Research Square

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A Bibliometric Analysis of the Research Landscape of Frailty in Colorectal Cancer

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Abstract

Background

Frailty is increasingly recognized as an important factor affecting treatment tolerance, perioperative recovery and prognosis in patients with colorectal cancer. This study aimed to map global and Chinese research trends, hotspots and emerging directions in frailty among patients with colorectal cancer using CiteSpace.

Methods

Literature related to frailty in colorectal cancer published between January 2005 and March 2025 was retrieved from the Web of Science Core Collection and CNKI. CiteSpace 6.4.R1 was used to analyze annual publication trends, countries, institutions, authors, keyword co-occurrence, burst terms and keyword clusters.

Results

A total of 836 records were included, comprising 783 records from WoSCC and 53 records from CNKI. Publications showed an overall upward trend during the study period. In the WoSCC literature, major hotspots included elderly patients, surgery, sarcopenia, nutritional status, comprehensive geriatric assessment, adjuvant chemotherapy and survival. In the CNKI literature, research mainly focused on frailty, nursing care, complications, influencing factors, preoperative frailty and postoperative frailty. Keyword clustering suggested that international research has gradually shifted toward perioperative risk stratification, body composition assessment, comprehensive geriatric assessment and prehabilitation.

Conclusion

Research on frailty in colorectal cancer has expanded steadily over the past two decades. Current evidence highlights the need to integrate frailty screening, nutritional and muscle-mass assessment, comprehensive geriatric assessment, prehabilitation and post-discharge follow-up into colorectal cancer management. Future studies should develop standardized assessment tools and multidisciplinary intervention pathways for frail colorectal cancer patients.

Clinical trial number:

Not applicable.

1 Introduction

Data from GLOBOCAN 2022, published by the International Agency for Research on Cancer (IARC) of the World Health Organisation, show that colorectal cancer is one of the most common malignant tumours worldwide, ranking among the top in terms of both new cases and deaths [1]. This high incidence not only places a significant disease burden on patients but also severely impacts their quality of life. Frailty is a clinical syndrome closely associated with ageing, primarily characterised by a decline in multisystem physiological reserves and increased susceptibility to stress, and is closely linked to adverse outcomes such as mortality, hospitalisation and functional decline [2]. Patients in a state of frailty are more prone to complications, prolonged hospital stays and limited functional recovery following acute stressors such as disease progression or surgery; in severe cases, this may even increase the risk of death [3]. The risk of developing colorectal cancer increases with age, and the elderly constitute a significant patient population for this disease [4]. Recent studies have shown that frailty frequently accompanies the disease progression in patients with colorectal cancer (CRC) and is closely associated with an increased incidence of postoperative complications, prolonged hospital stays, functional decline and poor survival outcomes, significantly reducing patients' quality of life [5]. This study employs bibliometric methods, utilising CiteSpace to conduct a visual analysis of research on frailty in colorectal cancer, thereby providing a reference for future studies on frailty in colorectal cancer.

However, existing studies on frailty in colorectal cancer remain heterogeneous in assessment tools, clinical endpoints and intervention strategies. It is still unclear how research priorities have evolved and which topics are emerging as future directions. A bibliometric analysis may help clarify the development of this field and identify clinically relevant priorities for perioperative risk stratification and frailty management.

2 Materials and Methods

2.1 Search Strategies and Data Collection

Literature Sources and Screening A computerised search was conducted in the CNKI (China National Knowledge Infrastructure) and Web of Science (WOS) Core Collection databases, covering the period from the inception of the databases to 1 March 2025.

For WoSCC, the query was TS = ((“colorectal cancer” OR “colorectal neoplasm” OR “colon cancer” OR “rectal cancer” OR CRC) AND (frailty OR frail OR sarcopenia OR “muscle weakness” OR “skeletal muscle index”)). Records were limited to the Web of Science Core Collection, document types “Article” or “Review,” and English language. The retrieval period ranged from database inception to 1 March 2025, yielding 783 papers.

For CNKI, the subject query was (colorectal cancer + colorectal carcinoma + colon cancer + rectal cancer + colorectal neoplasms) AND (frailty + frailty syndrome + sarcopenia + muscle loss + muscle weakness). Chinese-language journal articles related to frailty in colorectal cancer were included. After removing duplicate publications, news reports, non-academic articles, and studies unrelated to frailty in colorectal cancer, 53 papers were finally retrieved.

2.2 Data processing

Before CiteSpace analysis, duplicate records were removed. Records with incomplete bibliographic information, news reports, non-academic articles and studies unrelated to frailty in colorectal cancer were excluded after title and abstract screening. Synonymous keywords, such as “colorectal cancer” and “colorectal neoplasms,” “frailty” and “frail,” and “sarcopenia” and “muscle loss,” were manually merged to improve the consistency of keyword analysis. The cleaned datasets from WoSCC and CNKI were then imported into CiteSpace for bibliometric visualization.

2.3 Statistical Analysis

Visualisation analysis was performed using CiteSpace 6.4.R1 software. The included literature was exported in RefWorks format, saved as a file named ‘download_txt’ in the ‘input’ folder, and the software automatically converted the format to ‘download_converted.txt’, saving it in the ‘output’ folder. The data was imported into CiteSpace and relevant parameters were configured: the time span was set from January 2005 to March 2025, with a time slice of 1 year. The selection criterion was set to TOPN with a threshold of 50; the clipping method was selected as the Pathfinder method, with the option to include the shortest time span and the entire network; all other settings were left at their default values. Finally, knowledge maps of research on frailty in colorectal cancer were generated.

3 Results

3.1 An overview of publications in frailty research in colorectal cancer

Between 2005 and 2025, annual publications on frailty in colorectal cancer showed an overall upward trend. The WoSCC literature peaked in 2022, whereas CNKI publications reached the highest number in 2024. The top three countries in terms of publication volume in the field of frailty in colorectal cancer were: the United States (183 articles), the Netherlands (93 articles) and Japan (75 articles), indicating that these three countries have made the primary contributions to research in the field of frailty in ageing societies (see Table 1).

Table 1
Number of publications on frailty in colorectal cancer by country from 2005 to 2025.

Rank	Publications	Centrality	Country
1	183	0.2	United States
2	93	0	Netherlands
3	75	0	Japan
4	72	0.07	China
5	66	0.16	Canada
6	65	0.66	United Kingdom
7	60	0.32	Italy
8	44	0.07	France
9	39	0.07	Australia

3.2 Research institutions and collaborative networks

In the WoSCC dataset, the University of Alberta ranked first with 34 publications, followed by Maastricht University and Harvard University with 22 and 21 publications, respectively. Among Chinese institutions, Anhui Medical University, the Department of Gastrointestinal Surgery at Guangzhou First People's Hospital (affiliated with Guangzhou Medical University), and Hebei Medical University published the most articles, with 2, 2 and 2 articles respectively. To conduct a visual analysis of the publishing institutions, 377 network nodes and 695 links were generated for WoSCC literature, with a network density of 0.0099; there were 23 institutions with ≥ 10 relevant publications. For China, 71 network nodes and 32 links were generated, with a network density of 0.0129.

3.3 Distribution of Author Collaboration Networks

A visual analysis was conducted using the authors of the published papers as nodes, yielding a total of 531 nodes (N) and 917 links (E), with a network density of 0.0065. When assessing the development level of a discipline, the quantity and quality of researchers involved in publishing literature serve as highly valuable metrics [6]. Among the most productive authors, Prado, Carla M and Baracos, Vickie E each published 13 articles, indicating their active contribution to frailty-related research in colorectal cancer. In the CNKI dataset, the most productive authors included Wang Qiang, Zhong Bingzheng and Zhang Yongmei. According to Price's Law, the threshold for core authors was calculated as $M = 0.749 \times \sqrt{N_{max}}$, where Nmax represents the number of publications by the most productive author. A total of 11 core authors were identified, contributing 91 articles. These findings suggest that author collaboration in this field has begun to form several active research groups, although the overall collaboration density remains relatively low.

3.4 Analysis of the keywords

3.4.1 High-frequency Keywords

A total of 465 keywords were extracted from the WoSCC dataset and 71 keywords from the CNKI dataset. The high-frequency keywords from both datasets are summarized in Tables 2 and 3. In the WoSCC literature, the most frequent keyword was "elderly patients", followed by "surgery", "colon cancer", "comprehensive geriatric assessment", "chemotherapy" and "care". In the CNKI literature, the most frequent keyword was "frailty", followed by "colorectal cancer", "older adults", "influencing factors", "aging" and "nursing".

Keyword co-occurrence analysis further showed different research emphases between the two datasets. As shown in Fig. 4, the WoSCC network was mainly centered on elderly patients, clinical outcomes, mortality, sarcopenia, surgery and colon cancer, whereas the CNKI network focused more on frailty, colorectal cancer, older adults, complications, nursing care and perioperative frailty. These findings suggest that international studies have paid more attention to clinical outcomes, body composition and treatment-related issues, while Chinese studies have focused more on perioperative care, risk factors and postoperative frailty management.

Table 2
High-frequency keywords in WoSCC studies on frailty in colorectal cancer.

No.	Frequency	Keyword	Starting year	Betweenness centrality	No.	Frequency	Keyword	Starting year	Betweenness centrality
1	21	cancer patients	2011	0.29	7	16	nutritional status	2014	0.15
2	56	chemotherapy	2008	0.21	8	35	adjuvant chemotherapy	2008	0.14
3	14	1st line treatment	2008	0.21	9	71	comprehensive geriatric assessment	2008	0.13
4	101	surgery	2011	0.18	10	19	carcinoma	2008	0.13
5	47	adults	2011	0.18	11	93	colon cancer	2010	0.12
6	159	elderly patients	2009	0.15	12	49	care	2012	0.12

Table 3
High-frequency keywords in CNKI studies on frailty in colorectal cancer.

No.	Frequency	Keyword	Starting year	Betweenness centrality	No.	Frequency	Keyword	Starting year	Betweenness centrality
1	29	Frailty	2020	0.52	7	6	Complications	2014	0.83
2	28	Colorectal cancer	2008	0.33	8	5	Review	2008	0.27
3	14	Older adults	2008	0.47	9	4	Enterostomy	2008	0.06
4	10	Influencing factors	2011	0.42	10	4	Postoperative frailty	2008	0.23
5	10	Aging	2011	0.6	11	4	Preoperative frailty	2010	0.28
6	6	Nursing	2009	0.64	12	3	Elderly patients	2012	0.11

Note: The centrality score reflects the influence of a keyword within the field; the higher the score, the greater the influence.

3.4.2 Evolution of Emergent Terms

Emergent terms reflect key issues in a particular field of research, namely keywords that appear frequently over a given period. The burst terms in WoSCC and CNKI studies on frailty in colorectal cancer are shown in Fig. 5. In WoSCC studies, early hotspots such as quality of life, breast cancer, adjuvant chemotherapy, first-line treatment and comprehensive geriatric assessment persisted for relatively long periods, whereas more recent burst terms included inflammation and malnutrition. In CNKI studies, older adults, enterostomy, adverse outcomes and exercise emerged as recent topics of interest.

3.4.3 Cluster Analysis of Keywords in Research on Frailty in Colorectal Cancer

Keyword clustering analysis was performed using the LLR algorithm. In the WoSCC dataset, the clustering network contained 465 nodes and 971 edges, forming 15 clusters. The modularity Q value was 0.7361 and the silhouette S value was 0.8064, indicating a clear and reliable clustering structure. The main clusters included sarcopenia, postoperative complications, overall survival, colorectal cancer, physical activity, geriatric oncology, body composition, rectal cancer, elderly patients, computed tomography, colon cancer, skeletal muscle index, outcome, and neoadjuvant chemoradiotherapy. These clusters suggest that international research has mainly focused on frailty-related prognosis, postoperative outcomes, sarcopenia, body composition and treatment response in colorectal cancer.

In the CNKI dataset, the keyword clustering network contained 71 nodes and 117 links, forming six clusters. The modularity Q value was 0.7327 and the silhouette S value was 0.9574, suggesting good cluster homogeneity. The main clusters were risk factors, postoperative frailty, length of hospital stay, preoperative frailty, elderly patients and inflammatory factors. These findings indicate that Chinese research

has focused more on perioperative frailty, postoperative complications, risk factors and inflammatory changes in colorectal cancer patients.

4 Discussion

4.1 Research trends reflect a shift from frailty recognition to risk-oriented management in colorectal cancer

The increasing number of publications suggests that frailty has gradually moved from a descriptive geriatric concept to a clinically actionable factor in colorectal cancer care. In this field, frailty is no longer interpreted simply as a consequence of ageing, but as a marker of reduced physiological reserve that may influence surgical tolerance, postoperative recovery, complications and survival. Ding et al. reported that commonly used frailty tools could predict adverse postoperative outcomes in patients with colorectal cancer [7]. Zhou et al. and Moreno-Carmona et al. also showed that frailty was associated with postoperative complications, mortality and poor survival [8, 9]. These studies support the need to include frailty assessment in perioperative risk evaluation.

The comparison between WoSCC and CNKI literature further indicates different stages of research development. International studies have focused more on prognosis-related topics, such as survival, sarcopenia, body composition and comprehensive assessment, whereas Chinese studies remain concentrated on nursing care, complications, influencing factors and perioperative frailty. This pattern suggests that research in China is moving from descriptive analysis toward clinical management, but standardized screening tools, intervention pathways and multicenter validation studies are still limited. Future studies should therefore place greater emphasis on translating frailty assessment into practical decision-making and continuous care models.

4.2 Standardized frailty assessment for perioperative risk stratification

Frailty assessment helps identify patients with limited physiological reserve before surgery. However, current tools are not interchangeable. Argillander et al. found that preoperative frailty screening using the Groningen Frailty Indicator was associated with postoperative complications and new institutionalization in older patients undergoing surgery for non-metastatic colorectal cancer [10]. Aguilar-Frasco et al. further showed that the Memorial Sloan Kettering Frailty Index and CT-derived skeletal muscle index were related to major postoperative complications, ICU admission, and prolonged hospital stay, suggesting that clinical frailty assessment may be strengthened by objective body composition evaluation [11]. In addition, Elabbas et al. reported that the Clinical Frailty Scale could help predict postoperative functional outcomes in geriatric colorectal surgery patients [12].

These findings suggest that frailty assessment should be practical rather than excessive. A brief screening tool may first be used in outpatient or preoperative settings to identify vulnerable patients. Those with suspected frailty should then receive a more detailed evaluation, including physical function, nutritional status, cognition, comorbidities, medication use, and social support. Such a stepwise approach may help clinicians balance assessment efficiency with individualized perioperative decision-making.

4.3 Frailty, treatment continuity and long-term prognosis

Keyword clusters such as “postoperative complications,” “overall survival,” “mortality,” and “adjuvant chemotherapy” indicate that frailty research in colorectal cancer has gradually extended from short-term surgical outcomes to treatment continuity and long-term prognosis. Lund et al. reported that vulnerable older patients with colorectal cancer frequently experienced chemotherapy dose reductions or discontinuation, whereas CGA-based geriatric intervention increased the proportion of patients completing scheduled chemotherapy [13]. This finding suggests that frailty-related vulnerability may directly affect treatment delivery, not only postoperative recovery. In addition, Bong et al. found that the survival benefit of oxaliplatin-based adjuvant chemotherapy was reduced in patients older than 70 years and that oxaliplatin use was associated with chemotherapy discontinuation in this age group [14]. Rosberg et al. further showed that adjuvant chemotherapy was associated with improved 5-year overall survival in high-risk stage II colon cancer, but less than half of eligible patients actually received chemotherapy [15]. Together, these findings indicate that frailty assessment may help identify patients who are likely to benefit from adjuvant treatment while avoiding excessive treatment burden.

Frailty should therefore be considered a multidimensional vulnerability phenotype rather than a single preoperative risk factor. Frail patients often have reduced physiological reserve, poor nutritional status, decreased muscle strength, and lower tolerance to surgical stress and chemotherapy. These factors may delay recovery, reduce treatment adherence, and ultimately worsen survival and quality of life. Accordingly, frailty assessment should be integrated into colorectal cancer treatment decision-making together with tumor stage, comorbidities, surgical risk, performance status, and patient preference.

4.4 Nutritional status, sarcopenia and inflammation as modifiable risk domains

The keyword clusters related to nutritional status, sarcopenia, body composition and inflammation suggest that frailty in colorectal cancer is closely linked to metabolic and functional decline. Low BMI alone is not sufficient to define frailty, but it may reflect reduced nutritional reserve, muscle loss or cancer-related wasting. Yuan et al. reported that lower BMI was associated with a higher risk of frailty in older adults [16]. In cancer patients, Xie et al. showed that muscle-mass indicators had prognostic value when incorporated into malnutrition assessment [17]. McGovern et al. further found that frailty in patients undergoing colorectal cancer surgery was associated with malnutrition, altered body composition, systemic inflammation and short-term clinical outcomes [18]. These findings suggest that nutrition, muscle mass and inflammation should be assessed together when evaluating frailty-related risk. Future interventions should therefore combine nutritional support, resistance exercise, inflammation monitoring and postoperative rehabilitation. An updated meta-analysis also showed that sarcopenia was associated with increased postoperative morbidity after colorectal cancer surgery, further supporting the need to include body composition assessment in frailty-related risk evaluation [19].

4.5 Toward integrated frailty management: prehabilitation, CGA and continuity of care

The emergence of prehabilitation and comprehensive geriatric assessment as research hotspots reflects a shift from passive risk prediction to active optimization before treatment. Multimodal prehabilitation, usually including exercise training, nutritional support, psychological intervention and health education, may improve functional reserve before surgery. Molenaar et al. reported that prehabilitation before colorectal cancer surgery reduced severe and medical complications and improved functional recovery [20]. Bojesen et al. also found that a four-week multimodal prehabilitation programme was associated with better early postoperative recovery [21].

Current guidelines also recommend structured perioperative evaluation and management of frailty in older adults undergoing colorectal surgery [22]. CGA provides a broader framework for identifying vulnerabilities that cannot be captured by a single frailty score, including impaired physical function, cognitive decline, malnutrition, polypharmacy, comorbidities and insufficient social support. Dolin et al. proposed integrating geriatric assessment and intervention into perioperative care for vulnerable older patients with colorectal cancer, highlighting the value of individualized and multidisciplinary management [23].

Therefore, future frailty management should combine screening, CGA, prehabilitation, ERAS-based perioperative care and post-discharge follow-up. For China, more resource-adapted models are needed, such as nurse-led frailty screening, dietitian-guided nutrition support, exercise guidance, geriatric consultation, surgical decision-making and family-based rehabilitation. Recent work on ERAS® 3.0 further suggests that frailty management should extend beyond hospitalization and include home-based geriatric, nutritional and exercise interventions after discharge [24].

5 Strengths and limitations

- This bibliometric analysis provides a comprehensive overview of publication trends, collaborative patterns and emerging research hotspots in frailty among patients with colorectal cancer. By integrating 836 records from WoSCC and CNKI, including 783 WoSCC records and 53 CNKI records, this study offers a comparative perspective on international and Chinese research development. However, several limitations should be acknowledged. First, the dataset size was moderate, especially for the CNKI literature, and the imbalance between WoSCC and CNKI records may have affected the comparability of the two datasets. Second, only WoSCC and CNKI were searched; therefore, relevant studies indexed in PubMed, Embase, Scopus or other regional databases may have been missed. Third, differences in indexing systems, language, keyword standards and database coverage between WoSCC and CNKI may have influenced the identification of research hotspots. Fourth, although duplicate records and irrelevant studies were screened and synonymous keywords were manually harmonized, no formal validation against an external gold-standard set of key publications was performed. Finally, CiteSpace parameters, including time slicing, pruning strategy and threshold settings, may influence the structure of the generated knowledge maps, and bibliometric indicators should be interpreted as descriptive measures rather than direct evidence of study quality or clinical effectiveness.

6 Conclusion

- This CiteSpace-based bibliometric analysis mapped the development of research on frailty in colorectal cancer from 2005 to 2025. International studies mainly focused on surgery, survival, sarcopenia, body composition, comprehensive geriatric assessment and

prehabilitation, whereas Chinese studies concentrated more on nursing care, complications, influencing factors and perioperative frailty. Future research should develop standardized screening tools and integrated management pathways that combine frailty assessment, nutritional and exercise-based prehabilitation, perioperative care and post-discharge follow-up to improve outcomes for frail colorectal cancer patients.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

The bibliographic records analyzed in this study were retrieved from the Web of Science Core Collection (WoSCC) and China National Knowledge Infrastructure(CNKI). The WoSCC dataset can be accessed through the WoSCC search portal(https://www.webofscience.com/wos/woscc/basic-search) using the search strategy reported in the Methods section. The CNKI dataset can be accessed through the CNKI academic search portal (https://kns.cnki.net/kns8s/defaultresult/index) using the search strategy reported in the Methods section. No accession numbers are assigned by these bibliographic databases. The cleaned search records and CiteSpace input files are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

(I) Conception and design: Min Wang and Mengjin Wang
(II) Administrative support: Min Wang
(III) Data analysis and interpretation: Mengjin Wang, Zichun Xu and Jinming Wei
(IV) Manuscript writing: Mengjin Wang
(V) Final approval of manuscript: All authors

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References

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, Jemal A. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024;74:229–63. 10.3322/caac.21834.
2. Dent E, Hanlon P, Sim M, Jylhävä J, Liu Z, Vetrano DL, Stolz E, Pérez-Zepeda MU, Crabtree DR, Nicholson C, et al. Recent developments in frailty identification, management, risk factors and prevention: A narrative review of leading journals in geriatrics and gerontology. Ageing Res Rev. 2023;91:102082. 10.1016/j.arr.2023.102082.
3. Chu W, Chang SF, Ho HY. Adverse Health Effects of Frailty: Systematic Review and Meta-Analysis of Middle-Aged and Older Adults With Implications for Evidence-Based Practice. Worldviews Evid Based Nurs. 2021;18:282–9. 10.1111/wvn.12508.
4. Siegel RL, Wagle NS, Cercek A, Smith RA, Jemal A. Colorectal cancer statistics, 2023. CA Cancer J Clin. 2023;73:233–54. 10.3322/caac.21772.
5. Xia L, Yin R, Mao L, Shi X. Prevalence and impact of frailty in patients undergoing colorectal cancer surgery: A systematic review and meta-analysis based on modified frailty index. J Surg Oncol. 2024;130:604–12. 10.1002/jso.27778.

6. Du Q, Zhao R, Wan Q, Li S, Li H, Wang D, Ho CW, Dai Z, Chen Y, Shan D. Protocol for conducting bibliometric analysis in biomedicine and related research using CiteSpace and VOSviewer software. STAR Protoc. 2024;5:103269. 10.1016/j.xpro.2024.103269.
7. Ding L, Hua Q, Xu J, Yang J, Yao C. Predictive performance of different measures of frailty (CFS, mFI-11, mFI-5) on postoperative adverse outcomes among colorectal cancer patients: a diagnostic meta-analysis. Eur Geriatr Med. 2024;15:471–9. 10.1007/s41999-024-00960-9.
8. Zhou Y, Zhang XL, Ni HX, Shao TJ, Wang P. Impact of frailty on short-term postoperative outcomes in patients undergoing colorectal cancer surgery: A systematic review and meta-analysis. World J Gastrointest Surg. 2024;16:893–906. 10.4240/wjgs.v16.i3.893.
9. Moreno-Carmona MR, Serra-Prat M, Riera SA, Estrada O, Ferro T, Querol R. Effect of frailty on postoperative complications, mortality, and survival in older patients with non-metastatic colon cancer: A systematic review and meta-analysis. J Geriatr Oncol. 2024;15:101639. 10.1016/j.jgo.2023.101639.
10. Argillander TE, Schäfer S, van Westreenen HL, Kamper A, van der Zaag-Loonen HJ, van Duijvendijk P, van Munster BC. The predictive value of preoperative frailty screening for postoperative outcomes in older patients undergoing surgery for non-metastatic colorectal cancer. J Geriatr Oncol. 2022;13:888–91. 10.1016/j.jgo.2022.03.005.
11. Aguilar-Frasco JL, Moctezuma-Velázquez P, Rodríguez-Quintero JH, Castro E, Armillas-Canseco F, Hernández-Gaytán CA, Pastor-Sifuentes FU, Moctezuma-Velázquez C. Preoperative frailty assessment in older patients with colorectal cancer: use of clinical and radiological tool. Langenbecks Arch Surg. 2023;408:19. 10.1007/s00423-023-02754-2.
12. Elabbas E, Sharma A, Thu K, Tan A, Alim M, Zhang Y. Functional outcome and frailty in colorectal surgery patients. ANZ J Surg. 2023;93:2664–8. 10.1111/ans.18602.
13. Lund CM, Vistisen KK, Olsen AP, Bardal P, Schultz M, Dolin TG, Rønholt F, Johansen JS, Nielsen DL. The effect of geriatric intervention in frail older patients receiving chemotherapy for colorectal cancer: a randomised trial (GERICO). Br J Cancer. 2021;124:1949–58. 10.1038/s41416-021-01367-0.
14. Bong JW, Lee H, Jeong S, Kang S. Older Age Threshold for Oxaliplatin Benefit in Stage II to III Colorectal Cancer. JAMA Netw Open. 2025;8:e2525660. 10.1001/jamanetworkopen.2025.25660.
15. Rosberg V, Jessen M, Qvortrup C, Smith HG, Krarup PM. Impact of adjuvant chemotherapy on long-term overall survival in patients with high-risk stage II colon cancer: a nationwide cohort study. Acta Oncol. 2023;62:1076–82. 10.1080/0284186x.2023.2251086.
16. Yuan L, Chang M, Wang J. Abdominal obesity, body mass index and the risk of frailty in community-dwelling older adults: a systematic review and meta-analysis. Age Ageing. 2021;50:1118–28. 10.1093/ageing/afab039.
17. Xie H, Wei L, Ruan G, Zhang H, Shi J, Lin S, Liu C, Liu X, Zheng X, Chen Y, et al. Performance of anthropometry-based and bio-electrical impedance-based muscle-mass indicators in the Global Leadership Initiative on Malnutrition criteria for predicting prognosis in patients with cancer. Clin Nutr. 2024;43:1791–9. 10.1016/j.clnu.2024.05.039.
18. McGovern J, Grayston A, Coates D, Leadbitter S, Hounat A, Horgan PG, Dolan RD, McMillan DC. The relationship between the modified frailty index score (mFI-5), malnutrition, body composition, systemic inflammation and short-term clinical outcomes in patients undergoing surgery for colorectal cancer. BMC Geriatr. 2023;23. 10.1186/s12877-022-03703-2.
19. Keshavjee S, McKechnie T, Shi V, Abbas M, Huang E, Amin N, Hong D, Eskicioglu C. The Impact of Sarcopenia on Postoperative Outcomes in Colorectal Cancer Surgery: An Updated Systematic Review and Meta-Analysis. Am Surg. 2025;91:887–900. 10.1177/00031348251329748.
20. Molenaar CJL, Minnella EM, Coca-Martinez M, Ten Cate DWG, Regis M, Awasthi R, Martínez-Palli G, López-Baamonde M, Sebio-Garcia R, Feo CV, et al. Effect of Multimodal Prehabilitation on Reducing Postoperative Complications and Enhancing Functional Capacity Following Colorectal Cancer Surgery: The PREHAB Randomized Clinical Trial. JAMA Surg. 2023;158:572–81. 10.1001/jamasurg.2023.0198.
21. Bojesen RD, Dalton SO, Skou ST, Jørgensen LB, Walker LR, Eriksen JR, Grube C, Justesen TF, Johansen C, Slooter G, et al. Preoperative multimodal prehabilitation before elective colorectal cancer surgery in patients with WHO performance status I or II: randomized clinical trial. BJS Open. 2023;7. 10.1093/bjsopen/zrad134.
22. Saur NM, Davis BR, Montroni I, Shahrokni A, Rostoft S, Russell MM, Mohile SG, Suwanabol PA, Lightner AL, Poylin V, et al. The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the Perioperative Evaluation and Management of Frailty Among Older Adults Undergoing Colorectal Surgery. Dis Colon Rectum. 2022;65:473–88. 10.1097/dcr.0000000000002410.
23. Dolin TG, Mikkelsen M, Jakobsen HL, Nordentoft T, Pedersen TS, Vinther A, Zerahn B, Vistisen KK, Suetta C, Nielsen D, et al. Geriatric assessment and intervention in older vulnerable patients undergoing surgery for colorectal cancer: a protocol for a randomised controlled trial (GEPOC trial). BMC Geriatr. 2021;21:88. 10.1186/s12877-021-02045-9.

24. Dalsgaard EA, Dolin TG, Lund CM, Lykke J, Munk T, Vinther A, Rosenberg J. Optimized post-discharge care in patients with frailty after colon cancer surgery (project ERAS® 3.0): A protocol for a randomized controlled trial. J Geriatr Oncol. 2025;16:102289. 10.1016/j.jgo.2025.102289.

Figures

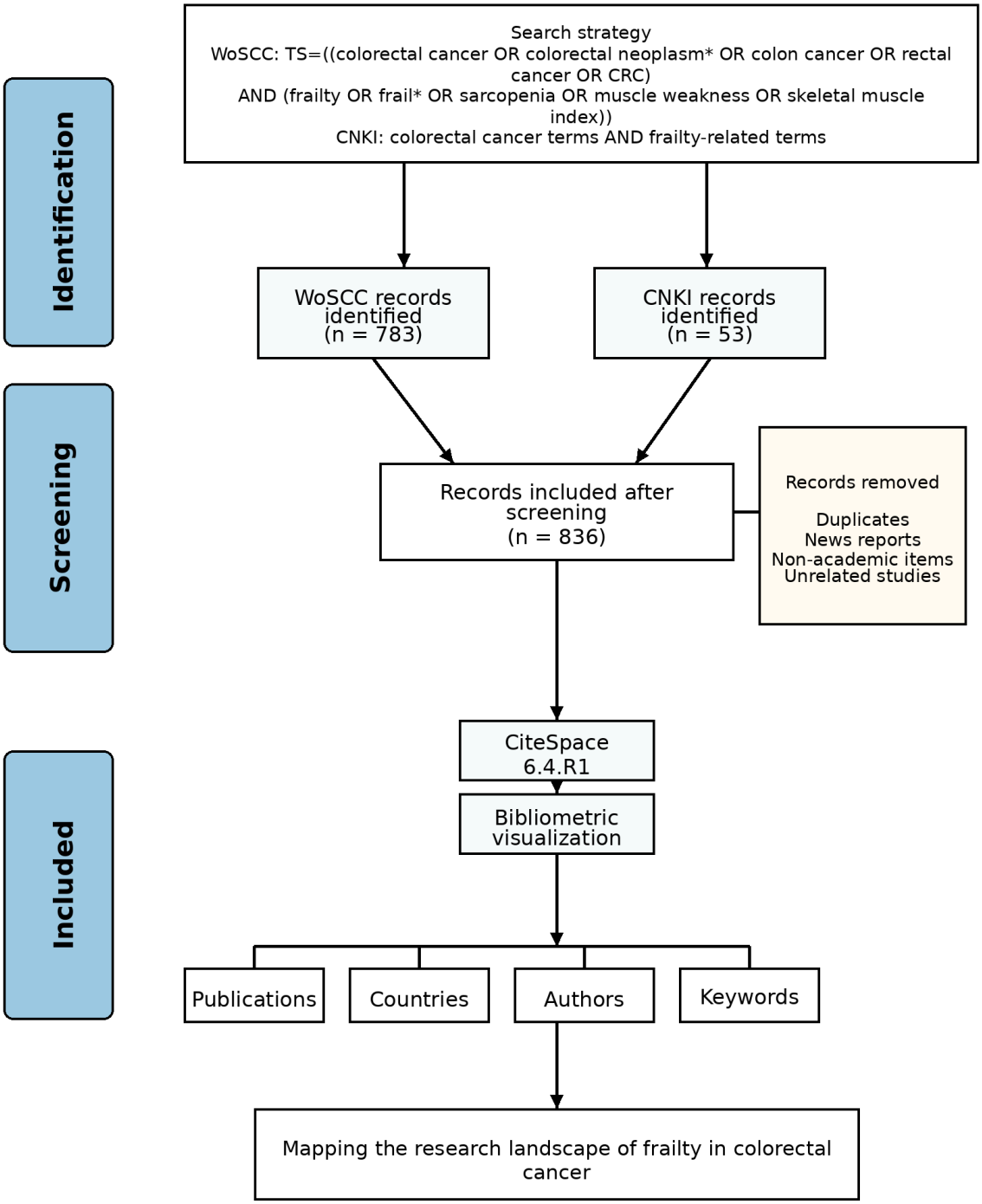


Figure 1

Literature screening flowchart for frailty research in colorectal cancer.

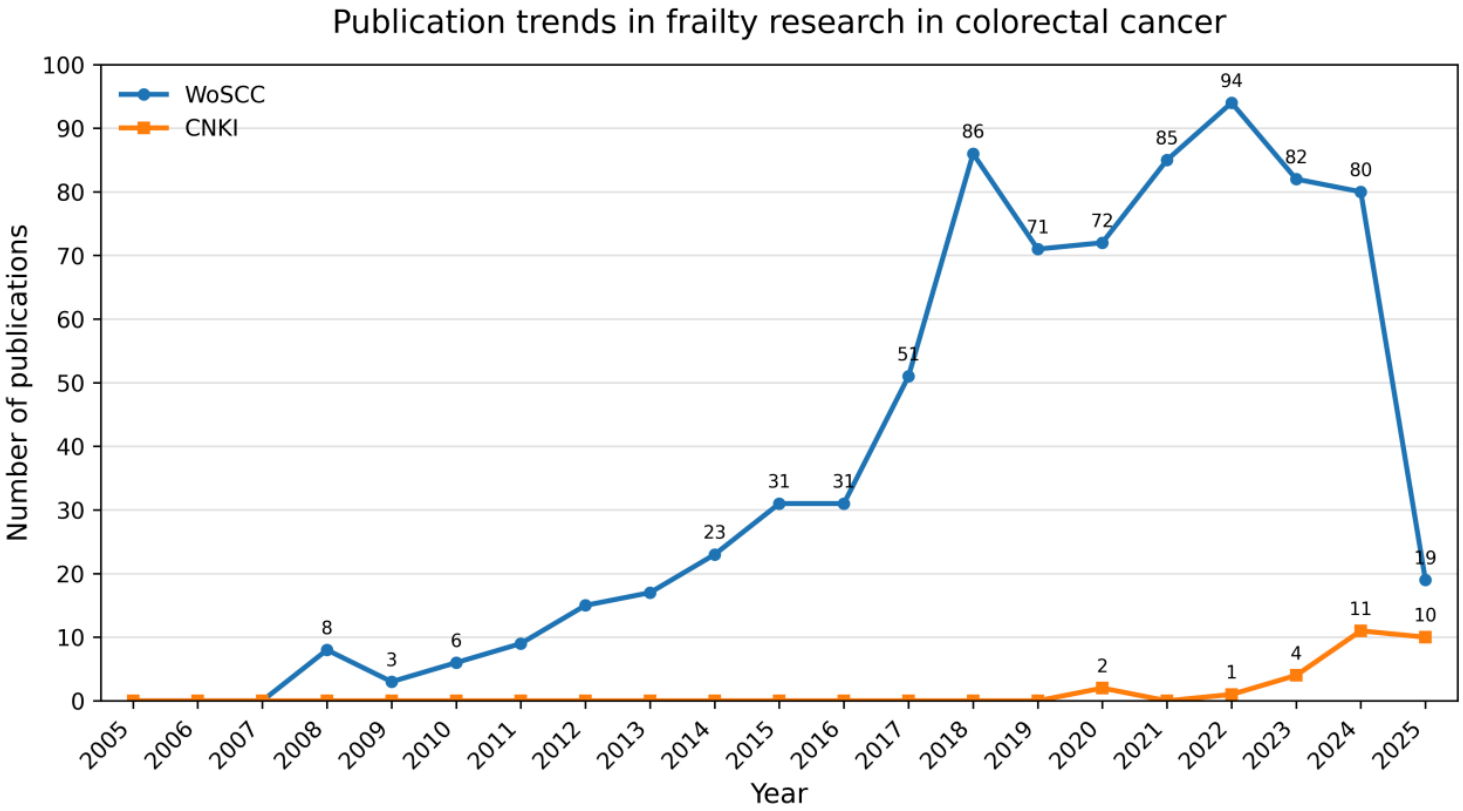


Figure 2

Publication trends in frailty research among patients with colorectal cancer from 2005 to 2025.

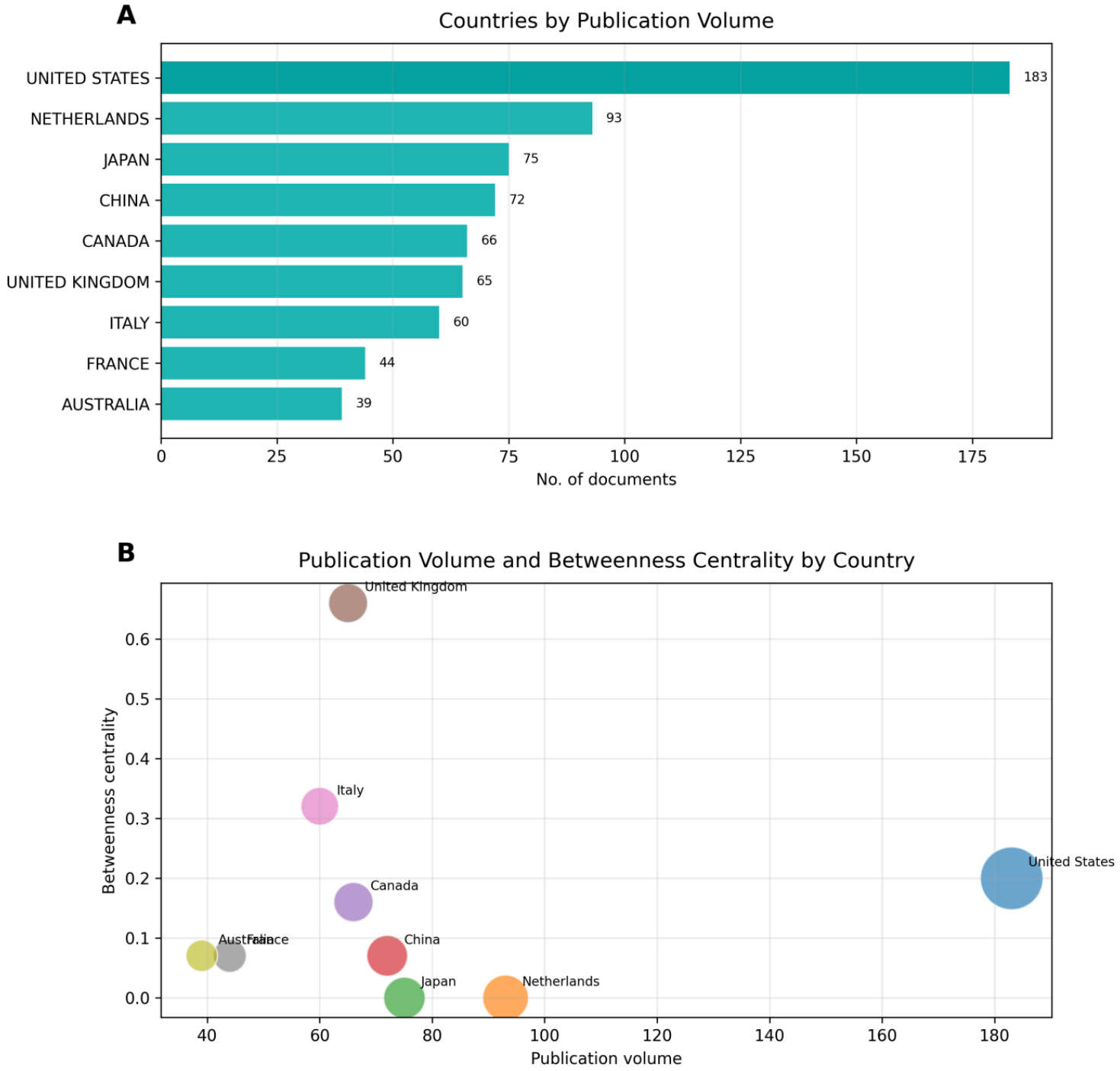


Figure 3

Country distribution and centrality analysis of frailty research in colorectal cancer.

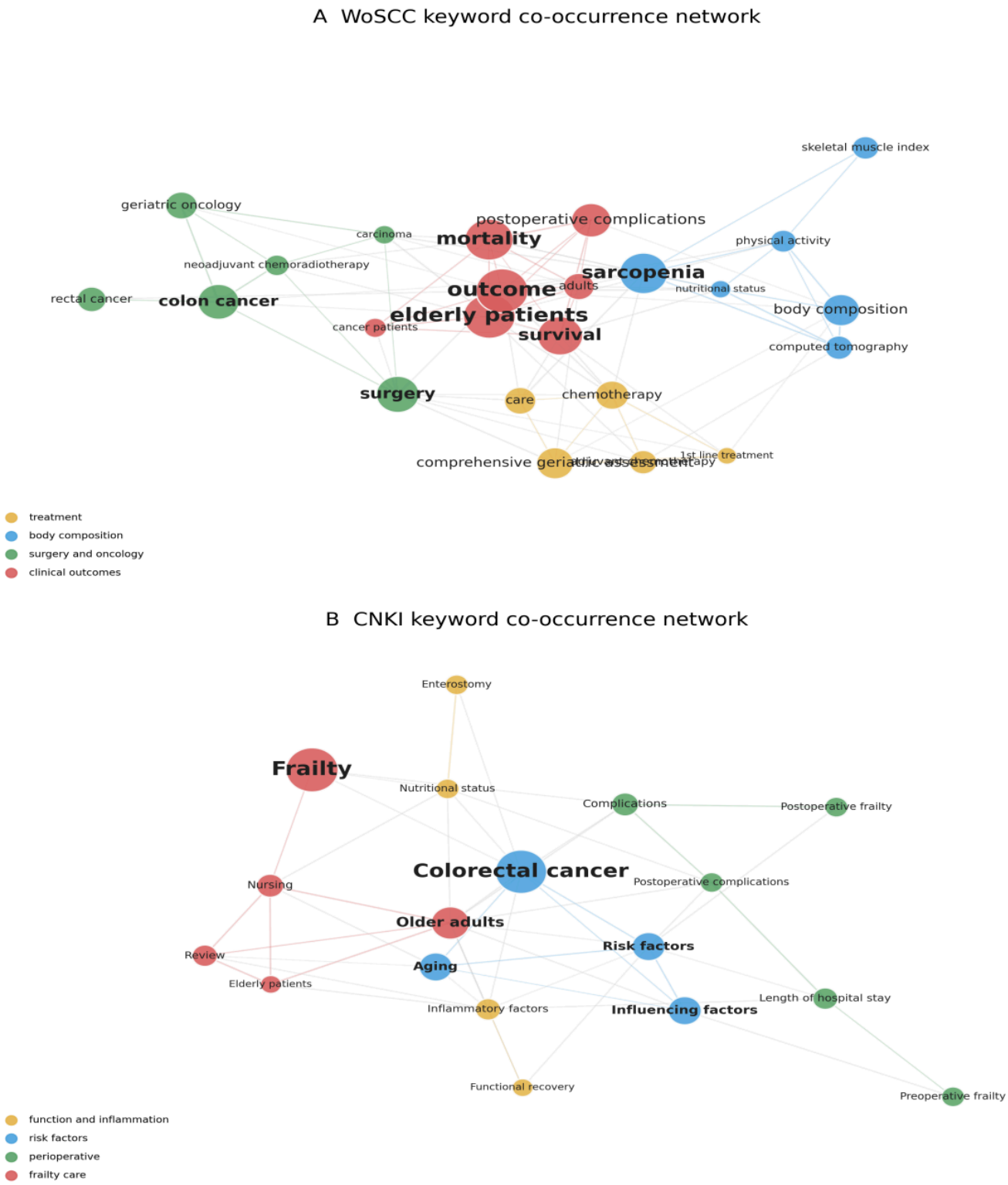


Figure 4

Keyword co-occurrence networks of frailty research in colorectal cancer. (A) WoSCC; (B) CNKI.

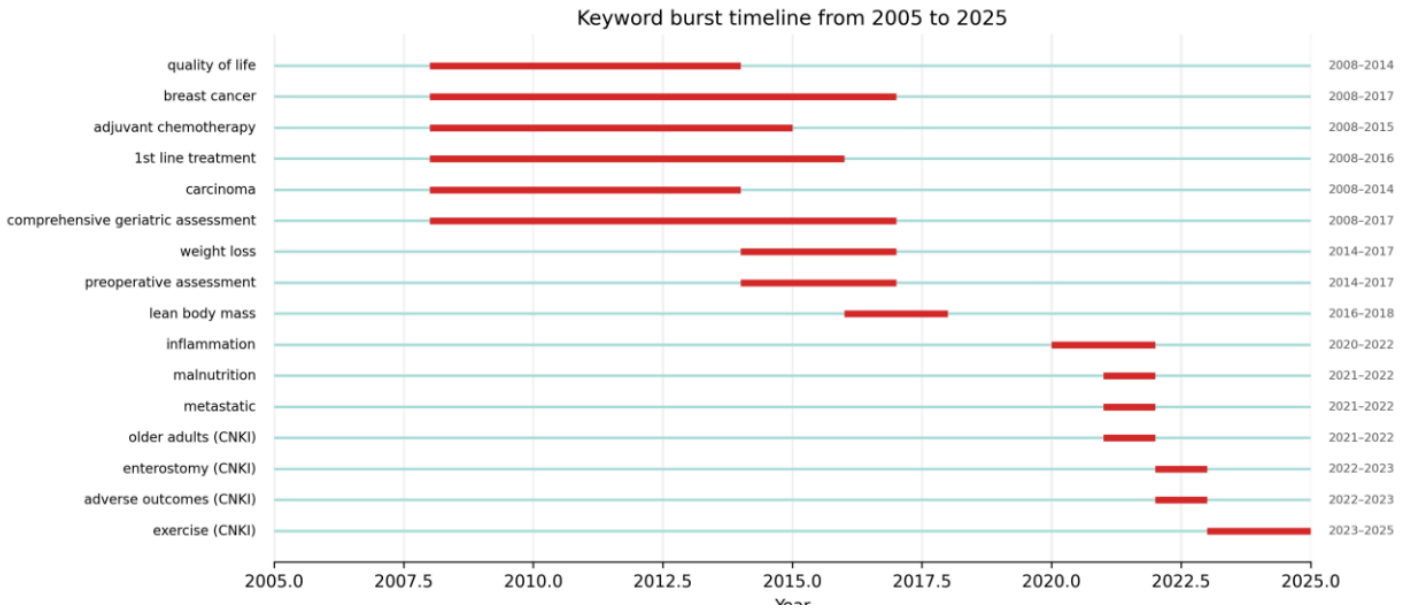


Figure 5

Keywords with the strongest citation bursts in frailty research in colorectal cancer. (A) WoSCC; (B) CNKI.