Defining a specialty through its literature: A bibliometric analysis of acute care surgery 2005 to 2020

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ABSTRACT

Background: Acute care surgery (ACS) has grown and evolved since it was conceived in 2005. However, ACS is not recognized in the National Library of Medicine's Medical Subject Heading thesaurus. This article uses bibliometrics to help define an identity for ACS as a subspecialty of surgery and argue for its addition to the Medical Subject Heading thesaurus.
Methods: The terms "Acute Care Surgery," "Wounds and Injuries," "General Surgery," and "Critical Care" were searched with and without the Text Word [TW] modifier using PubMed. The intersections of search sets were identified with the AND conjunction to determine the proportion of ACS literature relevant to each subject term and calculate the penetration of ACS as a keyword term into each subject domain.
Results: A [Medical Subject Heading] limited search on the term "Acute Care Surgery" yielded a predictable return of 0 article. Search of the cohesive term "Acute Care Surgery" [All Fields], restricted to MEDLINE-indexed, English-language articles yielded 2,351 articles published between 2005 and 2020, inclusive. Using ACS as [Text Word] yielded 517 articles. There was a progressive increase in the rate of annual publications. The frequency of subject terms in the ACS [All Fields] set was as follows: Critical Care, 49.70%; General Surgery, 23.26%; and Wounds and Injuries, 20.88%. The frequency of subject terms in the ACS [TW] set was as follows: Critical Care, 32.88%; General Surgery, 43.52%; and Wounds and Injuries, 15.28%. Of this set, 8.32% of articles were not tagged or did not contain a reference to any of these 3 major subjects.
Conclusion: This study demonstrates that ACS as a subject matter is being increasingly expressed in the literature. Adding ACS as a dedicated term into the National Library of Medicine's Medical Subject Heading thesaurus of controlled vocabulary as a specialty of Surgery would facilitate indexing and retrieval of the literature most relevant to acute care surgeons.

INTRODUCTION

There are several ways by which a clinical specialty may be defined. These include recognition by the American Board of Medical Specialties through the availability of a certifying examination, the existence of dedicated professional societies and journals, the availability of structured education programs, or by common usage and practice. This article proposes that a specialty can also be defined by identifying a common body of literature using specialty-specific terminology. This proposal's strength would be augmented if the specialty's name were included as a Medical Subject Heading (MeSH) term in the National Library of Medicine's standard vocabulary under the Unified Medical Language System (UMLS) Metathesaurus [1]. The term "Acute Care Surgery" (ACS) had some basis in common usage but did not exist in the medical literature until 2005. As of this writing, it still does not exist in the MeSH thesaurus. The term was adopted as the preferred title for the specialty encompassing trauma, emergency surgery, and critical care by an ad hoc committee of the American Association for the Surgery of Trauma (AAST) [2]. That landmark editorial recognized a developing crisis in the field of trauma surgery. Trauma call was identified as being disruptive to the interest of maintaining an elective surgical practice, but attempts to isolate trauma as a clinical specialty were hampered by the undesirable characteristics of a focused trauma practice. These included the need for continuous coverage, limited revenue generation [3], and a lack of opportunity to practice surgical skills. The latter relates to improved imaging technology, increasing use of

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nonoperative management for solid organ injuries, and the deferral of procedural interventions to specialties such as interventional radiology, neurosurgery, and orthopedics [4]. Thus, the model for trauma care as an isolated surgical specialty was deemed nonviable except perhaps in central urban centers with a high proportion of penetrating trauma. These centers were able to preserve operative experience but did not resolve reimbursement issues or lifestyle considerations [5]. Alternative models have been proposed, such as the "European model," where trauma care is commonly provided by an orthopedist in conjunction with other specialty-based care [6], but these models were not deemed viable in the American system.

With the evolution of new practice styles following the waning of the "golden age of trauma surgery," recruitment of high-quality surgeons into the field of trauma became progressively difficult [6]. The ensuing identity crisis resulted in the emergence of the field of ACS. A fellowship-based educational structure for ACS was proposed that expanded existing critical fellowships from 12 to 24 months to include coverage of trauma and emergency general surgery plus rotations in specialty care related to trauma, such as vascular, thoracic, hepatobiliary, otolaryngology, neurosurgery, and orthopedics [4]. Since then, the term "Acute Care Surgery" has expanded in common usage and in the literature. Many clinical departments and divisions in academic, private, and hybrid centers previously titled "Trauma" have changed their names to include "Acute Care Surgery" to more accurately reflect the scope of services practiced and taught. However, the term received firm recognition in 2012, when the *The Journal of Trauma, Injury, Infection, and Critical Care* changed its name to *The Journal of Trauma and Acute Care Surgery* [7].

The science of Statistical Bibliography, now known as Bibliometrics, emerged from a 1917 analysis of the literature pertaining to comparative anatomy that demonstrated fluctuations in interest and the distribution of literature about specific animal kingdoms across countries spanning the years 1550 to 1860 [8]. Defining the scope of a particular knowledge domain is useful for identifying gaps in knowledge. This in turn allows rational allocation of resources for future study. It also allows the assessment of the efficiency and effectiveness of prior resource allocations. Bibliometrics can identify patterns of research productivity by author, institution, dissemination source (journals), geography, and subtopics. Bibliometrics is commonly used to assess the importance of an article through citation metrics as well as the dissemination impact on the scientific literature of particular journals [9]. This article has 4 specific aims. The first is to examine the volume of literature associated with the term "Acute Care Surgery" by describing the scope of the subject matter associated with the term and identifying the term's penetration into the mainstream surgical literature. The second is to promote the readership's familiarity with the challenges of storage and retrieval of the scientific knowledge base. The third is to support a campaign to influence the National Library of Medicine to insert "Acute Care Surgery" as a MeSH term as a subspecialty of Surgery into its MeSH thesaurus, thereby facilitating retrieval of literature on the topic. The fourth is to assess the impact of the early literature on the subject by evaluation of standard citation metrics [9].

METHODS

The cohesive terms "Acute Care Surgery," "Wounds and Injuries," "General Surgery," and "Critical Care" were separately searched with and without the Text Word [TW] modifier using PubMed [10]. Quotation marks were used to create cohesive terms so that only articles with the complete term would be retrieved versus articles with any of the component terms. "Wounds and Injuries" was selected as the MeSH term representing trauma surgery since Trauma and Trauma Surgery do appear as major terms in the MeSH thesaurus, although the words individually appear in several subheadings, including subjects like Psychological Trauma. The same is true of the terms Emergency Surgery and Emergency General Surgery. The [TW] modifier

includes a search of all words and numbers in the title, abstract, other abstract, MeSH terms, MeSH Subheadings, Publication Types, Substance Names, Personal Name as Subject, Corporate Author, Secondary Source, Comment/Correction Notes, and Other Terms. These are typically non-MeSH subject terms or author-supplied "keywords" [11]. Without the [TW] modifier, the PubMed default is to include all [All Fields] in an unspecified search that would include ACS occurring in the title of the journal or name of the author's department. The search sets using ACS are referred to herein as "ACS search sets." The search sets generated by using "Wounds and Injuries," "Critical Care," and "General Surgery" are referred to as "subject searches." All search sets were filtered to include only MEDLINE-indexed, English-language articles published across a 16-year span between 2005 and 2020, inclusive. The former year represents the first time ACS was used in the literature, and the latter year represents the most recently available full-year results. All searches include electronic publication (epub) dates in 2020, ahead of print publications in 2021. The general format of the search string used was as follow: ("Acute Care Surgery"[All Fields]) AND ((medline [Filter]) AND (english[Filter]) AND (2005:2020[pdat])). The key term within quotes was substituted as described, and each subject was searched with both the [All Fields] and the [Text Word] modifier.

The two ACS search sets (with and without [TW] modifier) were then combined using the "AND" conjunction with each of the other subject-matter searches, yielding the intersection of those search sets. This allowed the determination of the proportion of the ACS literature with each of those subjects as a major focus. Replacing the denominator from the number of articles in the ACS search sets to the number of articles in each subject search set allowed calculation of the penetration of ACS as a term into each of the subject domains. The penetration of terms is reported as raw numbers and percentages. Comparative statistics were not applied nor considered relevant. Additionally, the National Center for Biotechnology Information of the U.S. National Library of Medicine [13] was used to search the term "Acute Care Surgery" to see if it exists anywhere within the MeSH thesaurus.

The ACS search sets, without and with the [TW] modifier, were analyzed by year of publication to illustrate the progression of literature volume associated with ACS over time. For the most restrictive search, where ACS was retrieved as a [TW], additional analysis was performed to identify patterns of source (journal), contributing authors, and country of publication These are presented numerically and by visual representation, where appropriate. MeSH term analysis was performed by exporting the ACS search result from PubMed to EndNote and then from EndNote into a tab-delimited CSV file, subsequently imported to MS Excel™. Medical Subject Headings (MeSH) and author-supplied keywords were extracted from the article set and sorted by frequency. Biblioshiny [14] was used for graphical visualizations of article relationships. All findings are presented as descriptive statistics using frequencies of occurrence or percentages. Citescore, a tool used to measure the citation impact of journals indexed in the Scopus bibliometric database, was used to assess the impact of the top journal sources [9,13]. CiteScore is considered to have some advantages over the traditional impact factor [15]. It is calculated annually and counts citations over 4-year window and divides these by the number of publications published during that time. This project was exempt from IRB review because it uses only published information and contains no original human subject data.

RESULTS

As of this writing, there are no instances of "Acute Care Surgery" identified by searching the UMLS MeSH thesaurus, confirmed by performing a [MeSH] limited search on the term "Acute Care Surgery" which yielded a predictable return of 0 article. Using "Acute Care Surgery [All Fields]" yielded 2,352 PubMed-indexed, English-language articles published between 2005 and 2020, inclusive. When the search was restricted to the use of ACS as a [Text Word], which includes
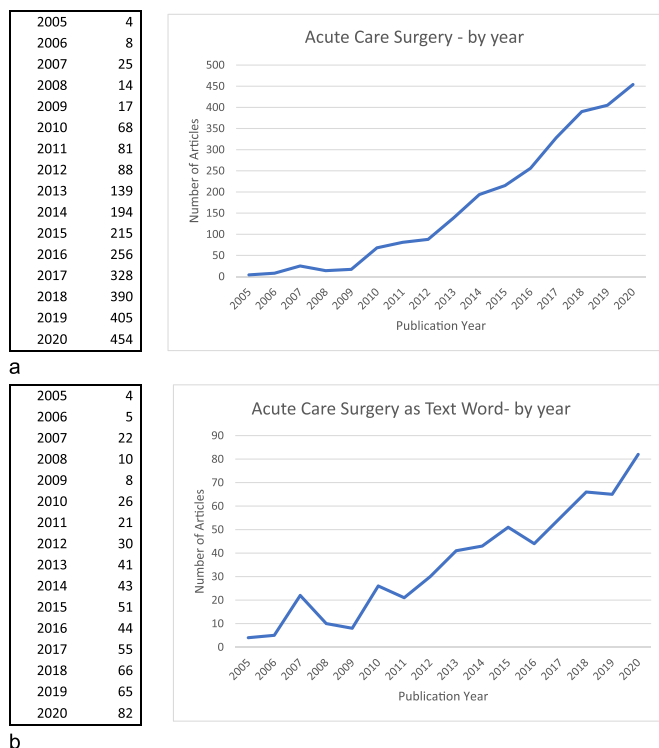
2005	4
2006	8
2007	25
2008	14
2009	17
2010	68
2011	81
2012	88
2013	139
2014	194
2015	215
2016	256
2017	328
2018	390
2019	405
2020	454

a

2005	4
2006	5
2007	22
2008	10
2009	8
2010	26
2011	21
2012	30
2013	41
2014	43
2015	51
2016	44
2017	55
2018	66
2019	65
2020	82

b

Fig 1. A, Search query: ("Acute Care Surgery"[All Fields]) AND ((Medline[Filter]) AND (English[Filter]) AND (2005:2020[pdat])) Result: 2,351 (the results do not sum due to epub–pubdate overlaps). B, Search query: "Acute Care Surgery" ("English"[Language]) AND (("acute care surgery"[tw]) AND (Medline[sb])). Result: 517 (the results do not sum due to epub–pubdate overlaps).

author-supplied keywords but excludes the term in the journal title or author's department, the results decreased to 517. Combining the 2 ACS search sets by the AND conjunction returned 517 articles, confirming that all articles within the [Text Word] search set were included within the [All Fields] search set, although not vice versa. The first occurrence of the term "Acute Care Surgery" as a [Text Word] in an English, MEDLINE-indexed article was in 2005, credited to an ad hoc committee of the AAST [2]. When broken down by year of publication, both sets showed a progressive increase in the rate of annual publications. This is demonstrated in Figure 1, A and B.

Table 1 summarizes the results when the ACS search sets were combined by the AND conjunction with each of the subject domain searches for "Wounds and Injuries," "General Surgery," and "Critical Care." The

distribution of subjects in the ACS [All Fields] set ($n = 2,352$) was as follows: Critical Care, 49.70%; General Surgery, 23.26%; and Wounds and Injuries, 20.88%. Because this process included articles published within journals or from departments that include ACS in their name, this may be viewed as reflecting the scope of interest of surgeons affiliated with the ACS domain. Of this search set, 6.16% of articles were not tagged or did not contain reference to any of these 3 major subjects (Table 1, A). The penetration of ACS in published literature with major term tags of "Wounds and Injuries," "General Surgery," and "Critical Care" was 1.48%, 0.85%, and 0.95%, respectively. ACS was not included in 96.72% of the articles retrieved with at least 1 subject term [All Fields] (Table 1, B).

The distribution of subjects in the ACS [TW] set ($n = 517$) was as follows: Critical Care, 32.88%; General Surgery, 43.52%; and Wounds and Injuries, 15.28%. This reflects the intentional labeling of authors that submitted articles with ACS specified within the title or the abstract, or as a keyword. Of this search set, 8.32% of articles were not tagged or did not contain a reference to any of these 3 major subjects (Table 1, C). The penetration of ACS in the published literature with major term tags of "Wounds and Injuries," "General Surgery," and "Critical Care" was 0.24%, 1.36%, and 0.42%, respectively. ACS was not included in 96.72% of the articles retrieved with at least 1 subject term [TW] (Table 1, D). The year-to-year progressions of ACS [TW] articles published on each of the subjects are shown in Figure 2.

MeSH term analysis revealed a total of 6,478 occurrences of 2,010 distinct major and minor subject headings for an average of 12.5 MeSH assignments per article. When only major terms are considered, there were 620 occurrences of 303 subject headings for an average of 1.2 major subject terms per article. The top 25 most common MeSH terms among articles using ACS as a Text Word are shown in Table 2. Many of the most common terms relate to patient characteristics or health services process rather than specific clinical concepts. However, because the MeSH thesaurus is highly granular, manually combining closely related clinical concepts reveals a more accurate view of the subject matter reflected in the ACS literature. These combined "top 10" major terms are shown in Table 3.

The journals that published the most ACS articles and the article counts are shown in Figure 3. The *Journal of Trauma and Acute Surgery* was noted to be the most prominent source of ACS literature, with or without combining articles prior to the name change from *The Journal of Trauma, Injury, Infection, and Critical Care*. The most prolific authors writing on the subject of ACS are shown in Figure 4. As with other specialties, high publication productivity is associated with relatively few authors and journal sources and a "long tail" of authors and journals responsible for only a few published articles. Yet, the long tail can represent a major component of the targeted interest [16]. Of the 20 authors with the most publications, 4 (Britt, Jurkovich, Moore (EE), and Scalea)

Table 1
Search results and intersection of ACS with specific subject matter. (A, C): Penetration of subjects into ACS search set. (B, D): Penetration of ACS into subject search sets

|		Number of articles (n)	Number intersecting articles	Subject Search/ACS [All Fields]	ACS [All Fields]/subject search
ACS	[All Fields]	2352		(A)	(B)
AND	Wounds and Injuries [All Fields]	33,238	491	20.88%	1.48%
AND	General Surgery [All Fields]	64,401	547	23.26%	0.85%
AND	Critical Care [All Fields]	123,074	1169	49.70%	0.95%
	Articles with none of the 3 major subjects or without ACS			6.16%	96.72%
			Total	100.00%	100.00%
				Subject search/ACS [TW]	ACS [TW]/subject search
ACS	[TW]	517		(C)	(D)
AND	Wounds and Injuries [Text Word]	33,234	79	15.28%	0.24%
AND	General Surgery [Text Word]	16,559	225	43.52%	1.36%
AND	Critical Care [Text Word]	40,120	170	32.88%	0.42%
	Articles with none of the 3 major subjects or without ACS			8.32%	97.98
			Total	100.00%	100.00%
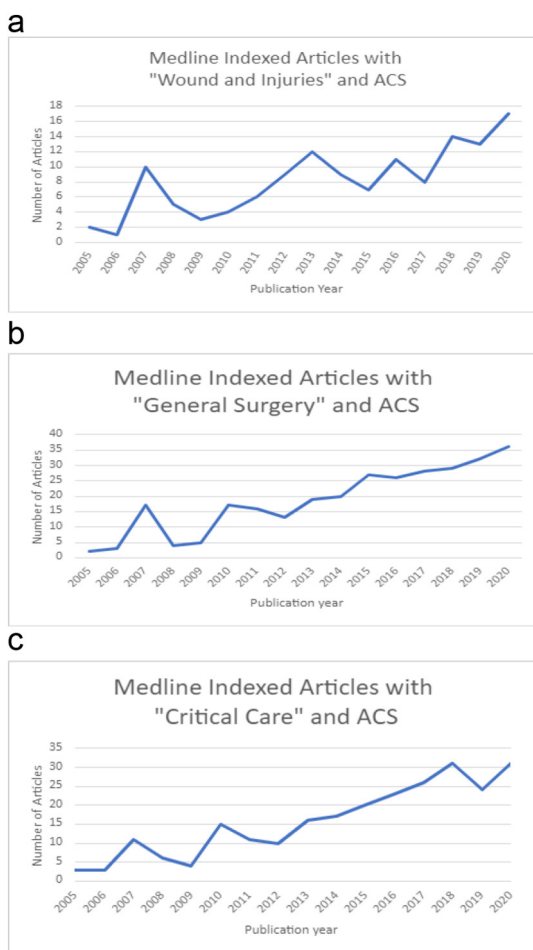
Fig 2. Results of combined search. A–C, Specific subject matter articles with ACS keyword tag.

Table 2

Most common MeSH terms tagged to ACS literature (*n* = 517 articles).

	Most common major & minor terms			Most common major terms	
Rank	Term	Count	Rank	Term	Count
1	Humans	530	1	*General Surgery	18
2	Female	288	2	*Internship and Residency	17
3	Male	249	3	*Surgical Procedures, Operative	17
4	Adult	188	4	*Models, Organizational	15
5	Middle Aged	187	5	*Outcome Assessment, Health Care	13
6	Retrospective Studies	177	6	*Emergencies	12
7	Aged	124	7	*Appendectomy	11
8	United States	87	8	*Emergency Treatment	10
9	Treatment Outcome	77	9	*Attitude of Health Personnel	9
10	Acute Disease	66	10	*Fellowships and Scholarships	9
11	Aged, 80 and over	62	11	*Hospital Mortality	9
12	Young Adult	62	12	*Laparoscopy	9
13	Adolescent	51	13	*Quality Improvement	9
14	General Surgery/*education	42	14	*Curriculum	8
15	Length of Stay	42	15	*Pandemics	8
16	Time Factors	42	16	*Career Choice	7
17	Critical Care	40	17	*Emergency Service, Hospital	7
18	Length of Stay/statistics & numerical data	38	18	*Clinical Competence	6
19	Emergencies	35	19	*Emergency Medical Services	6
20	Hospital Mortality	35	20	*Trauma Centers	6
21	Wounds and Injuries/*surgery	35	21	*Traumatology	6
22	Surveys and Questionnaires	32	22	*Cholecystectomy, Laparoscopic	5
23	Workforce	31	23	*Communication	5
24	Prospective Studies	30	24	*Coronavirus Infections	5
25	Risk Factors	29	25	*Cost of Illness	5
				*Laparotomy	5
				*Models, Theoretical	5
				*Pneumonia, Viral	5

were among the 19 original members of the AAST Ad Hoc Committee to Develop the Reorganized Specialty of Trauma, Surgical Critical Care, and Emergency Surgery. The top contributing countries with a geographical visualization are shown in Figure 5. The impact of the top journals publishing articles in the ACS space is indicated by the CiteScore listed in Table 4. This shows that the subject is well accepted within the mainstream academic space.

DISCUSSION

Because of the exponentially increasing size of the published literature, it is essential that an organized approach be taken to managing the scientific knowledge base. The UMLS Metathesaurus and its derivative, the NLM MeSH thesaurus, function to identify the major subject matter within published articles to facilitate retrieval. Subject indexing has traditionally been performed manually, with guidelines, by librarians but is moving toward computer automation using natural language processing techniques and artificial intelligence [17]. The term "Acute Care Surgery" is currently and conspicuously absent from the MeSH thesaurus despite its emergence over the last 15 years as a newly recognized subspecialty of surgery. The term "Acute Care Surgery" did not appear as a cohesive term in the literature until the 2005 article reflecting the work of the AAST ad hoc committee. Editorialization on the subject was the most prominent theme of articles using the term over the next several years. However, articles reporting patent data and using ACS as a text word term began appearing as early as 2006 [18]. In common practice, ACS is used somewhat ambiguously. As originally intended by the ad hoc committee of the AAST, ACS was intended to represent the

emerging subspecialty of surgery which included trauma, emergency general surgery, and critical care. However, it is frequently used to refer to the emergency general surgery component of the broader specialty. Some academic departments and divisions have modified their names to reflect their broad scope of surgical practice but include trauma as in "trauma and acute care surgery," which technically could be considered redundant. This ambiguity, however, does not impair the recognition of the specialty or the clinical focus of those who identify as acute care surgeons. Consideration was given to alternative search strategies, including using "Trauma and Acute Care Surgery" as the ACS search set, but these strategies were found to be either more restrictive or less representative of the subject-focused, mainstream

Table 3

Major subjects by combined clinical concepts

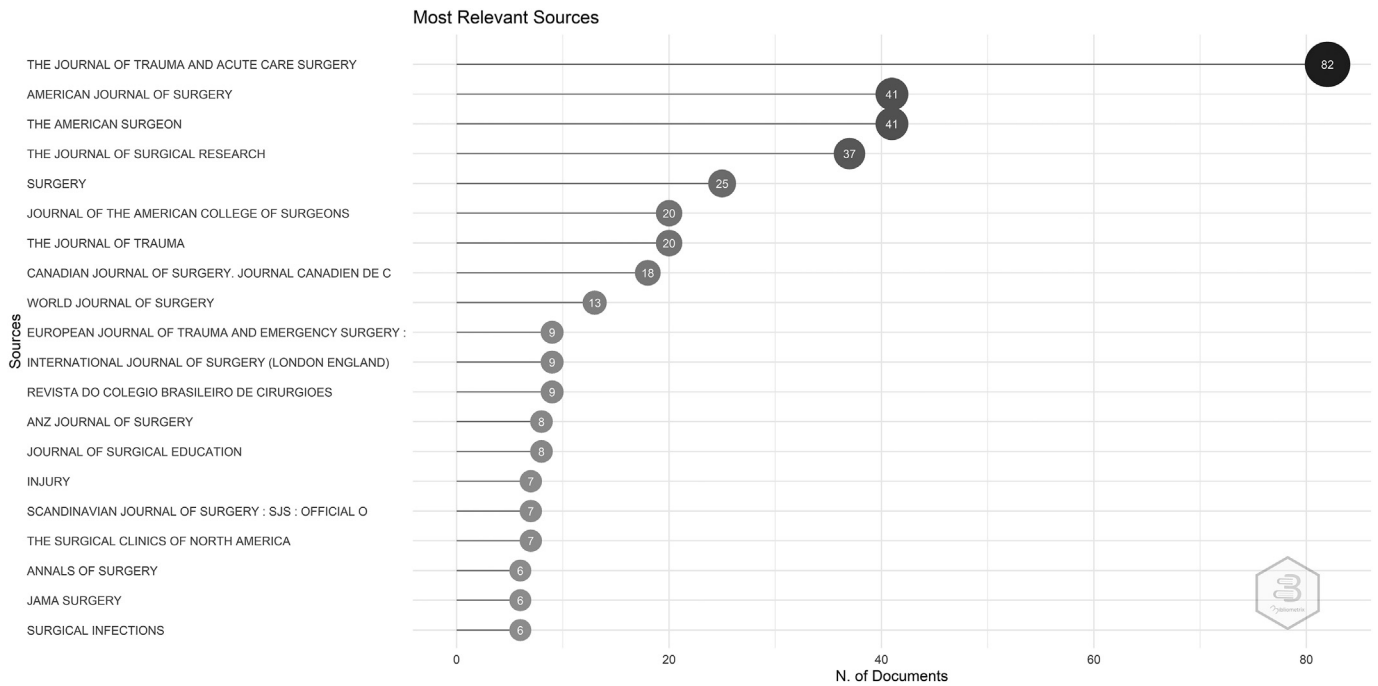| Most common major subject terms combined by clinical concept	
Clinical subject	Count
General surgery	22
Appendectomy	20
Surgical procedures	20
Laparotomy/laparoscopy	16
Traumatology	16
Cholecystitis	13
Vascular	8
Wounds and injuries	6
Colon	4
Intestines	4

Fig 3. Top 20 journals by the number of articles from the primary search set.

surgical literature of primary interest to practicing Acute Care Surgeons. This could also impair the search strategy's Recall metric, which is further discussed below.

There are various search engine options for searching the MEDLINE database of the NLM (PubMed, Ovid, EBSCOHost, etc). Some sources, such as Cochrane Library, will include MEDLINE-indexed articles but limits them to systematic reviews and meta-analyses. This bibliometric analysis used PubMed to specifically search the MEDLINE database. Although the study could theoretically be conducted using broader databases and alternative terms, this limited search represents a cross-sectional snapshot of the mainstream surgical literature likely to be of most interest to practicing surgeons. It demonstrates that ACS is becoming ingrained into surgical terminology and is increasingly recognized as a subspecialty with a defined scope and identifiable practitioners. The asymmetrical geographic distribution and relatively few prolific authors are typical of an "early adopter" model of new subjects and are likely to change over time.

The MeSH nomenclature represents a fluid and evolving vocabulary which as of this writing does not include ACS. The term "Trauma" is not represented as a major heading in a surgical context but maps to "Wounds and Injuries." Various headings and subheadings using trauma in a surgical context have been introduced between 1975 (Trauma Centers) and 2021 (Trauma Nursing). A search of the MeSH thesaurus for the term "Surgery" yields 85 headings and subheadings with 28 total occurrences of "surgery" or "surgical." [12]. The term "Acute Care" does not occur within that MeSH thesaurus and ACS does not occur as a cohesive term anywhere within the MeSH thesaurus. Although many other relevant subspecialty terms are also missing from the MeSH thesaurus, a full analysis of MeSH inefficiencies is beyond the scope of this article. This situation creates a challenge for optimizing subject matter searches.

The efficiency of literature search techniques is subject to the metrics of Recall and Precision [19]. These metrics are similar to sensitivity (TP/(TP + FN)) and PPV (TP/(TP + FP)) used to evaluate the accuracy of laboratory tests. Recall is the number of retrieved relevant articles
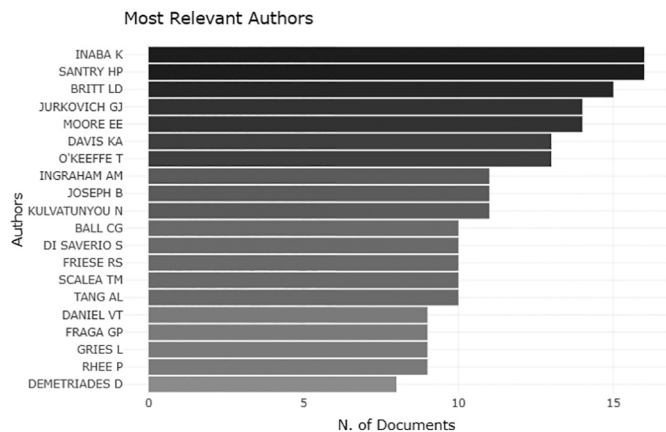

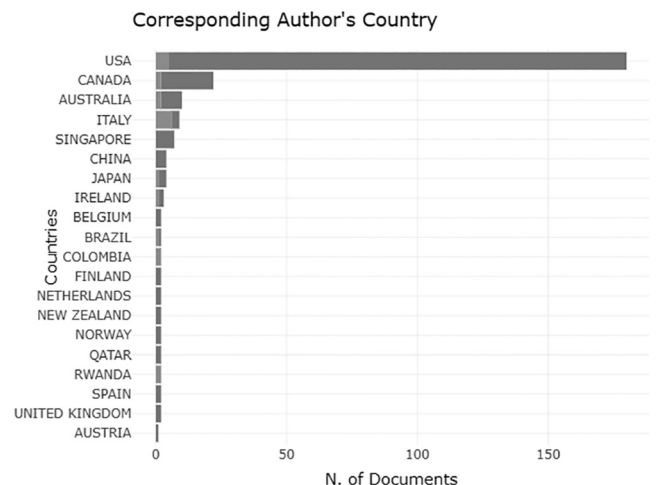**Fig 4.** Total articles published by the top 20 authors using the term Acute Care Surgery.

Fig 5. Geographical contribution to the Acute Care Surgery literature.

Table 4
Journal citation impact

Journal title	CiteScore
Journal of Trauma and Acute Care Surgery	5.2
American Journal of Surgery	3.7
The American Surgeon	1.1
The Journal of Surgical Research	3.0
Surgery	5.9
Journal of the American College of Surgeons	8.1
The Journal of Trauma	Continued as *The Journal of Trauma and Acute Care Surgery*
Canadian Journal of Surgery	2.2
European Journal of Trauma and Emergency Surgery	4.0
International Journal of Surgery (London England)	8.2
Revista do Colegio Brasileiro de Cirurgioes	1.4
ANZ Journal of Surgery	1.8
Journal of Surgical Education	3.5
Scandinavian Journal of Surgery	3.4
The Surgical Clinics of North America	4.5
Annals of Surgery	15.3
Injury	3.8
JAMA Surgery	18.3
Surgical Infections	3.8

in proportion to all relevant articles, whereas Precision is the number of retrieved relevant articles in proportion to all retrieved articles. Recall can only be estimated unless a gold standard exists to accurately define the number of relevant articles within a large pool of literature. It is generally considered that there will be a tradeoff between Recall and Precision, although the relationship is not linear [19]. The goal of any subject search is to identify the highest number of relevant articles while retrieving the fewest possible articles that are not relevant to the subject of interest. This is particularly important for meta-analysis and systematic reviews, which have come to be regarded as the highest level of scientific evidence [20]. Author-supplied keywords are the only method available to identify an article as specifically relevant to the subject of Acute Care Surgery in a [TW] search. Using [All Fields] searching allows retrieval of articles published by departments, divisions, or journals containing ACS in their name, regardless of the subject focus of the article. We have shown that >90% of articles retrieved by either strategy will be tagged with the subjects of Wounds and Injuries, General Surgery, or Critical care, yielding Precision values of 0.94 (ACS [TW]) and 0.94 (ACS [AllFields]). The reliability of information retrieval strategies is naturally dependent on the accuracy of indexing. Because ACS is a relatively new term and is used ambiguously, it is likely underrecognized by information professionals and indexing algorithms, leaving much of the relevant literature untagged.

The finding that a vast majority of articles of potential interest to acute care surgeons are not indexed using an author-supplied term for ACS demonstrates a major challenge to rapid information retrieval and filtering. The lack of a defined associated MeSH term compounds this problem, leaving it to the authors to include ACS as a keyword to facilitate retrieval. The addition of Acute Care Surgery as a term into the MeSH thesaurus could markedly improve the reliability of subject matter indexing and facilitate accurate information retrieval. Because the MeSH Tree is a constantly evolving taxonomy, suggestions for additions or changes to MeSH vocabulary can be submitted to the National Library of Medicine Customer Support Center. All submissions are reviewed to determine if the suggestion is necessary, is useful, and meets other criteria, such as reproducibility in use and understandability. Additions and changes to MeSH vocabulary are communicated annually by the National Library of Medicine via freely available webinars and through publications on the Medical Subject Headings website [21].

This article describes the factual results of computerized literature searches under the conditions described. It is subject to the natural limitations of inaccurate indexing that potentially compromised Precision and Recall. Additionally, the body of published knowledge in any

given field is a moving target and rapidly expanding. Since the adoption of ACS as a term denoting a new specialty evolved from established practices, penetration of the term into subject-focused literature remains limited. Identifying literature of interest to acute care surgeons still requires authors to supply ACS as a keyword when submitting manuscripts or inclusion of the phrase in the title, abstract, or other searchable fields. The majority of literature of interest to acute care surgeons remains untagged with ACS, requiring manual identification using other subject terms.

In conclusion, this study demonstrates that ACS as a subject term is being increasingly expressed in the literature since its formal introduction in 2005. It is currently associated with relatively similar frequencies in articles with "wounds and injuries", "general surgery," and "critical care" as the major subject. Our bibliometric evaluation reveals international participation and collaboration in the subject matter, which are also characteristics of specialties. Author and journal publication patterns follow a long tail pattern. Major challenges remain in the accurate indexing and retrieval of relevant scientific knowledge. The addition of ACS as a dedicated term into the NLM's MeSH thesaurus as a specialty of Surgery would facilitate indexing and retrieval of the literature most relevant to Acute Care Surgeons.

Abbreviations

NLM	National Library of Medicine
MeSH	Medical Subject Heading
ACS	Acute Care Surgery
TW	Text Word
TP	true positive
TN	true negative
FP	false positive
FN	false negative

Disclosures

- Author Contribution: Dr John Aucar is responsible for the conception of this study and participated in all aspects, including the drafting of the manuscript. Dr Jessica Veatch and Elizabeth Kiscaden participated in literature searching, data analysis, preparation of tables, and editing of the manuscript. All authors have reviewed the final manuscript and approved its submission for publication.
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References

[1] The Metathesaurus. https://www.nlm.nih.gov/research/umls/new_users/online_learning/OVR_002.html, Accessed September 25, 2021.
[2] Committee to Develop The Reorganized Specialty of Trauma, Surgical Critical Care, and Emergency Surgery. Acute care surgery: trauma, critical care, and emergency surgery. J Trauma. 2005;58(3):614–6.
[3] Aucar JA, Hicks LL. Economic modeling comparing trauma and general surgery reimbursement. Am J Surg. 2005;190(6):932–40.
[4] Spain DA, Miller FB. Education and training of the future trauma surgeon in acute care surgery: trauma, critical care, and emergency surgery. Am J Surg. 2005;190(2):212–7.
[5] Ciesla DJ, Moore EE, Moore JB, Johnson JL, Cothren CC, Burch JM. The academic trauma center is a model for the future trauma and acute care surgeon. J Trauma 2005;58(4):657–61; discussion 661–2.
[6] Moore EE, Maier RV, Hoyt DB, Jurkovich GJ, Trunkey DD. Acute care surgery: Eraritjaritjaka. J Am Coll Surg. 2006;202(4):698–701.
[7] Journal of Trauma and Acute Care—about the journal surgery. https://journals.lww.com/jtrauma/Pages/aboutthejournal.aspx. [Accessed 25 September 2021].
[8] Raisig Lm. "Statistical bibliography in the health sciences.". Bull Med Library Assoc. 1962;50:450–61. [Web.].

[9] Roldan-Valadez E. Current concepts on bibliometrics: a brief review about impact factor, Eigenfactor score, CiteScore, SCImago journal rank, source-normalised impact per paper, H-index, and alternative metrics. Irish J Med Sci. 2019;188.3:939–51. [Web].

[10] Advanced search results—PubMed. https://pubmed.ncbi.nlm.nih.gov/advanced/. [Accessed 18 May 2021].

[11] Help—PubMed. https://pubmed.ncbi.nlm.nih.gov/help/#tw. [Accessed 18 May 2021].

[12] National Center for Biotechnology Information. https://www.ncbi.nlm.nih.gov/.

[13] How are CiteScore metrics used in Scopus? https://service-elsevier-com.cuhsl. creighton.edu/app/answers/detail/a_id/14880/supporthub/scopus/. [Accessed 20 November 2021].

[14] Aria M, Cuccurullo C. Bibliometrix: an R-tool for comprehensive science mapping analysis. J Informet. 2017;11(4):959–75.

[15] CiteScore vs. Impact factor: how do we rate journal quality? https://library.osu.edu/ researchcommons/2017/06/12/citescore-vs-impact-factor. [Accessed 20 November 2021].

[16] Kreuter MW, Hovmand P, Pfeiffer DJ, Fairchild M, Rath S, Golla B, et al. The "long tail" and public health: new thinking for addressing health disparities. Am J Public Health. 2014;104(12):2271–8.

[17] Névéol A, Shooshan SE, Claveau V. Automatic inference of indexing rules for MEDLINE. BMC Bioinform. 2008;9 Suppl 11(Suppl. 11):S11.

[18] Ripley RT. Streptococcus milleri infections of the pleural space: operative management predominates. Am J Surg. 2006;192(6):817–21.

[19] Buckland Michael. The relationship between recall and precision. J Am Soc Inf Sci. 1994;45(1):12–9.

[20] Goossen K. Optimal literature search for systematic reviews in surgery. Langenbecks Arch Surg. 2018;403(1):119–29.

[21] Medical Subject Headings—home page. https://www.nlm.nih.gov/mesh/meshhome. html.