

Postprint: Core Symptoms and Influencing Factors of Gastrointestinal Symptom Clusters in Gastric Cancer Patients Undergoing Postoperative Chemotherapy

Authors: Zou Yanling^{1,2}, Wang Xiaoqing², Li Xun¹, Zhang Ziyang¹, Li Yi¹, Yang Lihua², Gao Juan², Guan Huiyun², Duan Peibei^{3*}

Date: 2024-02-05T00:00:00+00:00

Abstract

Background Gastric cancer patients undergoing postoperative chemotherapy experience multiple gastrointestinal symptoms that interact with each other, and there is a lack of effective intervention targets. In recent years, network analysis has become a hotspot for identifying intervention targets.

Objective To construct a gastrointestinal symptom network in gastric cancer patients during postoperative chemotherapy, identify core symptoms and analyze their influencing factors, thereby providing a reference for precise symptom management.

Methods Using convenience sampling, gastric cancer patients undergoing postoperative chemotherapy were selected as study subjects from the oncology medical and surgical wards of four tertiary Grade A traditional Chinese medicine hospitals in southern, central, and northern Jiangsu Province (Jiangsu Provincial Hospital of Traditional Chinese Medicine, Suzhou Hospital of Traditional Chinese Medicine, Wuxi Hospital of Traditional Chinese Medicine, Xuzhou Hospital of Traditional Chinese Medicine) between March and December 2022. The Gastric Cancer Specific Module of the M.D. Anderson Symptom Inventory was used to assess gastrointestinal symptoms and their severity, and patients' traditional Chinese medicine constitution classifications were evaluated. A gastrointestinal symptom network was constructed using R language to analyze centrality indices; univariate analysis and multiple linear regression analysis were employed to explore influencing factors of core gastrointestinal symptoms in gastric cancer patients undergoing postoperative chemotherapy.

Results A total of 362 electronic questionnaires were collected, with 355 valid questionnaires, yielding an effective response rate of 98.1%. Among

gastrointestinal symptoms in gastric cancer patients undergoing postoperative chemotherapy, the highest incidence rates were loss of appetite (83.1%), taste alteration (81.7%), and nausea (71.0%); the top three in severity were loss of appetite (2.77 points), taste alteration (2.50 points), and nausea (2.27 points). Network analysis revealed that taste alteration had the greatest strength ($rS=1.27$) and highest closeness centrality ($rC=1.50$); vomiting had the greatest betweenness centrality ($rB=1.76$). Univariate analysis showed statistically significant differences in taste alteration severity scores among patients with different genders, smoking histories, and traditional Chinese medicine constitutions ($P<0.05$). Multiple linear regression analysis indicated that gender, smoking history, and phlegm-dampness constitution were influencing factors of taste alteration severity scores in gastric cancer patients undergoing postoperative chemotherapy ($P<0.05$).

Conclusion Taste alteration is the core symptom of the gastrointestinal symptom cluster in gastric cancer patients undergoing postoperative chemotherapy, with gender, smoking history, and phlegm-dampness constitution being its influencing factors. Nursing staff can develop targeted interventions based on core symptoms and their influencing factors to improve the efficacy of gastrointestinal symptom management in gastric cancer patients during chemotherapy.

Full Text

Abstract

Background: Gastrointestinal symptoms in gastric cancer patients treated with postoperative chemotherapy are diverse and interconnected, with a lack of effective intervention targets. In recent years, network analysis has emerged as a prominent approach to identify intervention targets. **Objective:** To construct a network of gastrointestinal symptoms in gastric cancer patients treated with postoperative chemotherapy, identify core symptoms and analyze the factors influencing core symptoms, so as to provide a reference for precise symptom management. **Methods:** Convenience sampling method was used to select postoperative chemotherapy patients with gastric cancer in the medical oncology and surgical oncology department of four tertiary-level Chinese medicine hospitals (Jiangsu Provincial Hospital of Traditional Chinese Medicine, Suzhou Hospital of Traditional Chinese Medicine, Wuxi Hospital of Traditional Chinese Medicine, and Xuzhou Hospital of Traditional Chinese Medicine) in South, Central, and North Jiangsu Province, from March to December 2022, as the study subjects. The MD Anderson Symptom Inventory Gastrointestinal Cancer (MDASI-GI) was used for evaluating gastrointestinal symptoms and their severity among patients receiving postoperative chemotherapy for gastric cancer, as well as assessing the classification of traditional Chinese medicine constitution among patients. The network of gastrointestinal symptoms was constructed using an R package to identify the centrality indexes. The univariate analysis and multiple linear regression analysis were conducted to investigate factors influencing

core gastrointestinal symptoms in patients undergoing postoperative chemotherapy for gastric cancer. **Results:** A total of 362 electronic questionnaires were collected, 355 were valid, with a valid recovery rate of 98.1%. The highest incidence of gastrointestinal symptoms in patients with postoperative chemotherapy for gastric cancer was lack of appetite (83.1%), taste alteration (81.7%) and nausea (71.0%), and the top three in terms of severity were lack of appetite (2.77 points), taste alteration (2.50 points) and nausea (2.27 points). Network analysis showed that taste alteration had the highest intensity ($rS=1.27$) and the highest tight centrality ($rC=1.50$); vomiting had the highest betweenness centrality ($rB=1.76$). The results of univariate analysis showed statistically significant differences in the severity scores of taste alteration symptoms among postoperative chemotherapy patients with gastric cancer of different genders, smoking histories and traditional Chinese medicine constitutions ($P<0.05$). The results of multiple linear regression analysis showed that gender, smoking history and phlegm-damp substance were the factors influencing the severity of taste alteration symptoms in patients with gastric cancer after chemotherapy ($P<0.05$). **Conclusion:** Taste alteration is the core symptom of gastrointestinal symptoms in gastric cancer patients undergoing postoperative chemotherapy. Gender, smoking history, and phlegm-damp substance are influential factors contributing to taste alteration. Nursing staff can develop intervention strategies based on these core symptoms and their influencing factors to enhance the efficacy of managing gastrointestinal symptoms during chemotherapy in gastric cancer patients.

Keywords: Stomach neoplasms; Chemotherapy; Core symptoms; Gastrointestinal Tract; Network analysis; Taste alteration

Introduction

Gastric cancer is the third leading cause of cancer-related deaths worldwide [?]. Currently, the primary treatment approach for this disease involves surgery combined with postoperative adjuvant chemotherapy [?]. However, surgical treatment alters the physiological structure of the patient's digestive tract, and adjuvant chemotherapy further exacerbates gastrointestinal symptoms [?], severely impacting quality of life [?] and potentially leading to chemotherapy interruption, thereby reducing long-term survival rates [?]. Our research group has previously identified nine common gastrointestinal symptoms in postoperative chemotherapy patients with gastric cancer, including nausea, vomiting, and loss of appetite [?]. However, the numerous and interacting symptoms within this cluster lack effective intervention targets, resulting in low intervention precision and failing to demonstrate the advantages of symptom cluster management [?]. In recent years, symptom network analysis based on machine learning technology has gradually become a research hotspot in this field. This method can construct symptom networks and identify core symptoms through quantitative analysis of centrality indexes, providing intervention targets for clinical symptom management and achieving effective management of symptom clus-

ters [?]. Building upon our previous research, this study employed convenience sampling and network analysis to identify core symptoms within the gastrointestinal symptom cluster and explore influencing factors among postoperative chemotherapy patients with gastric cancer, providing a reference for targeted intervention and personalized symptom management.

1.1 Survey Subjects

Using convenience sampling, we selected postoperative chemotherapy patients with gastric cancer from the oncology medical and surgical wards of four tertiary Grade A Chinese medicine hospitals in southern, central, and northern Jiangsu Province (Jiangsu Provincial Hospital of Traditional Chinese Medicine, Suzhou Hospital of Traditional Chinese Medicine, Wuxi Hospital of Traditional Chinese Medicine, and Xuzhou Hospital of Traditional Chinese Medicine) between March and December 2022 as study subjects. Inclusion criteria were: (1) confirmed diagnosis of primary gastric cancer; (2) receiving postoperative chemotherapy; (3) age ≥ 18 years, clear consciousness, and ability to communicate and read normally; (4) informed consent and voluntary participation. Exclusion criteria were: (1) patients with severe cognitive dysfunction or mental illness; (2) patients with severe dysfunction of vital organs such as heart or brain; (3) patients unaware of their diagnosis.

Since the scale included nine symptoms, constructing the network model required estimating nine threshold parameters and 36 pairwise association parameters [$9 \times (9-1)/2$] [?], totaling 45 parameters. To ensure model reliability, the sample size was calculated at 3-5 cases per parameter [?], and considering a 20% attrition rate, the required sample size was 169-282 cases. All subjects provided informed consent and participated voluntarily. This study was approved by the hospital ethics committee (2021NL-089-03), and sub-center units followed the arrangements of their respective hospital science and technology departments for record management.

1.2 Measures

1.2.1 General Data Collection Form General data were collected through structured questionnaires in the “Hospital Research Data Collection and Management System,” including: gender, age, marital status, residence, education level, medical payment method, drinking history (defined as any past drinking behavior regardless of current status), smoking history (defined as any past smoking behavior regardless of current cessation), cancer stage, chemotherapy regimen, and constitution type.

1.2.2 MD Anderson Symptom Inventory-Gastrointestinal Cancer Module (MDASI-GI) Based on the 13 core symptoms of the Chinese version of the MD Anderson Symptom Assessment Scale [?], Wang et al. [?] added five gastrointestinal cancer-specific symptoms, totaling 18 items for evaluating symptoms in gastrointestinal cancer patients. This scale assesses

symptoms over the past 24 hours and demonstrates good internal consistency reliability (0.84-0.90) [?]. Following the original study guidelines, this study employed an 11-point Likert scale, where higher scores indicate more severe symptoms.

1.2.3 Traditional Chinese Medicine Constitution Classification This study referenced the TCM constitution classification standard proposed by Academician Wang Qi, which has been recognized as a society standard by the China Association of Chinese Medicine [?]. The standard includes nine constitution types. The original score for each subscale was calculated by summing item scores, then converted to a percentage: converted score (%) = (original score - number of items) \times 100 / (number of items \times 4). The constitution type with the highest score indicated the dominant constitution. In this study, all subjects' TCM constitution types were determined by senior attending physicians.

1.4 Statistical Methods

This study utilized the qgraph, bootnet, and ggplot2 packages in R software, calling the EBICglasso function to construct a symptom network diagram based on Spearman rank correlation analysis. Symptoms were represented as nodes, and connections between nodes as edges, with thicker edges indicating stronger correlations between symptoms. The centralityPlot function was used to generate charts including Strength, Closeness, and Betweenness indexes to evaluate node importance, proximity, and likelihood of serving as bridge symptoms. Strength reflects node importance in the network, measured by the sum of absolute correlation weights of edges, with larger values indicating greater influence on other symptoms. Closeness reflects node proximity to other nodes, measured by the inverse of the sum of distances between two nodes, with larger values indicating the symptom is more central in the network. Betweenness evaluates the likelihood of a node serving as a bridge, measured by the number of times the node lies on the shortest path between any two other nodes, with larger numbers indicating greater potential as a bridge symptom [?]. The corstability function performed bootstrap analysis to calculate stability. The stability of estimated network connections, closeness, and betweenness was assessed by calculating 95% confidence intervals (CI) for edge weight values. The correlation stability coefficient should ideally be >0.5 , but at minimum >0.25 [?].

This study used SPSS 25.0 software to analyze the incidence, severity, and influencing factors of gastrointestinal symptoms in postoperative chemotherapy patients with gastric cancer. Since severity scores for gastrointestinal symptoms did not follow a normal distribution, they were expressed as M(P25, P75), with means as supplementary evaluation tools. For influencing factors of core symptoms, measurement data were expressed as $(\bar{x}\pm s)$, with t-tests for two-group comparisons and ANOVA for multi-group comparisons. Multiple linear regression analysis was used to explore influencing factors of core symptoms. $P < 0.05$

was considered statistically significant.

Results

2.1 General Characteristics of Survey Subjects

A total of 362 electronic questionnaires were collected. Seven incomplete questionnaires were excluded, leaving 355 valid questionnaires with an effective recovery rate of 98.1%. The sample included 265 males (74.6%) and 90 females (25.4%); age ranged from 28-82 years, with a mean age of (61.0 ± 10.4) years; 343 were married (96.6%); 333 had medical insurance (93.8%); 219 were urban residents (61.7%); 212 had junior high school education or below (60.0%); 193 had stage III cancer (54.4%); and 341 had biased constitution types (96.0%).

2.2 Analysis of Gastrointestinal Symptom Incidence and Severity

Among gastrointestinal symptoms in postoperative chemotherapy patients with gastric cancer, the highest incidence rates were loss of appetite (83.1%), taste alteration (81.7%), and nausea (71.0%). The top three symptoms in terms of severity were loss of appetite (2.77 points), taste alteration (2.50 points), and nausea (2.27 points). Details are shown in Table 1 .

2.3 Network Analysis of Gastrointestinal Symptoms in Postoperative Chemotherapy Patients with Gastric Cancer

Based on edge thickness in the symptom network, the three symptom pairs with strongest correlations were: taste alteration-loss of appetite ($r=0.80$), nausea-vomiting ($r=0.76$), and taste alteration-bloating ($r=0.60$), as shown in Figure 1 [Figure 1: see original paper]. According to centrality indexes, the top three symptoms by strength were: taste alteration ($rS=1.27$), vomiting ($rS=0.95$), and loss of appetite ($rS=0.74$). The top three by closeness centrality were: taste alteration ($rC=1.50$), vomiting ($rC=0.65$), and loss of appetite ($rC=0.48$). The top two by betweenness centrality were: vomiting ($rB=1.76$) and bloating ($rB=1.76$), as shown in Figure 2 [Figure 2: see original paper].

Further testing of network stability yielded correlation stability coefficients of 0.825 for strength, 0.672 for closeness centrality, and 0.668 for betweenness centrality, indicating good stability for strength and closeness centrality indexes, with betweenness centrality showing the poorest stability. Therefore, this study selected strength and closeness centrality indexes as primary criteria for determining core symptoms [?].

2.4 Univariate Analysis of Factors Influencing Taste Alteration

No statistically significant differences in taste alteration scores were found among patients with different ages, marital status, residence, education level, medical payment method, drinking history, cancer stage, or chemotherapy

regimen ($P>0.05$). However, statistically significant differences were observed among patients with different genders, smoking histories, and TCM constitutions ($P<0.05$), as shown in Table 2 .

2.5 Multivariate Analysis of Factors Influencing Taste Alteration

Variables with statistically significant differences in univariate analysis were entered as independent variables, with chemotherapy-period taste alteration symptom scores as the dependent variable in multiple linear regression analysis. The results showed that gender, smoking history, and phlegm-damp constitution were influencing factors for taste alteration symptom severity scores in postoperative chemotherapy patients with gastric cancer ($P<0.05$), as shown in Table 3 .

Discussion

3.1 Taste Alteration as the Core Symptom with Highest Strength and Closeness in the Gastrointestinal Symptom Cluster

This study's results demonstrate that in symptom network analysis, taste alteration exhibited the maximum strength and closeness centrality, occupying a central position ($rC=1.50$, $rS=1.27$). Taste alteration is most closely related to and has the strongest influence on other symptoms, making it the core symptom among gastrointestinal symptoms. Taste alteration represents a distortion or abnormality of taste that negatively impacts patients' nutritional intake [?, ?]. Research shows that taste alteration has an incidence rate of 66%-93% and is one of the most common symptoms during chemotherapy [?]. This occurs because chemotherapy drugs directly or indirectly kill rapidly proliferating taste bud cells, exacerbating taste alteration [?]. Studies have shown that platinum-based chemotherapy regimens are particularly likely to cause taste alteration [?], and these drugs are commonly used in the chemotherapy regimens in this study. Wei et al. [?] found that taste alteration is the core symptom of neurotoxic symptom clusters in gastric cancer patients during postoperative chemotherapy. Han et al. [?] discovered in a three-week longitudinal study that taste alteration is a stable and core symptom in gastrointestinal cancer patients' chemotherapy symptom clusters. Ukovic et al. [?] found that taste corresponds to improved prognosis in cancer patients. Thus, taste alteration significantly impacts patients' physical and psychological health. Therefore, healthcare professionals should, on one hand, recognize the role of taste alteration in the gastrointestinal symptom network, strengthen knowledge training, timely assess symptom changes, encourage patients to actively report symptoms, guide patients in self-management of diet [?] and emotional regulation [?] to improve appetite, and track symptom management effectiveness with timely feedback to continuously improve the symptom management system. On the other hand, further research is needed on the core role of taste alteration in postoperative gastric cancer patients, exploring its mechanisms and associations with objective indicators such

as blood markers to enhance the efficiency and precision of gastric cancer symptom management interventions.

This study found that loss of appetite was the most common and severe symptom in gastric cancer patients, closely related to taste alteration. Loss of appetite had the highest incidence and severity, consistent with findings from Wang [?], Rha et al. [?], Papachristou et al. [?], and Wang [?], possibly due to surgical stress or chemotherapy drug stimulation causing abnormal secretion of neurotransmitters and inflammatory mediators and gastrointestinal mucosal damage. The association between loss of appetite and taste alteration ($r=0.80$) was the strongest, representing the most tightly connected symptom pair within the gastrointestinal symptom cluster, consistent with research by Zhu et al. [?] and Zhang [?]. This may be because taste alteration affects patients' eating behaviors and emotional states, leading to loss of appetite, malnutrition, electrolyte imbalance, and even hindering further treatment, seriously threatening patients' health [?, ?]. Nursing staff should pay attention to appetite changes in chemotherapy patients, monitor eating behaviors, and considering China's diverse food culture, actively explore personalized intervention strategies tailored to different regional dietary structures and habits. Additionally, enhanced telephone follow-up for home-based patients during chemotherapy intervals can improve self-management efficacy, effectively reducing the incidence and severity of appetite loss, improving nutritional status, and thereby enhancing quality of life.

3.2 Influencing Factors of Taste Alteration

3.2.1 Gender This study found that female patients experienced more severe taste alteration symptoms during postoperative chemotherapy than male patients, representing a high-risk population for taste alteration. These findings are consistent with studies by Barajas Galindo et al. [?] and McGreevy et al. [?], possibly related to differences in sex hormone levels between men and women [?], leading to decreased taste and smell functions. Research shows that women have more mucous-like taste buds and taste pores than men, resulting in higher taste sensitivity [?]. Additionally, women may experience greater psychological burden after illness, with anxiety and depression being more common in females, and these conditions are closely related to taste alteration [?]. Therefore, attention to female patients' psychological states is crucial in nursing care. Methods such as guiding family members and friends to communicate with patients, providing peer support, and sharing meals can enhance patients' sense of belonging and psychological support. Beyond psychological care, healthcare professionals should also consider the impact of women's changing social roles and different cultural backgrounds on treatment. Nursing staff should continuously enhance their professional knowledge and skills to better address the psychological needs of female patients and provide more comprehensive, personalized care.

3.2.2 Smoking This study showed that gastric cancer patients who smoked experienced more severe taste alteration during chemotherapy, suggesting that smoking cessation should be recommended during chemotherapy. These findings align with research by Vennemann et al. [?], Kaizu et al. [?], and Yoshimoto et al. [?]. The likely reason is that tobacco components may damage olfactory and taste cells, thereby interfering with taste and smell. Additionally, smoking worsens oral hygiene and can cause periodontal disease and other oral conditions, limiting dietary intake and increasing the risk of malnutrition. According to smoking cessation measures proposed in the “Healthy China 2030” Planning Outline [?], healthcare professionals should conduct in-depth smoking cessation education, emphasize the hazards of smoking to gastric cancer chemotherapy patients, provide relevant smoking cessation information and support, and enhance patients’ awareness and determination to quit. Actively promoting smoke-free hospital environments by posting prominent “No Smoking” warning signs in wards is an effective measure to remind patients and visitors to comply with smoke-free regulations. Hospitals should actively establish smoking cessation clinics by creating smoking cessation support groups, providing telephone counseling services, and implementing smoking cessation incentive programs. By offering diverse support options, different patient needs can be met, improving smoking cessation success rates.

3.2.3 Phlegm-Damp Constitution This study revealed that compared to balanced constitution, gastric cancer patients with phlegm-damp constitution experienced more severe taste alteration, with phlegm-damp constitution being a high-risk biased constitution for taste alteration. Phlegm-damp constitution refers to the accumulation of phlegm and dampness due to internal fluid retention, characterized by thick greasy tongue coating and vomiting of clear watery phlegm [?, ?]. Xu [?] found that phlegm-damp constitution accounted for the largest proportion (approximately 24%) of biased constitutions in gastric cancer patients during chemotherapy, and showed significantly higher characteristics than other symptoms in gastrointestinal manifestations such as oral mucositis, nausea, and vomiting. Zhang et al. [?] found that phlegm-damp constitution is one of the main biased constitutions in gastric cancer patients after chemotherapy and affects patient prognosis. Wang Qi [?] proposed the theory of “constitution-disease correlation” and “modifiable constitution,” suggesting that constitution is an important basis for predicting disease development and prognosis. With the deepening of TCM concepts of “preventing disease before onset” and “preventing disease progression,” the National Health Commission proposed in the “Healthy China Action (2019-2030)” the next goal of improving the cancer prevention and treatment system and advancing cancer prevention and control [?]. Studies have found that early intervention with traditional Chinese medicine can alleviate adverse reactions such as taste alteration during chemotherapy in gastric cancer patients [?]. This suggests that healthcare professionals should assess patients’ constitution early and implement active constitution interventions for patients with phlegm-damp constitution, such as

acupoint massage [?] and auricular point pressing [?], to improve constitutional weaknesses, block the adverse effects of constitutional factors on taste alteration, maintain the body in a healthy state, and achieve the goal of “when vital qi exists within, pathogenic factors cannot invade.”

Conclusion

This study primarily employed symptom network analysis to construct a gastrointestinal symptom network for postoperative chemotherapy patients with gastric cancer, finding that taste alteration occupies the most central position with the strongest strength and closeness connections, yet receives insufficient attention in current research. Gender, smoking, and phlegm-damp constitution are influencing factors of taste alteration. Therefore, oncology nurses should early identify high-risk patients for taste alteration during chemotherapy and implement targeted management to prevent its occurrence. Since this study is a cross-sectional survey, future longitudinal studies following gastric cancer patients' chemotherapy cycles are needed. Additionally, further research should identify more influencing factors of taste alteration during chemotherapy and explore mechanisms of action to provide evidence for efficient and precise symptom management.

Author Contributions: Zou Yanling and Duan Peibei were responsible for conceptualization and overall framework design. Zou Yanling, Li Xun, Zhang Ziyang, and Li Yi were responsible for data collection, collation, and entry. Zou Yanling, Wang Xiaoqing, Yang Lihua, and Gao Juan were responsible for results analysis and interpretation. Zou Yanling and Guan Huiyun were responsible for English revision. Duan Peibei, Wang Xiaoqing, and Yang Lihua were responsible for manuscript revision. Duan Peibei was responsible for quality control and final approval of the article, with overall responsibility and supervision.

Conflict of Interest: The authors declare no conflict of interest.

Funding: Jiangsu Provincial Traditional Chinese Medicine Science and Technology Development Plan Project (ZD202005); 2023 Nightingale Special Project (Y23017)

Citation: Zou YL, Wang XQ, Li X, et al. Analysis of gastrointestinal core symptoms and influencing factors in postoperative chemotherapy patients with gastric cancer [J]. Chinese General Practice, 2024. [Epub ahead of print].

Received: July 14, 2023; **Revised:** November 4, 2023; **Accepted:** [Epub ahead of print]

Editor: Jia Mengmeng

References

[1] AJANI J A, D' AMICO T A, BENTREM D J, et al. Gastric cancer, version 2.2022, NCCN clinical practice guidelines in oncology[J]. J Natl Compr Canc

Netw, 2022, 20(2): 167-192. DOI: 10.6004/jnccn.2022.0008.

[2] ZHANG Q Q, QIAN Y, YIN Y. Comparison of S-1-based vs. capecitabine-based adjuvant chemotherapy for patients with gastric cancer: a systematic review and meta-analysis[J]. *Eur J Clin Pharmacol*, 2021, 77(12): 1791-1804. DOI: 10.1007/s00228-021-03187-w.

[3] HOSHI H. Management of gastric adenocarcinoma for general surgeons[J]. *Surg Clin North Am*, 2020, 100(3): 523-534. DOI: 10.1016/j.suc.2020.02.004.

[4] MIASKOWSKI C, BARSEVICK A, BERGER A, et al. Advancing symptom science through symptom cluster research: expert panel proceedings and recommendations[J]. *J Natl Cancer Inst*, 2017, 109(4): djw253. DOI: 10.1093/jnci/djw253.

[5] CHANG X S, ZHU Y J, PENG J J, et al. Efficacy observation of acupuncture in improving symptom burden in patients with gastric cancer during postoperative adjuvant chemotherapy[J]. *Chinese Acupuncture & Moxibustion*, 2022, 42(11): 1226-1232. DOI: 10.13703/j.0255-2930.20211106-k0004.

[6] WANG X. Longitudinal study on symptom clusters and their subgroups identification in postoperative chemotherapy patients with gastric cancer[D]. Nanjing: Nanjing University of Chinese Medicine, 2019.

[7] XIA C, DUAN P B, YANG L, et al. Investigation of sentinel symptoms in 166 postoperative chemotherapy patients with gastric cancer[J]. *Journal of Nursing*, 2021, 28(8): 44-49. DOI: 10.16460/j.issn1008-9969.2021.08.044.

[8] YANG Z F, ZHU Z, HU Y, et al. Application progress of symptom networks in symptom management[J]. *Journal of Nursing Science*, 2022, 37(5): 91-94. DOI: 10.3870/j.issn.1001-4152.2022.05.091.

[9] EPSKAMP S, BORSBOOM D, FRIED E I. Estimating psychological networks and their accuracy: a tutorial paper[J]. *Behav Res Methods*, 2018, 50(1): 195-212. DOI: 10.3758/s13428-017-0862-1.

[10] MAO C, LI Y Y, ZHANG Y X, et al. Relationship between alexithymia and cognitive emotion regulation strategies in nursing college students: a network analysis model[J]. *Chinese Journal of Clinical Psychology*, 2021, 29(4): 753-757. DOI: 10.16128/j.cnki.1005-3611.2021.04.018.

[11] WANG X S, WILLIAMS L A, ENG C, et al. Validation and application of a module of the M. D. Anderson Symptom Inventory for measuring multiple symptoms in patients with gastrointestinal cancer (the MDASI-GI)[J]. *Cancer*, 2010, 116(8): 2053-2063. DOI: 10.1002/cncr.24920.

[12] CLEELAND C S, MENDOZA T R, WANG X S, et al. Assessing symptom distress in cancer patients: the M.D. Anderson Symptom Inventory[J]. *Cancer*, 2000, 89(7): 1634-1646. DOI: 10.1002/1097-0142(20001001)89:7<1634:aid-cncr29>3.0.co;2-v.

- [13] WANG X S, WANG Y, GUO H, et al. Chinese version of the M. D. Anderson Symptom Inventory: validation and application of symptom measurement in cancer patients[J]. *Cancer*, 2004, 101(8): 1890-1901. DOI: 10.1002/cncr.20448.
- [14] Beijing University of Chinese Medicine. Classification and determination of TCM constitution[S]. China Association of Chinese Medicine, 2009.
- [15] PAPACHRISTOU N, BARNA GHI P, COOPER B, et al. Network analysis of the multidimensional symptom experience of oncology[J]. *Sci Rep*, 2019, 9(1): 2258. DOI: 10.1038/s41598-018-36973-1.
- [16] ZHU Z, SUN Y L, KUANG Y, et al. Contemporaneous symptom networks of multidimensional symptom experiences in cancer survivors: a network analysis[J]. *Cancer Med*, 2023, 12(1): 663-673. DOI: 10.1002/cam4.4904.
- [17] YE Y X, QIN L, ZENG K, et al. Identification of core symptoms and symptom clusters in cancer patients during treatment intervals[J]. *Journal of Nursing Science*, 2022, 37(1): 20-24. DOI: 10.3870/j.issn.1001-4152.2022.01.020.
- [18] ZHANG L Y, GUO R X, LIANG Y R, et al. Effect of chemotherapy-related taste alteration on nutrition and quality of life in patients with gastrointestinal tumors[J]. *Journal of Nursing*, 2019, 34(21): 80-82. DOI: 10.3870/j.issn.1001-4152.2019.21.080.
- [19] ZHANG T T, ZHANG L Y. Research progress on interventions for chemotherapy-related taste alteration in cancer patients[J]. *Journal of Nursing*, 2020, 35(12): 99-102. DOI: 10.3870/j.issn.1001-4152.2020.12.099.
- [20] CAMPAGNA S, GONELLA S, SPERLINGA R, et al. Prevalence, severity, and self-reported characteristics of taste alterations in patients receiving chemotherapy[J]. *Oncol Nurs Forum*, 2018, 45(3): 342-353. DOI: 10.1188/18.ONF.342-353.
- [21] LARSEN A K, THOMSEN C, SANDEN M, et al. Taste alterations and oral discomfort in patients receiving chemotherapy[J]. *Support Care Cancer*, 2021, 29(12): 7431-7439. DOI: 10.1007/s00520-021-06316-4.
- [22] WEI L Z, LV F, LUO C F, et al. Study on sentinel symptoms and influencing factors of postoperative chemotherapy in patients with gastric cancer[J]. *Eur J Oncol Nurs*, 2023, 64: 102318. DOI: 10.1016/j.ejon.2023.102318.
- [23] HAN C J, REDING K, COOPER B A, et al. Stability of symptom clusters in patients with gastrointestinal cancers receiving chemotherapy[J]. *J Pain Symptom Manage*, 2019, 58(6): 989-1001.e10. DOI: 10.1016/j.jpainsymman.2019.07.029.
- [24] UKOVIC B, PORTER J. Nutrition interventions to improve the appetite of adults undergoing cancer treatment: a systematic review[J]. *Support Care Cancer*, 2020, 28(10): 4575-4583. DOI: 10.1007/s00520-020-05475-0.
- [25] SPENCER A S, DA SILVA DIAS D, CAPELAS M L, et al. Managing severe dysgeusia and Dysosmia in lung cancer patients: a systematic scoping

- review[J]. *Front Oncol*, 2021, 11: 774081. DOI: 10.3389/fonc.2021.774081.
- [26] ZHAO C X, LAI L Z, ZHANG L, et al. The effects of acceptance and commitment therapy on the psychological and physical outcomes among cancer patients: a meta-analysis with trial sequential analysis[J]. *J Psychosom Res*, 2021, 140: 110304. DOI: 10.1016/j.jpsychores.2020.110304.
- [27] WANG X. Study on symptom clusters and their influencing factors in post-operative gastric cancer patients[D]. Tangshan: North China University of Science and Technology, 2018.
- [28] RHA S Y, LEE J. Stable symptom clusters and evolving symptom networks in relation to chemotherapy cycles[J]. *J Pain Symptom Manage*, 2021, 61(3): 544-554. DOI: 10.1016/j.jpainsymman.2020.08.008.
- [29] ZHU Y, WANG W L, ZHOU L H, et al. Investigation of symptom clusters within one week after gastrointestinal tumor surgery[J]. *Chinese General Practice*, 2015, 18(21): 2568-2572. DOI: 10.3969/j.issn.1007-9572.2015.21.016.
- [30] ZHANG L. Effect of foot reflexology combined with music therapy on symptom clusters and quality of life in postoperative gastric cancer patients[D]. Hohhot: Inner Mongolia Medical University, 2020.
- [31] PELLEGRINI M, MERLO F D, AGNELLO E, et al. Dysgeusia in patients with breast cancer treated with chemotherapy-a narrative review[J]. *Nutrients*, 2023, 15(1): 226. DOI: 10.3390/nu15010226.
- [32] DE KRUIF A J, WESTERMAN M J, WINKELS R M, et al. Exploring changes in dietary intake, physical activity and body weight during chemotherapy in women with breast cancer: a Mixed-Methods Study[J]. *J Hum Nutr Diet*, 2021, 34(3): 550-561. DOI: 10.1111/jhn.12843.
- [33] BARAJAS GALINDO D E, VIDAL-CASARIEGO A, CALLEJA-FERNÁNDEZ A, et al. Appetite disorders in cancer patients: impact on nutritional status and quality of life[J]. *Appetite*, 2017, 114: 23-27. DOI: 10.1016/j.appet.2017.03.020.
- [34] MCGREEVY J, ORREVALL Y, BELQAIID K, et al. Characteristics of taste and smell alterations reported by patients after starting treatment for lung cancer[J]. *Support Care Cancer*, 2014, 22(10): 2635-2644. DOI: 10.1007/s00520-014-2215-7.
- [35] DE VRIES Y C, HELMICH E, KARSTEN M D, et al. The impact of chemosensory and food-related changes in patients with advanced oesophagogastric cancer treated with capecitabine and oxaliplatin: a qualitative study[J]. *Support Care Cancer*, 2016, 24(7): 3119-3126. DOI: 10.1007/s00520-016-3128-z.
- [36] CHENG H T, HO M C, HUNG K Y. Affective and cognitive rather than somatic symptoms of depression predict 3-year mortality in patients on chronic hemodialysis[J]. *Sci Rep*, 2018, 8(1): 5868. DOI: 10.1038/s41598-018-24267-5.

- [37] VENNEMANN M M, HUMMEL T, BERGER K. The association between smoking and smell and taste impairment in the general population[J]. *J Neurol*, 2008, 255(8): 1121-1126. DOI: 10.1007/s00415-008-0807-9.
- [38] KAIZU M, KOMATSU H, YAMAUCHI H, et al. Characteristics of taste alterations in people receiving taxane-based chemotherapy and their association with appetite, weight, and quality of life[J]. *Support Care Cancer*, 2021, 29(9): 5103-5114. DOI: 10.1007/s00520-021-06066-3.
- [39] YOSHIMOTO N, INAGAKI M, SEKIGUCHI Y, et al. Chemotherapy alters subjective senses of taste and smell but not dietary patterns in Japanese lung cancer patients[J]. *Support Care Cancer*, 2020, 28(4): 1667-1674. DOI: 10.1007/s00520-019-04958-z.
- [40] Xinhua News Agency. CPC Central Committee and State Council issued the “Healthy China 2030” Planning Outline[J]. *Gazette of the State Council of the People’s Republic of China*, 2016(32): 5-20.
- [41] WANG Q. Preface—Scientific paradigm and original research on foundation and application of TCM constitutionology: First International Constitution Medicine Forum—10th National TCM Constitution Academic Annual Meeting of China Association of Chinese Medicine[C]. Beijing, 2012.
- [42] WANG H Y. Study on TCM syndrome element distribution and syndrome types in gastric cancer patients based on data analysis[D]. Jinan: Shandong University of Traditional Chinese Medicine, 2022.
- [43] XU P. Relationship between chemotherapy toxicity and TCM constitution in gastric cancer patients[J]. *Jilin Journal of Traditional Chinese Medicine*, 2018, 38(6): 648-651. DOI: 10.13463/j.cnki.jlzyy.2018.06.008.
- [44] ZHANG P, YU M H, HE L B, et al. Relationship between TCM constitution types and infection, immune function, and gastrointestinal flora during chemotherapy in gastric cancer patients[J]. *Chinese Journal of Nosocomiology*, 2023, 33(3): 386-390.
- [45] Healthy China Action (2019-2030)[J]. *China Digital Medicine*, 2019, 14(11): 17.
- [46] NAN X H, WANG X X. Professor Wang Xixing’s experience in treating chemotherapy side effects[J]. *China Continuing Medical Education*, 2015, 7(18): 200-201. DOI: 10.3969/j.issn.1674-9308.2015.18.119.
- [47] XIE Y F, CHEN Y S, WU J W. Clinical observation of traditional Chinese medicine hot compress combined with acupoint massage in treating nausea and vomiting caused by chemotherapy in spleen deficiency and phlegm-dampness syndrome tumors[J]. *Chinese Medicine Modern Distance Education of China*, 2020, 18(24): 103-105. DOI: 10.3969/j.issn.1672-2779.2020.24.042.
- [48] LI Y, GAO H X, WU T T, et al. Visual analysis of knowledge map of phlegm-damp constitution in China based on CiteSpace[J]. *World Chinese Medicine*,

2023, 18(8): 1152-1159. DOI: 10.3969/j.issn.1673-7202.2023.08.016.

Note: Figure translations are in progress. See original paper for figures.

Source: ChinaXiv – Machine translation. Verify with original.