywords Plus in the field (Fig. 2C, D).

The trend topics analysis showed that topics predominantly increased in the last decade. Cancer, or treatment-related complications or symptoms such as septic shock, tumor lysis syndrome, neutropenia, respiratory failure, pain, lung cancer, breast cancer, and colorectal cancer, have drawn more attention in the field. Likewise, the

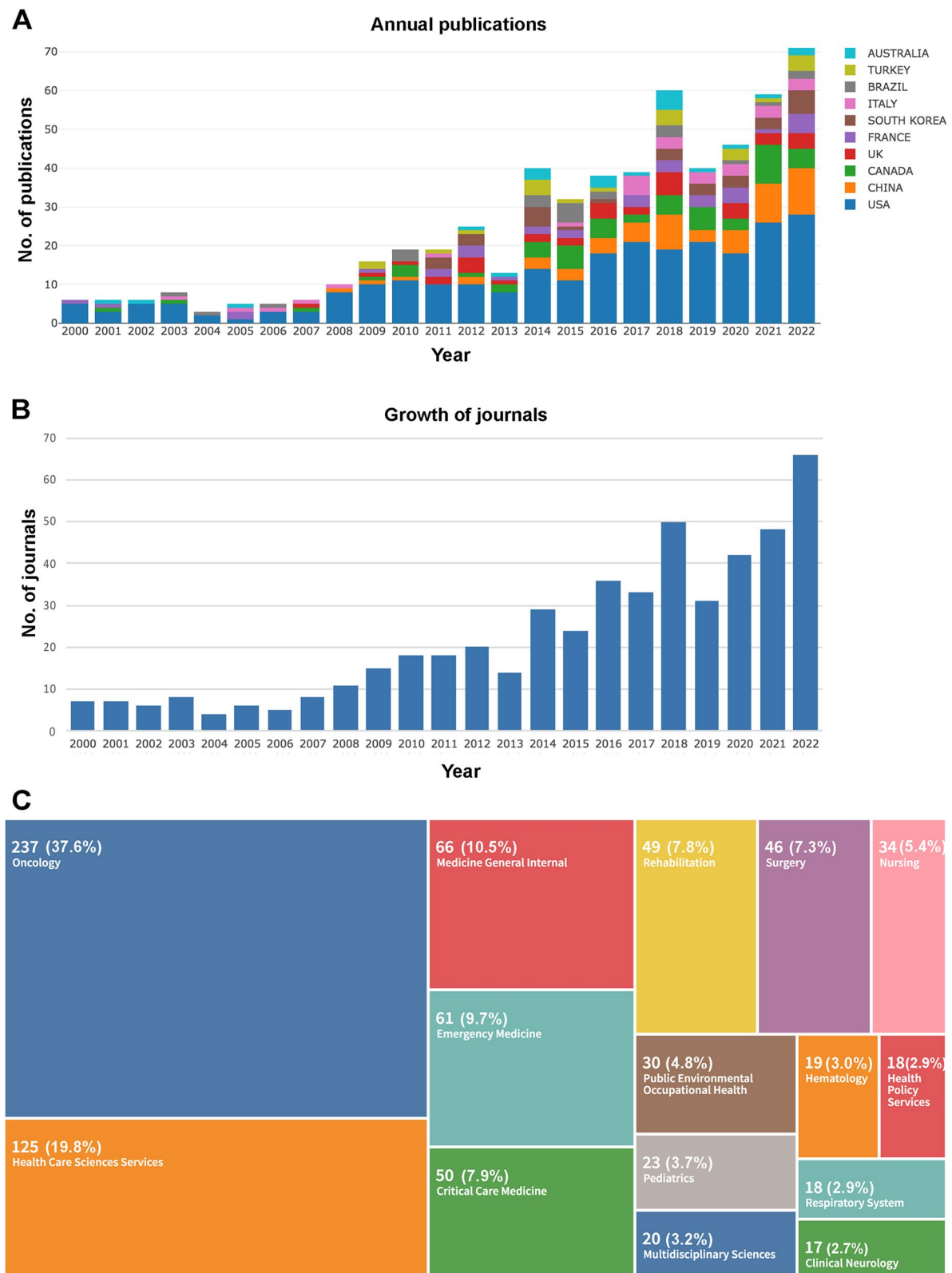


Fig. 1 **A** Annual publications and contributed countries from 2000 to 2022. **B** Annual growth of journals from 2000 to 2022. **C** The tree plot of the leading 15 WOS field categories

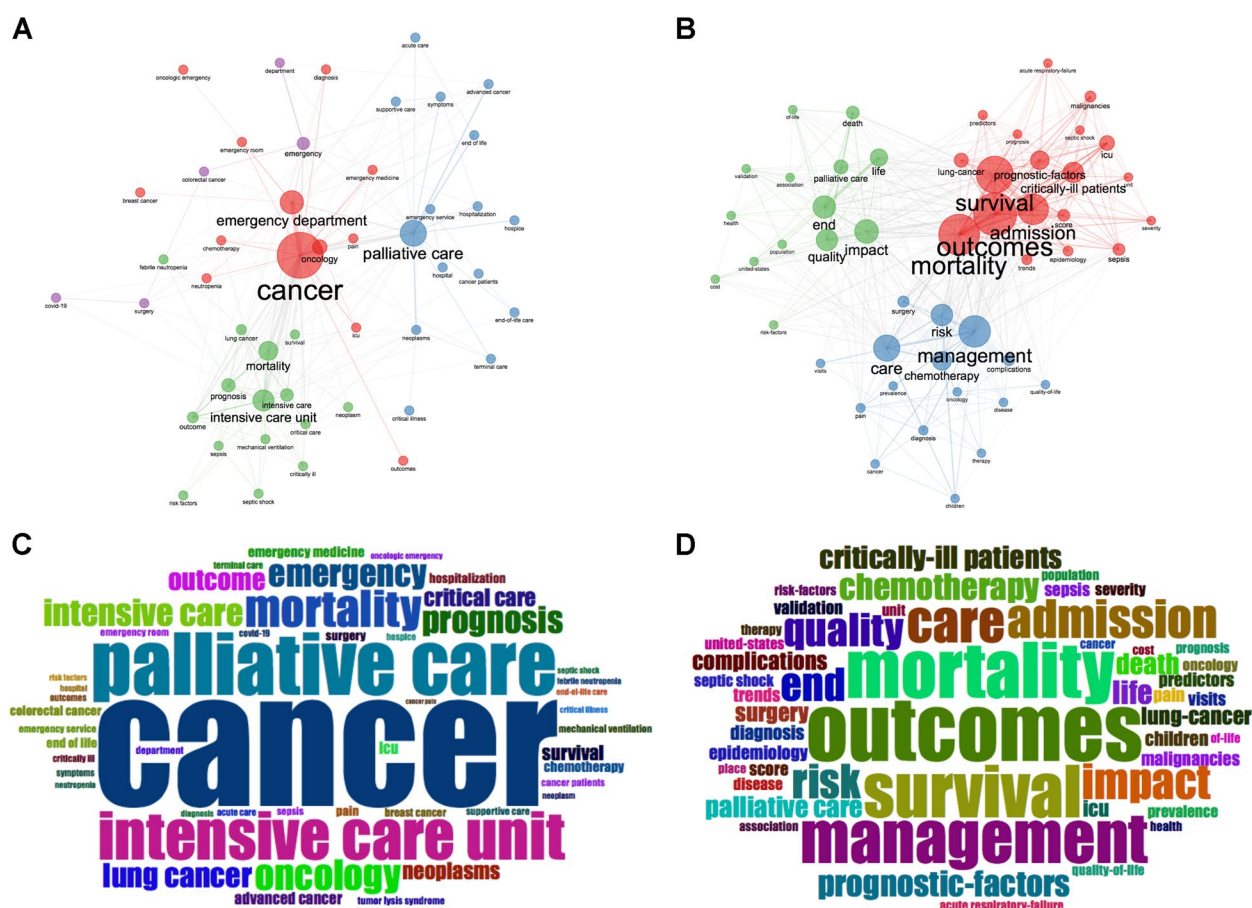


Fig. 2 Bibliometric analysis of keywords and keywords plus. **A** Co-occurrence network of keywords in clusters. **B** Co-occurrence network of keywords plus in clusters. **C** Word cloud of top 50 keywords. **D** Word cloud of top 50 keywords plus. The size of nodes in the co-occurrence network represents the frequency of the keywords or keywords plus, with larger nodes indicating higher frequency. Connections between nodes are represented by links (lines). The font size in the word cloud represents the frequency of co-occurrence

most frequent Keywords Plus terms, such as outcomes, mortality, and management, have been the research hot-spot during the last 10 years. The topic of the pandemic COVID-19 was also among the latest (Fig. 3).

The thematic map showed that the theme clusters are mainly distributed in the basic themes and niche themes quadrant. Basic themes mainly included chemotherapy, palliative care, intensive care, emergency department, management and outcomes while specialized themes mainly covered acute or critical conditions of brain metastasis, hyperviscosity syndrome, spinal cord compression, pericardial tamponade, hemorrhage, respiratory failure, septic shock, venous thromboembolism and malnutrition (Fig. 4A, B).

Citations and collaboration

The top 50 most local cited articles, mostly clinical descriptive studies, are listed in Table 1. The median GC and LC count of these articles were 10 (interquartile

range: 7–14) and 46 (interquartile range: 33–71) times, respectively. These top 50 local cited articles were published in journals such as *Supportive Care in Cancer*, *Critical Care Medicine*, *Journal of Clinical Oncology* and *JAMA Oncology* (Supplementary Fig. 2). The journal with the highest number of publications was *Supportive Care in Cancer* (Supplementary Table 1).

The country collaboration map demonstrated that USA has the highest number of collaborations with Canada, and European and Asian researchers (Fig. 5A).

The Sankey diagram displaying the interconnections among the most relevant affiliations, countries and keywords revealed that USA was the most influential and most collaborative country, with productive affiliations such as University of Texas MD Anderson Cancer Center, Memorial Sloan Kettering Cancer Center, Ohio State University, University of Washington, University of Rochester, and University of Pittsburgh. The research keywords cover a wide range of topics, including cancer,

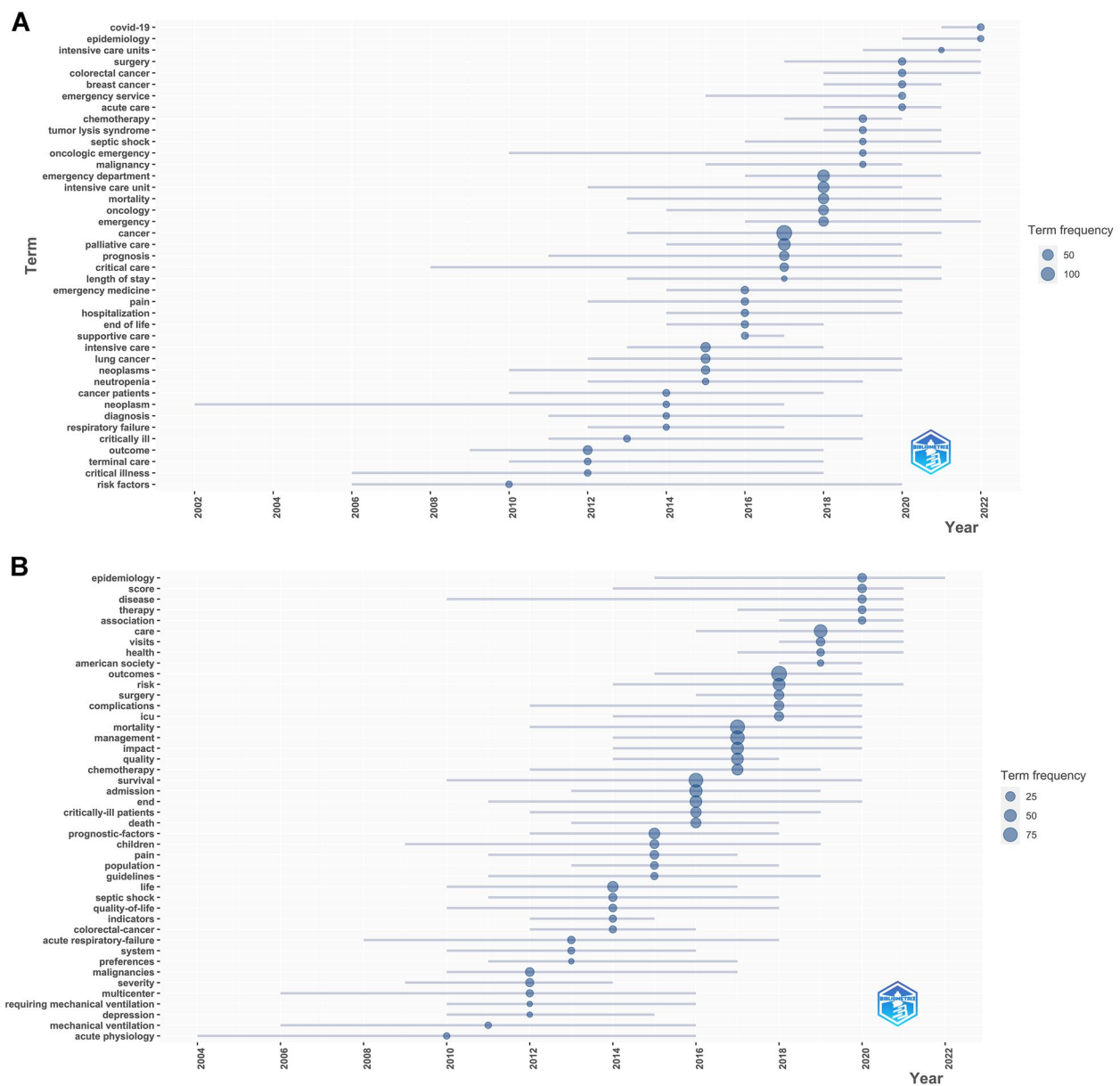


Fig. 3 The trend topics determined by **A** the Author Keywords, and **B** the Keyword Plus

palliative care, oncology, emergency, mortality, intensive care and prognosis (Fig. 5B).

Discussion

Emergency cancer care is a specialized subdiscipline that involves a multidisciplinary team of professionals, including emergency physicians, intensivists, oncologists, nurses, and other healthcare professionals [12]. Given the increasing life expectancy and rapid advances in cancer treatment, more cancer patients may require acute or intensive care during their treatment. Our

bibliometric analysis of scientific outputs in this field from 2000–2022 revealed a conspicuous increase across various categories of the WOS, highlighting its multifaceted and interdisciplinary nature. Evidently, more journals are accepting articles in this rapidly growing subdiscipline. When comparing the growth of publications in the WOS database's within Emergency Medicine category over the past decade, from 2584 in 2010 to 3529 in 2019 corresponding to an average annual growth rate of 3.86%, it is clear that the annual growth rate of publications in the emergency cancer

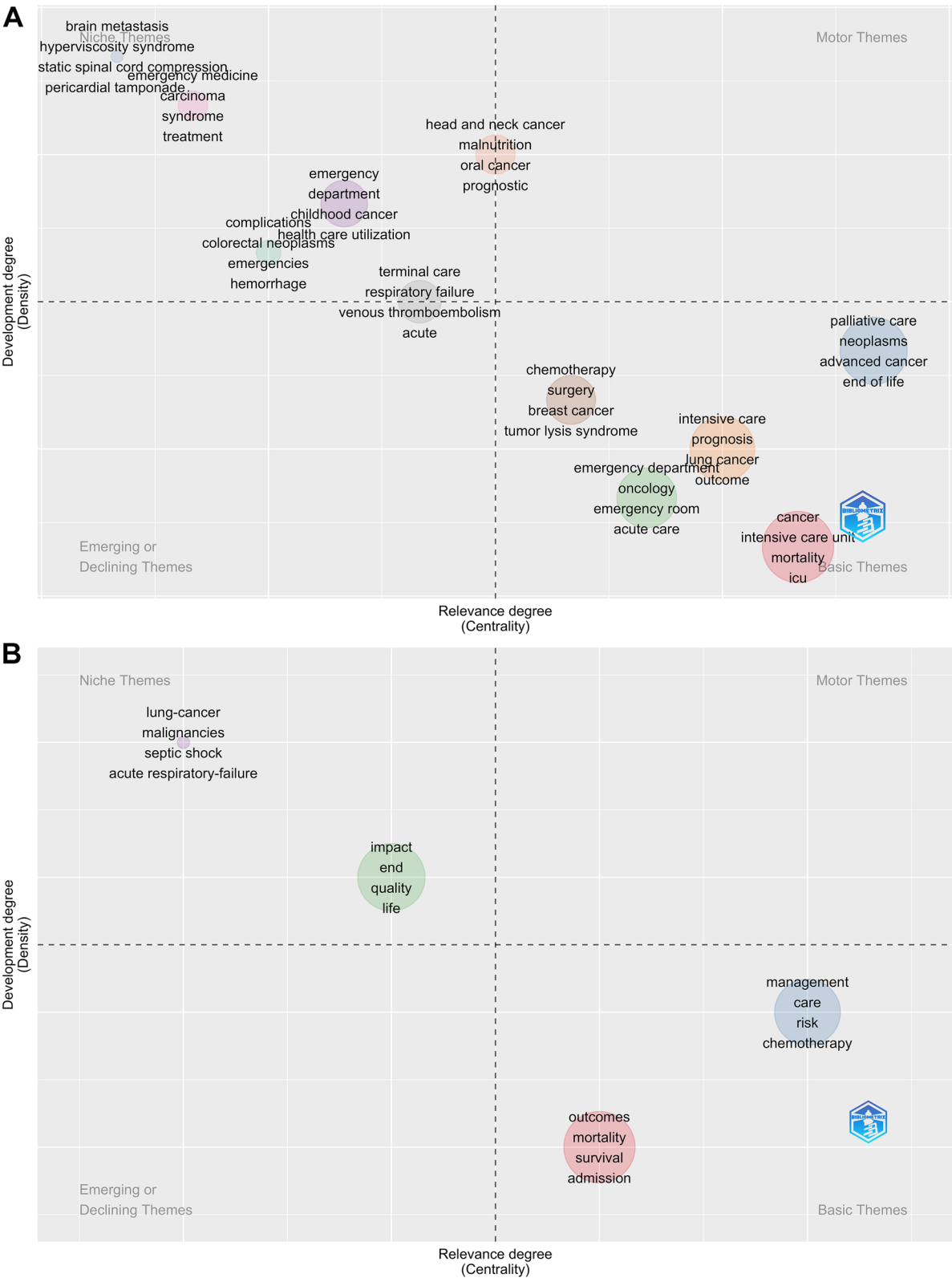


Fig. 4 The thematic map

Table 1 Top 50 local cited articles published between 2000 and 2022

Rank	Author	Journal	Title	Year	LC	GC	Normalized LC	Normalized GC	LC per year	GC per year
1	Deborah K Mayer, et al	J Clin Oncol	Why do patients with cancer visit emergency departments? Results of a 2008 population study in North Carolina	2011	62	222	12.51	6.42	5.64	20.18
2	Lisa Barbera, et al	CMAJ	Why do patients with cancer visit the emergency department near the end of life?	2010	51	245	9.94	5.58	4.25	20.42
3	Donna R Rivera, et al	JAMA Oncol	Trends in adult cancer-related emergency department utilization: an analysis of data from the nationwide emergency department sample	2017	45	104	29.08	7.88	9.00	20.80
4	Márcio Soares, et al	Crit Care Med	Characteristics and outcomes of patients with cancer requiring admission to intensive care units: a prospective multicenter study	2010	41	234	7.99	5.33	3.42	19.50
5	T Staudinger, et al	Crit Care Med	Outcome and prognostic factors in critically ill cancer patients admitted to the intensive care unit	2000	36	232	4.57	3.73	1.64	10.55
6	Guillaume Thiéry, et al	J Clin Oncol	Outcome of cancer patients considered for intensive care unit admission: a hospital-wide prospective study	2005	34	221	3.78	3.23	2.00	13.00
7	Jeffrey M Caterino, et al	JAMA Netw Open	Analysis of diagnoses, symptoms, educations, and admissions among patients with cancer presenting to emergency departments	2019	21	49	15.75	6.31	7.00	16.33
8	Christopher G Slatore, et al	J Clin Oncol	Intensive care unit outcomes among patients with lung cancer in the surveillance, epidemiology, and end results-medicare registry	2012	19	60	5.05	1.53	1.90	6.00
9	Shin Ahn, et al	Support Care Cancer	Emergency department cancer unit and management of oncologic emergencies: experience in Asian Medical Center	2012	17	48	4.52	1.22	1.70	4.80
10	Márcio Soares, et al	Crit Care	Performance of six severity-of-illness scores in cancer patients requiring admission to the intensive care unit: a prospective observational study	2004	15	76	2.78	1.96	0.83	4.22
11	Anne-Claire Toffart, et al	Chest	Use of intensive care in patients with nonresectable lung cancer	2011	15	59	3.03	1.71	1.36	5.36
12	J P Sculier, et al	Crit Care Med	Scoring systems in cancer patients admitted for an acute complication in a medical intensive care unit	2000	14	91	1.78	1.46	0.64	4.14
13	Michael Darmon, et al	Crit Care Med	Intensive care in patients with newly diagnosed malignancies and a need for cancer chemotherapy	2005	14	126	1.56	1.84	0.82	7.41
14	Claire Andréjak, et al	BMC Cancer	Admission of advanced lung cancer patients to intensive care unit: a retrospective study of 76 patients	2011	14	40	2.82	1.16	1.27	3.64
15	Lisa Barbera, et al	Ann Emerg Med	Do patient-reported symptoms predict emergency department visits in cancer patients? A population-based analysis	2013	14	68	5.95	2.69	1.56	7.56
16	M Soares, et al	Ann Oncol	Intensive care in patients with lung cancer: a multinational study	2014	14	59	8.03	2.67	1.75	7.38
17	Joann Hsu, et al	Am J Emerg Med	National characteristics of Emergency Department visits by patients with cancer in the United States	2018	14	33	13.11	3.17	3.50	8.25

Table 1 (continued)

Rank	Author	Journal	Title	Year	LC	GC	Normalized LC	Normalized GC	LC per year	GC per year
18	Jane M Geraci, et al	Support Care Cancer	Progressive disease in patients with cancer presenting to an emergency room with acute symptoms predicts short-term mortality	2006	13	40	3.61	1.15	0.81	2.50
19	Emily L Mueller, et al	Pediatr Blood Cancer	Why pediatric patients with cancer visit the emergency department: United States, 2006–2010	2015	13	48	9.75	2.11	1.86	6.86
20	N Yucel, et al	J BUON	Characteristics of the admissions of cancer patients to emergency department	2012	12	24	3.19	0.61	1.20	2.40
21	Nuri Bozdemir, et al	Turk J Med Sci	Demographics, Clinical Presentations and Outcomes of Cancer Patients Admitting to Emergency Department	2009	11	28	9.00	0.48	0.85	2.15
22	Katherine Enright, et al	J Oncol Pract	Population-based assessment of emergency room visits and hospitalizations among women receiving adjuvant chemotherapy for early breast cancer	2015	11	43	8.25	1.89	1.57	6.14
23	Corita R Grudzen, et al	JAMA Oncol	Emergency Department-Initiated Palliative Care in Advanced Cancer: A Randomized Clinical Trial	2016	11	141	6.35	7.24	1.83	23.50
24	G Maschmeyer, et al	Eur J Cancer	Outcome analysis of 189 consecutive cancer patients referred to the intensive care unit as emergencies during a 2-year period	2003	10	60	3.45	1.75	0.53	3.16
25	Monique M E M Bos, et al	Acta Oncol	Outcomes of cancer patients after unplanned admission to general intensive care units	2012	10	58	2.66	1.48	1.00	5.80
26	Yu Jung Kim, et al	Med Oncol	Who should be admitted to the intensive care unit? The outcome of intensive care unit admission in stage IIIB–IV lung cancer patients	2014	10	31	5.74	1.40	1.25	3.88
27	Laura Panattoni, et al	J Oncol Pract	Characterizing Potentially Preventable Cancer- and Chronic Disease-Related Emergency Department Use in the Year After Treatment Initiation: A Regional Study	2018	10	36	9.37	3.46	2.50	9.00
28	Marcelo R Bonomi, et al	Lung Cancer	Outcomes of elderly patients with stage IIIB–IV non-small cell lung cancer admitted to the intensive care unit	2012	9	35	2.39	0.89	0.90	3.50
29	Marcio Soares, et al	J Clin Oncol	Effects of Organizational Characteristics on Outcomes and Resource Use in Patients With Cancer Admitted to Intensive Care Units	2016	9	56	5.20	2.87	1.50	9.33
30	J E Nelson, et al	Crit Care Med	Self-reported symptom experience of critically ill cancer patients receiving intensive care	2001	8	282	4.67	5.32	0.38	13.43
31	George A Jelinek, et al	Emerg Med Australas	Caught in the middle: tensions around the emergency department care of people with advanced cancer	2013	8	27	3.40	1.07	0.89	3.00
32	Gulbin Aygencel, et al	J Crit Care	Prognostic factors in critically ill cancer patients admitted to the intensive care unit	2014	8	45	4.59	2.04	1.00	5.63
33	Susannah K Wallace, et al	Support Care Cancer	Outcome and cost implications of cardiopulmonary resuscitation in the medical intensive care unit of a comprehensive cancer center	2002	7	44	3.00	1.14	0.35	2.20

Table 1 (continued)

Rank	Author	Journal	Title	Year	LC	GC	Normalized LC	Normalized GC	LC per year	GC per year
34	Frederick Burge, et al	Med Care	Family physician continuity of care and emergency department use in end-of-life cancer care	2003	7	116	2.41	3.39	0.37	6.11
35	T Berghmans, et al	Support Care Cancer	Is a specific oncological scoring system better at predicting the prognosis of cancer patients admitted for an acute medical complication in an intensive care unit than general gravity scores?	2004	7	34	1.30	0.88	0.39	1.89
36	David Hui, et al	J Palliat Med	Discharge outcomes and survival of patients with advanced cancer admitted to an acute palliative care unit at a comprehensive cancer center	2010	7	69	1.36	1.57	0.58	5.75
37	Jae-Uk Song, et al	Support Care Cancer	Risk factors to predict outcome in critically ill cancer patients receiving chemotherapy in the intensive care unit	2011	7	31	1.41	0.90	0.64	2.82
38	J Gorham, et al	Lung Cancer	The lung cancer patient at the emergency department: a three-year retrospective study	2013	7	18	2.98	0.71	0.78	2.00
39	Eirini Kostakou, et al	J Crit Care	Critically ill cancer patient in intensive care unit: issues that arise	2014	7	40	4.01	1.81	0.88	5.00
40	Mark G Shrimel, et al	JAMA Oncol	Time-Limited Trials of Intensive Care for Critically Ill Patients With Cancer: How Long Is Long Enough?	2016	7	46	4.04	2.36	1.17	7.67
41	E Bruera, et al	J Palliat Care	Frequency of symptom distress and poor prognostic indicators in palliative cancer patients admitted to a tertiary palliative care unit, hospices, and acute care hospitals	2000	6	66	0.76	1.06	0.27	3.00
42	A P Polednak, et al	Cancer Detect Prev	Inpatient hospital admission through an emergency department in relation to stage at diagnosis of colorectal cancer	2000	6	15	0.76	0.24	0.27	0.68
43	Sascha Meyer, et al	Eur J Pediatr	Assessing the risk of mortality in paediatric cancer patients admitted to the paediatric intensive care unit: a novel risk score?	2005	6	35	0.67	0.51	0.35	2.06
44	C Christodoulou, et al	Anticancer Res	Performance status (PS): a simple predictor of short-term outcome of cancer patients with solid tumors admitted to the intensive care unit (ICU)	2007	6	36	2.82	1.64	0.40	2.40
45	P Caruso, et al	Eur J Cancer Care	Short- and long-term survival of patients with metastatic solid cancer admitted to the intensive care unit: prognostic factors	2010	6	31	1.17	0.71	0.50	2.58
46	Colin R Cooke, et al	Chest	Aggressiveness of intensive care use among patients with lung cancer in the Surveillance, Epidemiology, and End Results-Medicare registry	2014	6	23	3.44	1.04	0.75	2.88
47	Lesley A Henson, et al	BMJ Open	"I'll be in a safe place": a qualitative study of the decisions taken by people with advanced cancer to seek emergency department care	2016	6	31	3.46	1.59	1.00	5.17

Table 1 (continued)

Rank	Author	Journal	Title	Year	LC	GC	Normalized LC	Normalized GC	LC per year	GC per year
48	Zhi Yang, et al	PLoS One	Oncologic emergencies in a cancer center emergency department and in general emergency departments countywide and nationwide	2018	6	18	5.62	1.73	1.50	4.50
49	Jeffrey S Groeger, et al	Support Care Cancer	Probability of mortality of critically ill cancer patients at 72 h of intensive care unit (ICU) management	2003	5	32	1.72	0.94	0.26	1.68
50	Sebastiano Mercadante, et al	Support Care Cancer	A model of acute symptom control unit: Pain Relief and Palliative Care Unit of La Maddalena Cancer Center	2003	5	34	1.72	0.99	0.26	1.79

LC Local citations, GC Global citations

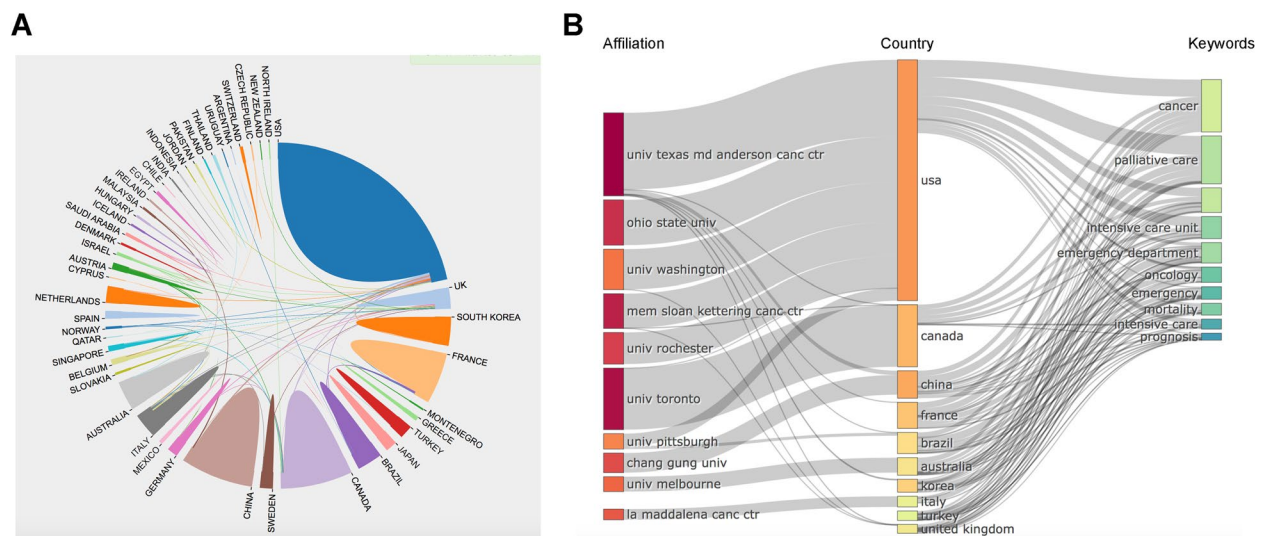


Fig. 5 **A** The country collaboration map. **B** Sankey diagram (3-fields plot) displaying the interactions among the most relevant affiliations (left), countries (middle) and author keywords (right). Thicker rectangles indicate greater frequency. The connecting nodes, inflows, and outflows depicts the interconnection

care subspecialty has outpaced that of the broader field [14].

Emergency or critical cancer care may involve a wide range of situations that patients may experience, ranging from diagnosis and treatment to follow-up management. Our cluster analysis revealed several mainstream topics that have consistently been of interest. Pain is a frequent complaint among terminal cancer patients visiting ED and is associated with topics of palliative care [8, 16–21]. It has been acknowledged that emergency and ICU physicians play a key role in end-of-life (EOL) care [11, 22, 23], though models of application are still a subject of debate [24–26]. Neutropenia and chemotherapy-related complications are clusters closely associated with ED. Neutropenia was once thought to be a very high mortality condition, but advances in the diagnosis and management of infection and the use of granulocyte colony-stimulating factor (G-CSF) have greatly improved survival rates [27]. Additionally, the top-cited publications related to cancer patients receiving emergency care usually focus on observational studies, which examined epidemiological, demographic and clinical features associated with diagnosis, symptoms and admissions [8, 17–21, 28–32]. Large-scale retrospective studies, which have received high levels of citations, have evaluated the primary reasons for ED visits, finding that pain, respiratory and gastrointestinal issues are the most common chief complaints [8, 16–21].

EDs often serve as an important entry point into inpatient care setting. Recent research has suggested that malignancies should not be an impediment to ICU

admission, especially for those with acute respiratory failure, sepsis, and septic shock, which have been identified in the cluster analysis as the most frequent life-threatening complications [5, 11, 33]. Symptom-oriented research is a predominant domain in the ED setting, while research on clinical outcomes and prognostic factors remain major themes in ICUs. There has been a steep acceleration of research progress in critically ill oncology and hematology since the 2017 publication of the research agenda, however there has yet to be any consensus reached on the predictors of mortality [11, 34–36]. Current evidence suggests that, in terms of short-term mortality after an ICU stay, it is not the underlying malignancy but rather performance status, severity of organ failure and need for mechanical ventilation that are associated with it [11, 37]. After recovery from complications, however, characteristics related to the neoplastic disease may regain their independent influence on further survival [5, 35]. Given the increasing use of novel therapies such as targeted therapy and immunotherapy in cancer patients, a re-evaluation of classic prognostic predictors may be prudent.

Patients seeking emergency or critical care for cancer represent a diverse population with conditions caused by the malignancy itself, complications from anti-cancer treatment, or underlying comorbidities [5, 19, 30, 32, 33]. In this study, while longstanding topics such as palliative care, chemotherapy, tumor lysis syndrome, and surgery remain the focus, there is an increasing emphasis on brain metastases, hyperviscosity syndrome, static spinal cord compression, pericardial tamponade, health care

utilization, complications, hemorrhage, venous thromboembolism, malnutrition, septic shock, and respiratory failure. The most commonly discussed types of cancer are lung, colorectal and breast cancer, likely because of their prevalence, and the growing demand for screening at initial diagnosis [38]. According to the analysis of 2020 National Health Interview Survey (NHIS) data, there is a need for more than 14 million, 6 million, and 2 million ED patients to receive breast, colorectal, or lung cancer screenings, respectively [39]. However, cancer screening in the ED as a pathway in cancer care is still not accepted as a consensus, and further research is encouraged [38–42]. The outbreak of COVID-19 has also become a prominent topic due to its effect on cancer services and the vulnerability of cancer patients [43, 44]. Novel telemedicine models have been widely researched as potential alternatives to in-person care, as tele-medicine allows for timely assessment and management for cancer patients faced with acute disease or treatment-related complications during the COVID-19 pandemic [45, 46].

Our bibliometric analysis revealed that the major hubs for scientific production are located in North America (USA and Canada), Europe (UK, France, Italy, and Brazil), and Asia (China and Korea), although publications are distributed all continents. The USA's prolific output of publications is matched by its extensive collaboration network, collaborating with partners from all around the world. Canada and the UK, on the other hand, tend to engage in more selective collaborative networking. Countries in continental Europe have a notable propensity for fostering scientific collaboration within the region, whereas countries such as China, Korea, and Australia mostly engage in collaborations on a national level. Despite existing racial disparities in the incidence, management, and outcome of cancer, there is a need for increased collaboration in order to improve the quality of emergency and critical cancer care [47, 48].

There are several limitations of the study that should be taken into consideration. First, the inherent nature of bibliometric approach is a major limitation of this study. Quantitative bibliometric analysis does not consider the quality of the research, the impact of the research, author or journal prestige, or the validity or reliability of research outcomes, which can lead to potential overestimation or underestimation of the results. For example, well-established evidence may not always be given the same visibility as newer evidence in the thematic map, potentially impacting its "popularity". Likewise, a topic that initially has high levels of popularity may receive more citations than other newly emerging topics, giving it an unfair advantage. Second, the sampling criteria employed for the

bibliometric analysis can also be a limitation of the study. Our retrieval of articles from the WOS database may not reflect global research activity due to not capturing work such as conference presentations, publications in non-English language, and publications that are not available in public database. Third, this study might not include all topics related to oncologic emergencies because the population we discussed here is highly heterogeneous. Cancer patients may present to the hospital for oncologic emergencies for a variety of reasons, such as malignancy, treatment-related complications, or the exacerbation of underlying comorbidities. This heterogeneity in comorbidities makes it challenging to determine which symptoms or conditions are associated with an oncologic emergency. The subjective assessments of the investigators (e.g., differentiating between related and unrelated morbidities) in deciding which to include or exclude may introduce bias in predicting oncologic emergencies.

In conclusion, there is a growing and evolving research interests in emergency and intensive care for cancer patients. Management of these patients requires a multidisciplinary integration of diagnosis and treatment, involving specialists in emergency medicine, critical care, and oncology. The data presented here provide a comprehensive profile of the field, highlighting the fact that there are still many unresolved issues that call for collaborative research.

Supplementary Information

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Additional file 1.

Additional file 2.

Additional file 3: SupplementaryTable 1.Top 20 academic journals with publications.

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Authors' contributions

Conceptualization, Jie QIAN; Data curation, Jinge SHEN and Qian XING; Formal analysis and interpretation, Jinge SHEN, Qian XING, Qi XU, and Jie QIAN; Funding acquisition, JIE QIAN; Writing – original draft, Jinge SHEN; Writing – review & editing, All authors.

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Availability of data and materials

The data used and/or analyzed during the current study available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethical review and approval were waived for this study due to not involving humans or animals.

Consent for publications

All authors agreed to this publication.

Competing interests

None declared.

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