

Asia Pacific Journal of Clinical Medical Research

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Asia Pacific Journal of Clinical Medical Research

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The Impact and Significance of Prenatal Blood Analysis on Postpartum Hemorrhage in Advanced-Age Primiparous Women

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Abstract: Objective: To investigate the correlation between prenatal plasma fibrinogen, D-dimer, hemoglobin, and platelet levels and postpartum hemorrhage in primiparous women of advanced maternal age. Methods: Fifty elderly primiparous women who delivered without postpartum hemorrhage and 50 who experienced postpartum hemorrhage were assigned to the control and experimental groups, respectively. Five milliliters of fasting venous blood were collected from each woman between 31 and 33 weeks of gestation. FIB, D-dimer, Hb, and PLT levels were measured using a fully automated hematology analyzer. Multivariate logistic regression analysis was performed, and ROC curves were plotted. Results: Compared with the control group, the experimental group showed statistically significant differences in FIB and Hb levels ($P < 0.05$), and extremely significant differences in PLT levels ($P < 0.01$). There was no statistically significant difference in D-D levels between the two groups ($P > 0.05$). FIB and PLT were identified as independent risk factors for postpartum hemorrhage, and both may contribute to the occurrence of postpartum hemorrhage. Conclusion: FIB and PLT showed significant correlations with postpartum hemorrhage, suggesting that FIB and PLT may contribute to the development of postpartum hemorrhage.

Keywords: Advanced Maternal Age; FIB; D-D; Hb; PLT; Postpartum Hemorrhage; Multivariate Logistic Regression Analysis; ROC Curve

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Postpartum hemorrhage (PPH) typically refers to vaginal bleeding exceeding 500 mL within 24 hours of delivery and is one of the most common complications in obstetrics. Statistics indicate that approximately 25% of maternal deaths worldwide are associated with postpartum hemorrhage. Even among survivors, sequelae such as puerperal infections, transfusion-related complications, postpartum mental disorders, and even Sheehan's syndrome may occur, severely impacting their quality of life^[1]. Therefore, the effective prediction and prevention of postpartum hemorrhage have become a global priority in obstetric research. Advanced maternal age (AMA) generally refers to pregnant women aged 35 or older. In recent decades, the number of women delaying childbearing has been increasing worldwide. In the United States, the proportion of births among women aged 35–39 and 40–44 rose by 5% and 8%, respectively, between 2006–2007 and 2014–2015; by 2015, women aged 35 and older accounted for 15.7% of all births^[2]. In England and Wales, the average age at first birth rose from 27.7 years in 1990 to 30.5 years in 2022. China has shown a similar trend, with the fertility rate for women aged 35–39 rising from 10.98‰ in 2005 to 18.60‰ in 2015, while the fertility rate for women aged 40–44 rose from 2.05‰ to 5.37‰ over the same period.

Recent studies indicate that the proportion of advanced-age pregnancies in China ranges from 10.00% to 20.24%. Postpartum hemorrhage is the leading cause of maternal mortality worldwide, and older primiparous women face a higher risk of postpartum hemorrhage due to their specific physiological characteristics^[3].

The increased risk of complications during spontaneous delivery in older mothers stems primarily from age-related physiological changes, including declining ovarian function, impaired vascular function, a weakened immune system, and reduced uterine contractility. These changes make older mothers more susceptible to complications such as gestational hypertension, gestational diabetes, and postpartum hemorrhage^[4]. The relationship between prenatal coagulation parameters and postpartum hemorrhage is receiving increasing attention. Plasma fibrinogen serves as a key substrate in the coagulation process; D-dimer reflects fibrinolytic system activity; hemoglobin reflects the body's oxygenation capacity and reserve function; and platelets are a core element of primary hemostasis^[5]. This study analyzes the correlation between prenatal plasma fibrinogen, D-dimer, hemoglobin, and platelet levels and postpartum hemorrhage, examining the associations and trends between these factors. The aim is to provide a theoretical foundation for advancing the diagnosis and treatment of postpartum hemorrhage in the western Guangxi region, with the goal of offering insights for the early clinical detection and risk prediction of postpartum hemorrhage and laying the groundwork for further research.

1. General Information

Fifty elderly primiparous women who delivered at our hospital without postpartum hemorrhage were randomly selected as the control group, and fifty elderly primiparous women who delivered at our hospital with postpartum hemorrhage were randomly selected as the experimental group. Among them, cases with postpartum blood loss exceeding 1,000 mL were classified as severe postpartum hemorrhage, while cases with postpartum blood loss between 500 and 1,000 mL were classified as normal postpartum hemorrhage. This study must be submitted to the hospital's Institutional Review Board for review and approval.

Inclusion Criteria: Patients meeting the relevant diagnostic criteria outlined in *Obstetrics and Gynecology*; all patients were singleton pregnancies; maternal age > 35 years; patients in the observation group with postpartum blood loss exceeding 500 mL within 24 hours, etc.

Exclusion Criteria: Patients with pre-existing coagulation disorders^[6].

2. Method

2.1 Sample Collection

Blood samples were collected from pregnant women between 31 and 33 weeks of gestation for testing. A 5-mL sample of fasting venous blood was drawn from each woman. Of this, 3 mL was collected into a vacuum-sealed anticoagulant tube, centrifuged at 3,000 rpm for 5 minutes to separate the plasma. Plasma fibrinogen (FIB), D-dimer (D-D), and hemoglobin (Hb) levels were measured using a fully automated hematology analyzer. The remaining 2 mL of venous blood was analyzed on the same instrument to determine platelet count (PLT). All procedures were conducted in strict accordance with the equipment manual and laboratory protocols, and all operations were completed within 2 hours^[7].

2.2 Observation Indicators

FIB, D-D, Hb, and PLT levels were collected from both groups of parturients before and after delivery. The correlation between prenatal FIB, D-D, Hb, and PLT levels and postpartum hemorrhage was analyzed^[8].

2.3 Statistical Methods

Statistical analysis was performed using SPSS 26 software. Continuous data are presented as mean $\pm$ standard deviation ($\bar{X} \pm S$). A test for homogeneity of variances was conducted for all groups. If variances were homogeneous, one-way ANOVA was used for comparisons of means across multiple groups, and the LSD method was used for pairwise comparisons between groups. If variances were heterogeneous, the Kruskal-Wallis rank-sum test was used. For continuous variables, the t-test for two independent samples was used; for categorical variables, the chi-square test or Fisher's exact test was used. A P-value < 0.05 was considered statistically significant.

3. Results

3.1 Comparison of FIB, D-D, Hb, and PLT Levels Between the Two Groups Before and After Delivery

FIB, D-D, Hb, and PLT levels were measured in both groups before and after delivery. Compared with the control group, the experimental group showed statistically significant differences in FIB and Hb ($P < 0.05$), and PLT levels in the experimental group were extremely significantly different ($P < 0.01$). There was no statistically significant difference in D-D levels between the two groups ($P > 0.05$). See Table 1 for specific data.

Table 1 Comparison of prenatal and postnatal FIB, D-D, Hb, and PLT levels between the two groups ($\bar{x} \pm s$, $n = 50$)

Group	n	Control group		Experimental group	
		Prenatal	Postnatal	Prenatal	Postnatal
FIB (g/L)	50	4.63±0.72	2.64±0.94 ^a	4.57±0.84	2.64±0.94 ^a
D (mg/L)	50	6.26±0.29	5.75±0.50	5.98±1.02	5.73±0.50
Hb (g/L)	50	115.46±4.66	101.33±10.18 ^a	113.08±3.35	98.74±16.93 ^a
PLT (10 ⁹ /L)	50	149.89±11.59	125.10±11.89 ^b	147.16±6.40	115.64±19.06 ^b

Note: Compared with the control group, a) $P < 0.05$; b) $P < 0.01$.

3.2 Multivariate Logistic Regression Analysis

The four variables identified in the univariate analysis (FIB, D-D, Hb, PLT) were included in a multivariate binary logistic regression model. The results of the multivariate logistic regression analysis showed that FIB (OR = 0.961, 95% CI: 0.927–0.994, $P = 0.026$) and PLT (OR = 0.245, 95% CI: 0.079–0.721, $P = 0.012$) were independent risk factors for postpartum hemorrhage. Neither D-D nor Hb reached statistical significance in the multivariate analysis ($P > 0.05$), as shown in Table 2.

Table 2 Multivariate logistic regression analysis of rebleeding in non-traumatic SAH

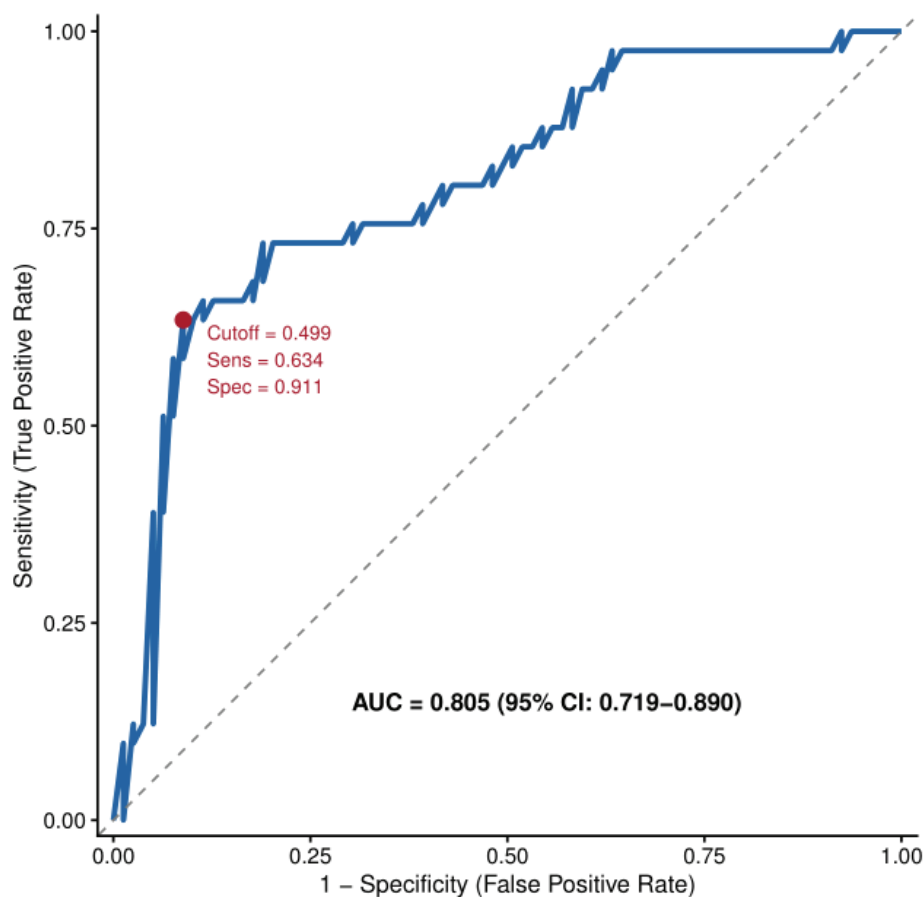
Variable	β	OR	95% CI	P-value
FIB	−0.040	0.961	0.927–0.994	0.026*
D-D	−0.004	0.996	0.982–1.009	0.560
Hb	0.111	1.117	0.959–1.313	0.164
PLT	−1.405	0.245	0.079–0.721	0.012*

Note: * indicates $P < 0.05$. OR: odds ratio; CI: confidence interval. Model AIC: 141.04.

3.3 ROC Curve Analysis

The results of the ROC curve analysis showed that AUC = 0.805 (95% CI: 0.719–0.890), indicating that the predictive model has good discriminatory ability. The optimal cutoff value determined using the Youden index was 0.499. At this optimal cutoff, the model's sensitivity was 63.4% and specificity was 91.1%. The results suggest that this predictive model exhibits high accuracy (specificity of 91.1%) in identifying patients with postpartum hemorrhage, providing a reference for early clinical screening and risk stratification. The fit of the logistic regression model is as follows: Null deviance: 154.11 (df = 119). Residual deviance: 119.04 (df = 109). AIC: 141.04. The residual deviance of the model was significantly lower than that of the null model (Δ deviance = 35.07, Δ df = 10), indicating that the inclusion of FIB and PLT significantly improved the model's ability to explain the occurrence of postpartum hemorrhage. The results are shown in Figure 1.

Figure 1 ROC curve for the postpartum hemorrhage prediction model



Note: The red dot indicates the optimal cutoff point determined by the Youden score (Cutoff = 0.499), corresponding to a sensitivity of 0.634 and a specificity of 0.911.

4. Discussion

Effective prevention and management of postpartum hemorrhage depend on the early identification and timely screening of high-risk populations. Currently widely used risk assessment tools for postpartum hemorrhage include those developed by the California Maternal Quality Collaborative (CMQCC), the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN), and the New York State Obstetric Bleeding Safety Guidelines (NYSBOH), among others ^[9]. However, these assessment tools have moderate predictive performance and are primarily designed for high-risk obstetric patients undergoing cesarean section; there is currently a lack of reliable predictive models for postpartum hemorrhage following vaginal delivery in older mothers.

Age is a critical factor that cannot be overlooked during childbirth, as there are significant differences in physical function and physiological status among mothers of different age groups. Younger women are generally in better health, with physiological functions in optimal condition; they exhibit relatively stronger uterine contractility and coagulation function, and thus face a relatively lower risk of postpartum hemorrhage. However, as women age, their physical functions gradually decline, and they may develop chronic conditions such as hypertension and diabetes. These conditions can impair physical health and coagulation function, thereby increasing the likelihood of postpartum hemorrhage ^[10]. The elasticity of the uterine muscles in older mothers may decrease, and uterine atony is more common after delivery, which can easily lead to postpartum hemorrhage. Indicators such as FIB, D-D, Hb, and PLT play a critical role in assessing a mother's coagulation function and physical condition. FIB is a crucial coagulation factor; its level directly affects the blood's ability to clot. D-dimer is a product of fibrin degradation, and its concentration reflects the activity of the body's fibrinolytic system. Hb is a key indicator for assessing maternal anemia, as anemia can impair a mother's physical resistance and tolerance to bleeding ^[11]. PLT plays a crucial role in hemostasis and the coagulation process. By comparing the levels of these indicators in the two groups of

women before delivery, we can identify differences in coagulation function and physical condition among different groups of women. The severity of postpartum hemorrhage varies, and different degrees of postpartum hemorrhage may be closely related to the levels of FIB, D-D, Hb, and PLT in the women's bodies. For women with mild postpartum hemorrhage, although FIB levels may decrease, they remain within a relatively normal range; D-D levels may only be slightly elevated, and changes in Hb and PLT levels are also relatively minor. In contrast, for women with moderate to severe postpartum hemorrhage, FIB levels may drop significantly, as massive bleeding leads to increased consumption of coagulation factors^[12]. D-D levels will rise markedly, indicating excessive activation of the body's fibrinolytic system. Hb levels will drop rapidly as blood loss increases, leading to worsening anemia in the mother. PLT counts may also decrease, further impairing coagulation function. Excessively low FIB levels may indicate coagulation deficiency, making it difficult to control bleeding during delivery and thereby increasing the risk of postpartum hemorrhage^[13]. Elevated D-dimer levels indicate a certain degree of thrombus formation and hyperfibrinolysis in the body, which may be related to the mother's hypercoagulable state and may also influence postpartum hemorrhage^[14]. Low Hb levels indicate that the mother may be anemic; anemia can impair the function of various organs, including uterine contractility, thereby increasing the likelihood of postpartum hemorrhage. A reduced platelet count or platelet dysfunction can impair platelet aggregation and hemostatic function, similarly increasing the likelihood of postpartum hemorrhage^[15]. By analyzing the correlation between these indicators and postpartum hemorrhage, we can establish corresponding predictive models to assess and predict the risk of postpartum hemorrhage, thereby enabling effective prenatal interventions to reduce its incidence.

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No

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Analysis of the Current Status of Research on Outpatient Physician-Patient Communication in China and Abroad over the Past Two Decades: A Comparison Based on CNKI and WOSCC

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Abstract: Objective: Outpatient doctor–patient communication directly influences diagnostic efficiency and patient satisfaction. However, domestic research remains limited in scale and often lacks systematic communication models. This study compares domestic and international research hotspots and trends over the past two decades through bibliometric and keyword evolution analysis, with particular attention to the role of narrative medicine. Method Literature published between January 1st, 2005 and December 31st, 2024 was retrieved from China National Knowledge Infrastructure (CNKI) and Web of Science Core Collection (WOSCC). CiteSpace was employed for bibliometric visualization, and representative studies were reviewed to identify thematic foci and methodological features. **Results:** Over the past two decades, research on outpatient physician–patient communication has exhibited a progressive trend, evolving from “basic concepts” to “relationships/experiences,” and ultimately to “mechanistic deepening.” Internationally, a transition has been completed—shifting from mere “information transmission” toward a framework encompassing “patient-centered care, shared decision-making, and narrative medicine.” This evolution has resulted in a comprehensive system that integrates theory, practical tools, and education, and has led to the widespread adoption of qualitative and mixed-methods approaches. Although the volume of domestic publications has grown rapidly, research remains predominantly focused on identifying problems and proposing countermeasures, while the exploration of underlying mechanisms and practical application at the grassroots level remains relatively insufficient. **Conclusion:** Research on physician–patient communication is evolving from a focus on single issues toward multidimensional integration; however, disparities persist—both domestically and internationally—regarding the pace of development, theoretical depth, and methodological approaches. Moving forward, through the synergistic advancement of institutional frameworks, education, and digitalization—and by drawing upon established best practices—we should construct an outpatient communication system that is quantifiable, replicable, and capable of continuous optimization, thereby achieving a balance among efficiency, patient experience, and trust.

Keywords: Outpatient Care; Doctor–Patient Communication; Bibliometric Analysis; Shared Decision-Making; Narrative Medicine

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Against the backdrop of the ongoing advancement of healthcare reform and the hierarchical diagnosis and treatment system, outpatient settings-as the most common venues for medical care-find that the quality of physician-patient communication directly impacts patients' healthcare experiences as well as the prevention and management of medical disputes. Among the various health policies issued in recent years, China's national authorities have repeatedly emphasized the need to strengthen the humanistic literacy and communication skills of medical professionals. The Action Plan for Enhancing Medical Humanistic Care (2024-2027) explicitly states the objective to "strengthen medical humanistic care, foster mutual trust and communication between medical professionals and patients, and build harmonious doctor-patient relationships"^[1]. This policy orientation indicates that physician-patient communication has evolved from being viewed merely as an ancillary "soft skill" to becoming a core element for enhancing the quality of medical services and fostering harmonious physician-patient relationships; it also serves as a vital pillar in the construction of a system for medical humanistic care.

The outpatient environment is unique: the patient consultation time is short and the flow of people is large. Doctors need to complete disease collection, risk notification, decision-making, and follow-up arrangements within a limited time^[2]. Unlike inpatient care, outpatient communication - due to its unique characteristics - is more prone to issues such as information asymmetry, intense emotional reactions, and poor patient adherence. For instance, patients often struggle to articulate their conditions clearly due to their complexity, while physicians-constrained by time limitations and work pressures-frequently overlook patients' emotional states and differences in understanding; this dynamic often leads to the emergence of a "pseudo-consensus" between doctor and patient^[3-4]. This indicates that outpatient physician-patient communication is not merely a matter of verbal expression, but, more fundamentally, a matter of medical process design and institutional support.

Early international research focused primarily on patient satisfaction and trust; however, following the emergence of the concepts of shared decision-making and health literacy after 2000, the academic community gradually shifted its focus toward patient engagement, risk communication, and informed consent^[5-6]. Over the past decade, digital healthcare has gradually emerged, further expanding the scope of outpatient communication scenarios-such as online consultations, internet hospitals, electronic health record sharing, and AI-assisted documentation. This shift has transformed communication from a face-to-face, discrete event into a continuous, cross-platform interaction^[7]; however, it has also given rise to issues concerning privacy protection, the delineation of liability, and the digital divide. In contrast, although domestic research has rapidly followed suit, it consists largely of conceptual explorations and lacks cross-database comparisons as well as a systematic review of emerging themes^[8].

Based on this premise, this paper employs CiteSpace software to integrate data from the China National Knowledge Infrastructure (CNKI) and the Web of Science Core Collection (WOSCC), conducting a knowledge mapping analysis of research on outpatient physician-patient communication published between January 1, 2005, and December 31, 2024. The study aims to address the following questions: What are the primary research hotspots and evolutionary trajectories in the field of outpatient physician-patient communication? In what key aspects do domestic and international studies differ and converge? Furthermore, with a focus on outpatient practice, what potential avenues for improvement exist for future research?

1. Data Sources and Research Methods

The data for this study were derived from the China National Knowledge Infrastructure (CNKI) and the Web of Science Core Collection (WOSCC). The search timeframe was set from January 1, 2005, to December 31, 2024. Within the CNKI database, the search field was set to "Subject," and the search query used was: "Outpatient Physician-Patient Communication" OR "Outpatient Communication" OR "Physician-Patient Communication." A total of 4,923 relevant documents were retrieved. In the WOSCC database, an advanced search strategy was employed, with the search field set to "Topic" (TS)-thereby conducting the search within the scope of titles, abstracts, and keywords. The search query used was: "TS = ('outpatient doctor-patient communication' OR 'outpatient communication' OR 'doctor-patient communication')." The database scope was restricted to SCI-Expanded, SSCI, and A&HCI, and the language of the literature was limited to English. To enhance data quality, this study subjected the initial search results to manual screening and data cleaning, excluding non-academic literature-such as notices, news reports, meeting minutes, patents, and book reviews-and removing entries with low relevance to the research topic or those that were duplicates. Given the requirements of bibliometric analysis regarding sample size

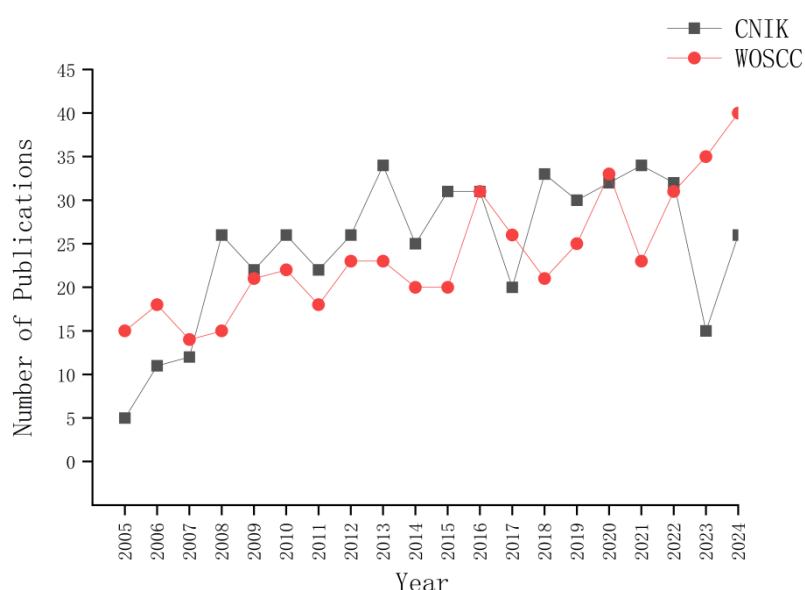
and structural stability, this study selected the top 500 documents-ranked by thematic relevance—from both the CNKI and WOSCC databases to serve as the final analytical sample. Previous studies have indicated that once a sample size reaches a certain magnitude (e.g., approximately 500 documents), the keyword co-occurrence network and clustering structure tend to stabilize, thereby reliably reflecting the knowledge structure and evolutionary trends of the research field^[9-10]. At the same time, the sample size aligns with common practices in existing bibliometric research. Furthermore, to clarify the regional composition of the “international” sample, this study conducted a statistical analysis of the distribution of authors’ countries within the literature included in the WOSCC. The results indicate that relevant research is primarily concentrated in North American and Western European countries, with the United States, the United Kingdom, Canada, and Australia accounting for a high proportion of publications, while African and certain Asian countries have a relatively low volume of publications. Therefore, the “foreign research” referred to in this thesis primarily reflects research trends dominated by the English-speaking academic system. The objects of comparison in this study are the knowledge structures and characteristics of thematic evolution within research on outpatient physician-patient communication across different academic systems, rather than a direct comparison of the performance of health care systems in different countries. Ultimately, CiteSpace software was employed to conduct keyword co-occurrence, burst detection, and cluster analyses on the included samples, with the aim of revealing research hotspots and their evolutionary trajectories.

2. Results and Discussion

2.1 Annual Publication Volume and National Distribution Characteristics

Between 2005 and 2008, the volume of publications related to outpatient physician-patient communication in the CNKI database was generally lower than that in the WOSCC database. From 2009 to 2013, the volume of domestic publications experienced a period of growth, reaching a peak in 2013 (34 articles), after which it exhibited a fluctuating trend. The volume of publications declined after 2022, dropping to 15 articles in 2023. In contrast, relevant research within the WOSCC database generally exhibits a trend of continuous growth; although annual fluctuations exist, the overall trajectory remains relatively stable, with 40 publications recorded in 2024. See Figure 1 for details.

Figure 1: Comparison of the Volume of Publications on Outpatient Physician-Patient Communication in China and Abroad Over the Past 20 Years



In terms of quantitative changes, the WOSCC sample exhibits a relatively continuous growth trajectory, whereas the CNKI sample displays periodic fluctuations. These disparities may be linked to shifts in the popularity of research topics, the level of policy attention, and the degree of interdisciplinary integration; however, publication volume alone is insufficient to directly assess differences in research maturity or quality. From the perspective of thematic evolution, the research content within the WOSCC sample has gradually expanded—shifting from an early focus primarily on information transmission and

patient satisfaction-to encompass areas such as communication skills training, patient engagement, shared decision-making, intercultural communication, and medical humanities education^[11]. In the CNKI sample, relevant studies tend to focus primarily on cross-sectional surveys and satisfaction assessments, while longitudinal intervention studies and evidence-based evaluations are relatively scarce^[12]. This difference is reflected primarily in divergent research paths and methodological orientations.

To further clarify the regional structure of the international sample, this study utilized CiteSpace to conduct a country-level collaboration network analysis of the 500 included English-language articles. The results indicate that the United States ranks first with 150 publications, followed by the Netherlands (44), the United Kingdom (35), Australia (25), Germany (24), and Italy (24) (see Table 1). Overall, the countries with the highest publication volumes are primarily concentrated in the North American and Western European regions.

Table 1. The Top 10 Countries Globally by Publication Volume in the Field of Outpatient Physician-Patient Communication

Rank	Nation	Number of Publications
1	America	150
2	Netherlands	44
3	Britain	35
4	Australia	25
5	Germany	24
6	Italy	24
7	Israel	16
8	Canada	12
9	Spain	12
10	France	8

This distribution pattern suggests that research on outpatient physician-patient communication within the WOSCC database is predominantly driven by the English-speaking academic sphere. Relevant countries embarked early on medical education, communication skills training, and evidence-based research; their research encompasses areas such as the development of communication skills assessment tools, the construction of shared decision-making models, and communication practices within cross-cultural contexts^[13-15]. It should be noted that disparities in publication volume do not necessarily reflect differences in research quality or institutional merit; rather, they tend to reflect factors such as the allocation of academic resources, database inclusion preferences, and linguistic advantages. In recent years, emerging themes-such as digital communication, AI-assisted documentation, and narrative medicine interventions-have appeared in WOSCC samples. For instance, some randomized controlled trials have demonstrated that blended communication skills training can enhance medical students' communication competence; meanwhile, artificial intelligence tools are being progressively applied in outpatient documentation and training settings, accompanied by ongoing discussions regarding privacy and ethical considerations^[16, 17]. Relevant studies within the CNKI sample have also begun to focus on digital healthcare and the cultivation of communication skills; however, the number of empirical intervention studies remains relatively limited. Overall, the analysis at this stage reveals differences across various academic systems in terms of publication trends, regional distribution, and research orientation. This difference provides the contextual basis for subsequent keyword evolution and topic clustering analysis.

2.2 Analysis of High-Productivity Authors and Institutions: Domestic and International Perspectives

Statistical analysis of institutional publication volumes reveals that research on outpatient physician-patient communication exhibits a certain degree of concentration at the institutional level. In the CNKI sample, Nanjing Medical University ranked first with 36 publications, followed by Sun Yat-sen University (13 articles) and Huazhong University of Science and Technology (12 articles) (see Table 2). Most relevant institutions conduct research within the framework of medical schools, with research themes primarily focusing on the cultivation of communication skills, medical humanities education, and the im-

provement of physician-patient relationships. This distributional characteristic indicates that domestic research on outpatient physician-patient communication is largely embedded within the context of medical education and clinical teaching reform. Among the WOSCC samples, the institutions with the highest publication volumes include Harvard University (31 papers), the University of California system (20 papers), and Maastricht University (14 papers), among others (see Table 2). Furthermore, a number of universities in North America and Europe also continue to participate in relevant research. Research topics span multiple areas, including shared decision-making, digital health communication, and the enhancement of patient satisfaction. The sustained involvement of institutions such as Maastricht University, Ohio University, and Case Western Reserve University demonstrates that international research in this field has evolved into a comprehensive system characterized by the interdisciplinary convergence of public health, psychology, and communication studies. This interdisciplinary nature leads its research to place greater emphasis on model construction and empirical verification, rather than being confined solely to the synthesis of clinical experience. It should be noted that the volume of publications produced by an institution primarily reflects the level of research resources and sustained team commitment; it does not directly indicate differences in research quality or impact. In terms of research thematic structure, a subset of institutions within the WOSCC sample exhibits characteristics of interdisciplinary engagement-specifically involving fields such as public health, psychology, and communication studies-whereas relevant research within the CNKI sample is more firmly grounded in medical education and the improvement of clinical practice. These divergences in disciplinary background and research approach provide essential context for interpreting the subsequent clustering structure of keywords.

Table 2. Top 10 Domestic and International Research Institutions by Publication Volume in the Field of Outpatient Physician-Patient Communication

Rank	Chinese Institutions	Number of Publications	Foreign Institutions	Number of Publications
1	Nanjing Medical University	36	Harvard University	31
2	Sun Yat-sen University	13	University of California	20
3	Huazhong University of Science and Technology	12	Maastricht University	14
4	Beijing University of Chinese Medicine	9	University of Ohio	14
5	Chinese Academy of Medical Sciences & Peking Union Medical College	8	Case Western Reserve University	11
6	China Medical University	7	Clalit Health Services in Israel	6
7	Beijing University	7	Bnai Zion Medical Center	6
8	capital medical university	7	Charite Universitätsmedizin Berlin	6
9	Sichuan Provincial People's Hospital	6	Netherlands Institute for Health Services Research	5
10	Fudan University	5	Radboud University Nijmegen	5

Following an analysis of the “Author” field within the included sample, the top 10 domestic and international authors by publication volume were identified (see Table 3). In the CNKI sample, the authors with the highest publication counts include Zhou Hongdan (4 articles), Zhao Tiefu (3 articles), Shang Weihong (3 articles), Ma Yongying (3 articles), and others. Overall, the disparity in publication volume among highly prolific domestic authors is relatively small; no distinct phenomenon of extreme concentration has yet emerged, and research within the field is characterized by a collaborative landscape involving the joint participation of numerous researchers. Within the WOSCC sample, the authors with the highest publication counts include Ben-Arve Eran (6 papers), Bensing Jozien Maria (3 papers), and Abel Gary (3 papers), among others. While a few individual authors demonstrate relatively high publication volumes, the presence of several scholars who consistently engage in research within this field indicates a distinct pattern of sustained research activity. In terms of the distribution structure of

authors, neither of the two sample sets exhibits a highly monopolistic pattern of core authors; however, certain differences exist regarding the maximum publication volume and the overall distribution morphology of the authors. In the WOSCC sample, the publication output of individual authors is relatively prominent, whereas the overall distribution in the CNKI sample is comparatively flatter. These differences may be attributed to factors such as research team size, collaboration patterns, database coverage scope, and the allocation of academic resources.

Table 3. The Top 10 Domestic and International Authors by Publication Volume in the Field of Outpatient Physician-Patient Communication

Rank	Chinese Author	Number of Publications	Non-Chinese Author	Number of Publications
1	Zhou Hongdan	4	Ben-arye Eran	6
2	Zhao Tiefu	3	Bensing Maria	3
3	Shang Weihong	3	Abel Gary	3
4	Ma Hanying	3	Xu Jia	2
5	Shao Jianwen	3	Gauchet Aurelie	2
6	Wang Jinfan	3	Foote Alison	2
7	Yu Kaihuan	2	Li Zhenzhu	2
8	Zhou Jingzhi	2	van dalen Jan	2
9	Zhang Hui	2	Grant Richard	2
10	Zhou Li	2	Hausmann Leslie	2

Structural characteristics at the author level provide complementary information for understanding the research network in this field. On the one hand, researchers who consistently engage with the same topic contribute to the establishment of stable research directions and the accumulation of methodologies; on the other hand, the involvement of multiple authors reflects the openness and diversity of the field. Future research could further integrate metrics such as author collaboration network density and betweenness centrality to investigate the impact of research collaboration structures on knowledge evolution.

3. Analysis of Research Hotspots and Trends

3.1 Research Hotspots

3.1.1 Hot Research Topics in China

Keywords serve as a core summary of the thematic content of a document; their high frequency of occurrence often reflects the research priorities and directions within a given field. This paper employs CiteSpace to conduct a co-word analysis of domestic literature concerning outpatient physician-patient communication; the top 10 entries, ranked in descending order of citation frequency, were selected to construct a distribution table of domestic research hotspots. For details, please refer to Table 4. The analysis results indicate that “医患沟通 (physician-patient communication)” is the absolute core keyword (cited 188 times; centrality: 1.15), followed by “医患关系 (physician-patient relationship)” (cited 73 times; centrality: 0.27) and “门诊 ((outpatient care))” (cited 49 times; centrality: 0.23). Centrality reflects a keyword’s mediating capacity to connect disparate topics within a knowledge network; the higher the centrality, the more central a position that topic occupies within the research structure. This result indicates that early domestic research focused primarily on conceptual definition and the exploration of relational structures. Subsequently, research gradually expanded to encompass themes such as “满意度 (satisfaction)”, “影响因素 (influencing factors)”, and “对策 ((countermeasures))”. Although citation counts and centrality remained relatively low, this shift reflects a transition in research focus from the mere description of relationships toward patient experience and intervention practices. At the same time, the emergence of keywords such as “医疗纠纷 (medical disputes)” and “医院管理 (hospital management)” suggests that the academic community has begun to focus on the institutional and legal issues stemming from communication imbalances. Overall, domestic research exhibits the following three characteristics: First, there is a high concentration of themes, and the core subject matter has not yet fully differentiated; second, while attention is paid to patient experience and communication effectiveness, there is a lack of quantitative analysis and systematic evaluation; and third, research addressing management and policy-level issues has not yet emerged as a prominent area of focus.

Table 4. Distribution of Hot Topics in the Top 10 Research Areas of Outpatient Physician-Patient Communication in China

Rank	Key words	Citation Count	Centrality
1	医患沟通	188	1.15
2	医患关系	73	0.27
3	门诊	49	0.23
4	满意度	22	0.09
5	影响因素	20	0.08
6	对策	18	0.03
7	门诊患者	18	0.01
8	原因	12	0.04
9	医疗纠纷	12	0.09
10	医院管理	12	0.04

3.1.2 Hot Research Topics Abroad

Based on the co-word analysis results generated by CiteSpace, the top 10 keywords were selected in descending order of citation frequency to construct a distribution table of research hotspots in the field of outpatient physician-patient communication abroad. For details, see Table 5. In terms of keyword structure, while retaining the core concept of “doctor-patient communication,” the WOSCC sample forms several interconnected clusters centered on terms such as “care,” “satisfaction,” and “health care,” suggesting a close link between the research topics and the contexts of patient experience and health services. The high frequency of terms such as “skills” and “information” reflects the sustained focus within this field on the development of communication competencies and information exchange mechanisms; the emergence of “primary care,” meanwhile, indicates that some research has extended into the context of primary health care.

Compared to the CNKI sample, the WOSCC keyword network exhibits distinct differences in thematic distribution. On the one hand, terms related to patient satisfaction and health service contexts account for a significant proportion of the high-frequency sequence; on the other hand, terms associated with communication skills and service systems have also entered the core structure. The aforementioned characteristics suggest that the international sample encompasses multiple levels of research content-including clinical communication practices, education and training, and service delivery systems-and exhibits a more diverse distribution of research themes. Spanning the fields of clinical practice, public health, and systems management, these studies demonstrate a trend toward interdisciplinary and systematic approaches. This expansion not only addresses the need to prioritize both medical quality and efficiency, but also offers a multidimensional perspective that serves as a valuable reference for research on outpatient physician-patient communication.

It should be noted that keyword frequency and centrality primarily reflect the level of research attention and the degree of thematic relevance; they do not directly evaluate research effectiveness or practical outcomes. The aforementioned analysis provides a foundation for subsequent keyword clustering and the comparison of evolutionary trends.

Table 5. Distribution of Hots Topics in the Top 10 International Research Areas on Outpatient Physician-Patient Communication

Rank	Key words	Citation Count	Centrality
1	doctor-patient communication/doctor patient communication	173	0.4
2	care	73	0.14
3	satisfaction	39	0.15
4	health care	35	0.11
5	impact	32	0.07
6	skills	30	0.21
7	information	29	0.13
8	primary care	26	0.10
9	communication	26	0.07
10	physicians	25	0.08

3.2 Research Directions

3.2.1 Research Directions in China

Utilizing CiteSpace software to extract and cluster high-frequency keywords can reveal the primary evolutionary paths and structural characteristics of research on outpatient physician-patient communication. By identifying and comparing clustered themes, one can delineate the research hotspots and shifting priorities across different stages within this field, thereby clarifying the core themes of academic interest and their evolutionary trends. This serves as a valuable reference for grasping the dynamics of the discipline's development and determining future research directions.

During the keyword analysis phase of this study, discrepancies involving Chinese and English terms, as well as symbols, were standardized. For instance, although “doctor-patient communication” and “doctor patient communication” appear as distinct forms within the database, they are semantically identical; consequently, they were consolidated into a single keyword for statistical analysis and clustering purposes, and are consistently represented as “doctor-patient communication” throughout the main text. At the same time, “primary care” and “primary health care” are consolidated and referred to collectively as “primary care” (Primary Health Care/General Practice). It should be noted that CiteSpace may, in the raw data, still list different word forms as distinct nodes, resulting in the appearance of duplicate labels with identical semantic meanings within the visualization. Regarding this phenomenon, our research team has explicitly acknowledged it in the methodology. section and has semantically merged these instances during the statistical analysis and interpretation within the main text, thereby avoiding double-counting.

Figure 2: Keyword Clustering Map of Domestic Literature on Outpatient Physician-Patient Communication over the Past 20 Years



In the CiteSpace settings, the minimum occurrence threshold for keywords was set to ≥ 3 to ensure that high-frequency keywords are representative. By conducting a cluster analysis of the literature on outpatient physician-patient communication within the CNKI database, its primary evolutionary pathways can be delineated. Research hotspots have centered on themes such as “医患沟通 (physician-patient communication)”, “医患关系 (physician-patient relations)”, “门诊患者 (outpatients)”, “门诊沟通 (outpatient communication)”, and “医疗纠纷 (medical disputes)”. Subsequently, themes such as “中小型医院 (small and medium-sized hospitals)” and “公共管理 (public administration)” gradually came into focus, while “共同决策 (collaborative design)” emerged as a new area of interest. Overall trends indicate that research has gradually expanded from an early focus on “沟通技巧 (communication skills)” to encompass “门诊管理 (outpatient management)”, “服务质量 (service quality)”, and “患者参与 (patient engagement)”, emphasizing that communication is not merely the transmission of information, but a key avenue for building trust and enhancing satisfaction. Zhao et al.^[3] noted that effective communication is closely correlated with patient adherence and the patient experience, and plays a significant role in ameliorating physician-patient relations. Concur-

rently, research has begun to explore the impact of institutional and service-level factors on physician-patient communication, seeking to establish a multi-stakeholder shared decision-making model at the healthcare system level. It is evident from this that domestic research has traversed a trajectory ranging from identifying the root causes of problems to improving relationships, and subsequently to institutional building and capacity enhancement, thereby gradually evolving toward greater applicability and systematization. The foregoing analysis provides a conceptual map for understanding the developmental stages and expanding thematic scope of domestic research on outpatient physician-patient communication; for details, please refer to Figure 2.

3.2.2 Current Status of International Research

Research conducted abroad exhibits a broader scope of keyword clustering. A keyword cluster analysis performed on the WOSCC sample reveals several thematic clusters, encompassing topics such as “general practice,” “decision making,” “narrative medicine,” “medical education,” and “oncology” (see Figure 3). In terms of cluster structure, the research content—while centering on the core concept of “doctor-patient communication”—also extends to primary care settings, shared decision-making processes, medical education, and specific disease domains. Within the clustering network, “doctor-patient communication” occupies an intersectional position among multiple thematic clusters, appearing repeatedly throughout the map; this highlights its pivotal role within the overall structure. Clustering around this central node, various themes form several interconnected modules. For instance, “decision making” is linked to the theme of communication, reflecting the fact that some studies situate patient-physician communication within the framework of shared decision-making; meanwhile, the emergence of terms such as “general practice” and “oncology” indicates that the research contexts encompass both primary care settings and specific disease domains. Among these, “narrative medicine” also constitutes an independent or semi-independent cluster module. Relevant literature indicates that narrative medicine emphasizes listening to and understanding patients’ illness narratives, focusing on their life experiences and emotional expressions^[18]. In the outpatient setting, given the limited time available for consultations, communication typically revolves around diagnosis and treatment decisions. Some studies have attempted to integrate the principles of narrative medicine into outpatient practice, exploring their impact on communication quality and the dynamics of physician-patient interaction, and intersecting with the subject of shared decision-making^[19].

Furthermore, international studies emphasize the role of medical education in cultivating physician-patient communication skills, positing that systematic training during the medical student and residency stages can improve the quality of outpatient physician-patient communication at its source^[20]. Its interdisciplinary nature is also highly evident, encompassing psychology, sociology, and management, thereby reflecting the comprehensive and complex nature of the research. Overall, the WOSCC sample exhibits structural characteristics characterized by an extension from core communication themes into diverse medical contexts and educational settings. The aforementioned analysis provides a cartographic basis for comparing research structures between domestic and international studies (see Figure 3).

Figure 3. Keyword Cluster Map of International Literature on Outpatient Physician-Patient Communication over the Past 20 Years



3.2.3 Comparative Analysis

As revealed by keyword clustering, both domestic and international literature samples center on “医患沟通 /doctor-patient communication;” however, there are distinct differences in the directions of thematic extension. Domestic Chinese sample studies center on the nexus of “医患关系 (physician-patient relations)—门诊患者 (outpatients)—门诊沟通 (outpatient communication)—医疗服务 (medical services)—医疗纠纷 (medical disputes)” and extend outward to encompass “中小型医院 (small and medium-sized hospitals),” “公共管理 (public administration),” “临床能力培养 (clinical competence training),” and “协同设计 (collaborative design)”. This indicates that domestic research is largely situated within the specific contexts of outpatient settings and healthcare management, focusing on the interplay between communication issues and the institutional environment. Keyword clustering in studies based on international samples points toward “general practice,” “decision making,” “narrative medicine,” and “medical education,” extending further into specialized fields such as “oncology” and “surgery,” as well as the concept of “the continuum of partnership style.” This indicates a greater emphasis on patient-centered shared decision-making frameworks, utilizing narrative approaches and structured processes to enhance the quality of communication and foster trust. Furthermore, it integrates communication skills as a core competency into both medical education and continuing professional development, thereby establishing a tripartite advancement model encompassing clinical practice, the humanities, and education ^[21].

In comparison, domestic and international studies exhibit three key areas of difference and complementarity: First, regarding thematic orientation, domestic studies focus on relationship repair and service governance, whereas international studies emphasize the integration of decision science and the humanities. Second, in terms of application scenarios, domestic research centers primarily on outpatient workflows and institutional management (specifically, the governance of small-to-medium and public hospitals), whereas international research advances concurrently across both general and specialized medicine, embedding communication within disease pathways and continuity of care. Third, regarding research network structures, the theme of communication in international keyword networks demonstrates relatively strong connections with education and decision-making frameworks, whereas in domestic studies, it is more closely linked to themes related to management and service governance.

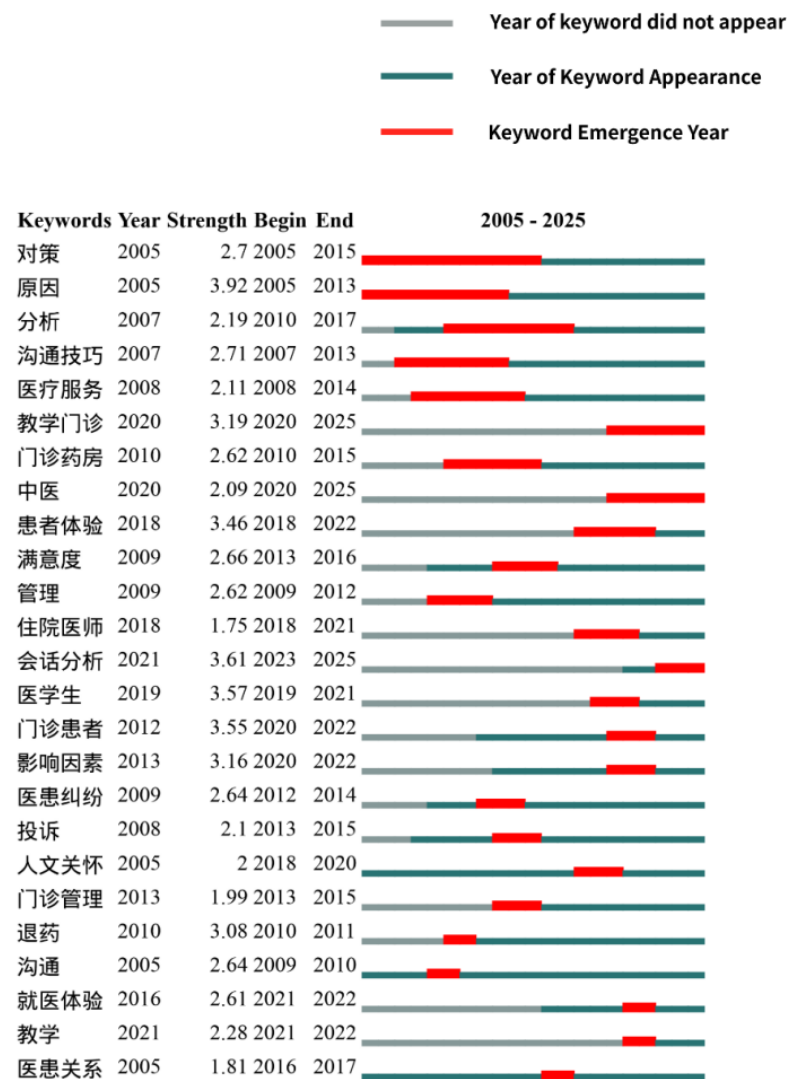
Overall, the domestic advantage lies in addressing pain points in outpatient care and prioritizing rapid implementation, whereas the international strength lies in leveraging shared decision-making and narrative medicine to establish a closed loop encompassing “theory, tools, and education.” Future research could introduce localized shared decision-making processes and narrative medicine interventions within the context of domestic outpatient settings. Concurrently, it could establish a competency-based system for communication training and assessment, thereby achieving an organic integration of practice-oriented approaches and theoretical foundations. This approach would not only sustain domestic achievements in process optimization and management mechanisms but also incorporate established international expertise regarding decision-making frameworks and capacity building, thereby steering outpatient physician-patient communication toward a sustainable, patient-centered trajectory ^[3]. It should be noted that research conducted domestically and abroad exhibits distinct characteristics regarding agenda setting and contextual selection; moreover, these differences may be influenced by factors such as healthcare system structures, academic traditions, and the scope of database coverage.

3.3 Evolution of Research Hotspots

Shifts in research hotspots often reflect the developmental stages of a discipline and the shifting focal points of scholarly interest. Keyword burst analysis is an effective method capable of revealing themes that have experienced a rapid surge in academic attention over a specific period, thereby aiding in the identification of frontier issues and research turning points within a given field. By dynamically tracking the emergence of keywords, one can clearly visualize the evolutionary trajectory of research on outpatient physician-patient communication—from its inception to its subsequent development—thereby revealing the processes of the rise, shifting, and deepening of research themes. Such analysis not only facilitates an understanding of the developmental trajectory of this field but also provides directional guidance for the expansion and innovation of future research.

3.3.1 Evolution of Research Hotspots in China

Figure 4: Evolution of Research Hotspots in Domestic Literature on Outpatient Physician-Patient Communication over the Past Two Decades



Using the period from January 1, 2005, to December 31, 2024, as the timeframe, a burst term analysis was conducted on domestic Chinese samples (see Figure 4). Burst intensity indicates the magnitude of the increase in a keyword's co-occurrence frequency during a specific time interval, serving to characterize the periodic shifts in research attention. Based on the temporal distribution characteristics and thematic content of emergent terms—and to facilitate analysis—the research period has been divided into three distinct phases, determined by the timing of appearance and thematic relevance of the top 20 keywords ranked by emergence intensity. This division is predicated on the concentration of temporal occurrences and the relative clustering of themes; it does not, however, imply the existence of rigid boundaries between these phases. ① 2005–2015: Problem-Oriented and Foundational Exploration. Prominent keywords during this phase frequently involved terms such as “causes,” “communication,” and “hospital management.” Discussions primarily revolved around communication issues set against the backdrop of strained physician-patient relations, focusing on the root causes of conflicts and the context of hospital management. Relevant studies during this period predominantly employed empirical analysis and case-based discussion methodologies^[22]. ② 2015–2020: Institutional Development and Humanistic Care. Representative burst terms during this period included “patient experience” and “healthcare-seeking experience.” The emergence of such vocabulary signaled that research topics were beginning to encompass aspects such as patient perceptions and service delivery processes^[7]. Some studies employed a mixed-methods approach—combining questionnaire surveys with qualitative interviews—to explore the relationship between communication practices and the institutional environment. ③ 2020–2024: Educational Practice and Informatization

Development. Key emergent terms during this period—such as “教学 (teaching),” “中医 (Traditional Chinese Medicine),” and “人文关怀 (humanistic care)” —reflect an expansion of research hotspots into the realms of education and informatization. On one hand, patient-physician communication was gradually integrated into the medical education curriculum, with research focusing on communication competence and educational interventions; on the other hand, informatization and the optimization of healthcare service workflows emerged as new themes^[23-24]. The selection of keywords for the aforementioned stages was guided by the principle of representing the distinctive characteristics of each research phase, rather than relying solely on rankings based on emergence intensity. For instance, certain terms with higher intensity but weaker thematic relevance were not included in the main text. Furthermore, emergence analysis primarily reveals trends in the evolution of attention; it is therefore inappropriate to infer from it the hierarchical stages of theoretical development or the progressive relationships of value.

Note: “Year of Appearance” denotes the year in which the keyword first appeared in the research; “Start Year” denotes the year in which the keyword began to burst; and “End Year” denotes the year in which the keyword burst concluded.

In summary, domestic research in China has undergone a progressive evolution—spanning the stages of “conflicts and countermeasures,” “experiences and institutions,” and “education and informatization”—thereby gradually realizing a transition from empirical inquiry to theoretical construction and interdisciplinary integration. In terms of temporal distribution, domestic research in China exhibits a discernible trend of expansion-shifting from discussions on conflicts and countermeasures toward themes concerning patient experience, institutional issues, and education and informatization—though no absolute boundaries exist between these various stages.

3.3.2 Evolution of Research Hotspots Abroad

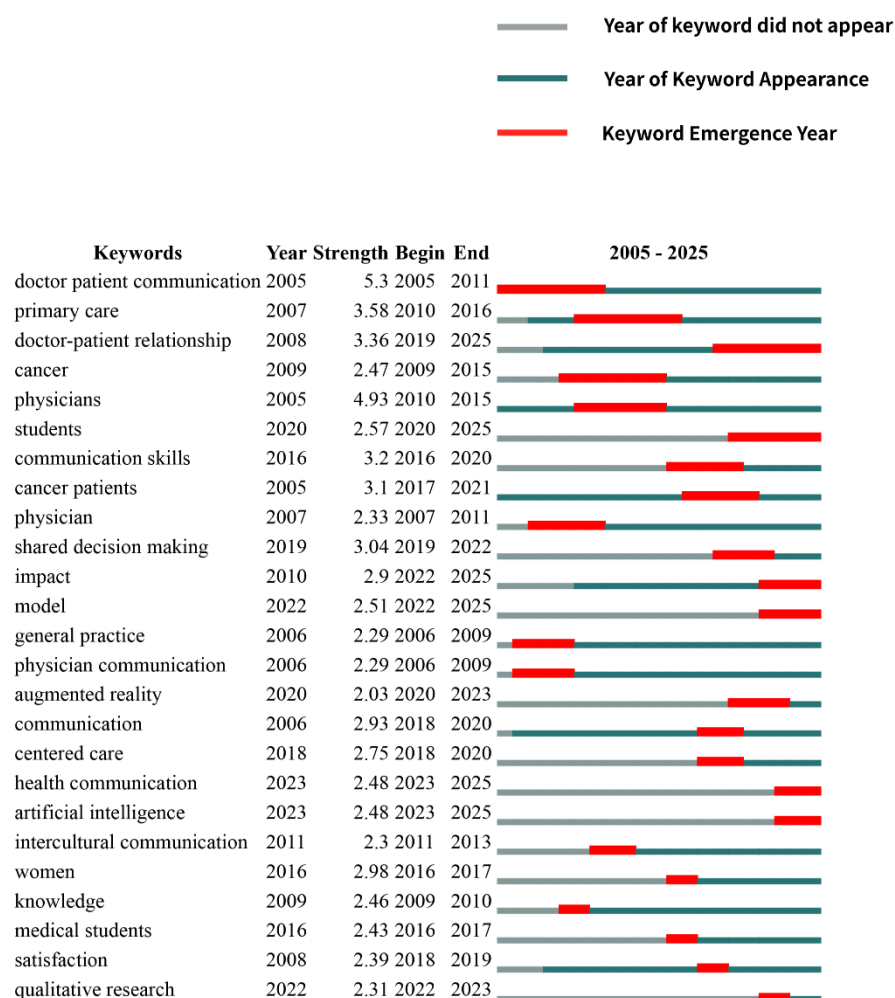
A keyword burst analysis of the WOSCC samples (see Figure 5) reveals that the evolution of keywords in the international research samples generally follows a progressive trajectory: moving from macro-level frameworks to specific scenarios, and subsequently to methodological innovations. It should be noted that burst terms reflect trends in increasing attention rather than directly indicating theoretical hierarchy or methodological maturity. To facilitate analysis, the sample has been divided into three time periods based on the temporal distribution characteristics of these burst terms. This division is based on the clustering of temporal data and does not imply the existence of distinct boundaries between the respective stages. ① From 2005 to 2010: Macro-level Focus and Preliminary Exploration. Key terms included “doctor-patient communication” and “intercultural communication.” Research during this period primarily focused on the fundamental role of communication in healthcare quality and patient safety, as well as the impact of cultural differences on doctor-patient communication, thereby establishing an academic consensus that positions communication as an independent subject of study. ② 2010-2018: Decision-Making Participation and Group Differences. Keywords included “communication skills,” “cancer patients,” and “medical students.” The research focused on the role of patients in decision-making, as well as the communication needs of specific groups—such as cancer patients—while also addressing communication skills training for medical students. ③ 2018-2024: Joint Decision-Making and Methodological Deepening. Key terms include “doctor-patient communication,” “questionnaire,” and “augmented reality,” indicating that research has advanced to the exploration of tools, technologies, and underlying mechanisms^[25]. See Figure 5 for details.

Overall, the WOSCC sample demonstrates shifts in the distribution of research contexts and topics across different time periods; discussions, initially centered on the subject of communication itself and cultural contexts, have gradually expanded to encompass topics such as participatory decision-making, specific patient populations, and technological tools. These changes primarily reflect an adjustment in the focal points of research attention; it would be inappropriate to infer from them any hierarchy of theoretical development or to judge the relative merits of specific models.

3.3.3 Summary

Based on a comprehensive analysis of keyword emergence and temporal distribution both within and outside China, it can be observed that samples from both categories consistently revolve around the theme of physician-patient communication across various stages; however, they exhibit differences in the directions of thematic expansion and their temporal distribution. First, regarding the distribution of topics in the early stages, emergent terms within the domestic Chinese sample were predominantly associated with doctor-patient conflicts and medical safety contexts, with research largely situated

Figure 5: Evolution of Research Hotspots in International Literature on Outpatient Physician-Patient Communication over the Past Two Decades



against the backdrop of real-world problems; conversely, the international sample addressed topics such as primary care and communication frameworks at an earlier stage. These disparities may be attributed to differences in healthcare system structures, academic traditions, and database coverage scopes. Second, in terms of temporal distribution, the timing of the emergence of certain themes—specifically those related to patient experience, education and training, and shared decision-making—differs between the two types of samples. In international samples, relevant keywords appeared relatively early on, whereas in domestic samples, they are concentrated within the last decade. It should be noted that the emergence time merely reflects changes in attention levels and is not synonymous with research depth or maturity. Third, regarding the analysis of thematic association structures, the international sample reveals distinct connections between the theme of communication and the fields of education, decision-making frameworks, and specific disease areas; concurrently, terms related to methodologies—such as questionnaires and technological tools—also feature prominently. In contrast, the domestic sample demonstrates stronger linkages with themes such as healthcare management, the institutional environment, and service workflows. The aforementioned differences primarily reflect variations in the research context and the background of the problem. From a discursive perspective, the strength of domestic research lies in its close alignment with outpatient settings and its capacity to rapidly address real-world pain points; however, it still requires strengthening in the areas of theoretical construction and interdisciplinary methodology. Driven by digitalization and AI, future research must integrate international experiences in shared decision-making and narrative medicine to explore more systematic and sustainable pathways for improving outpatient communication.

Overall, domestic and international studies exhibit distinct characteristics regarding agenda-setting and thematic association structures. These differences may be influenced by a multitude of factors, including the healthcare institutional environment, research traditions, and sample sources. Bibliometric results primarily reveal shifts in research focus and thematic evolution; therefore, it would be inappropriate to use them as a basis for making value judgments regarding theoretical maturity or practical efficacy.

3.4 Analysis of Frontier Trends in Keywords

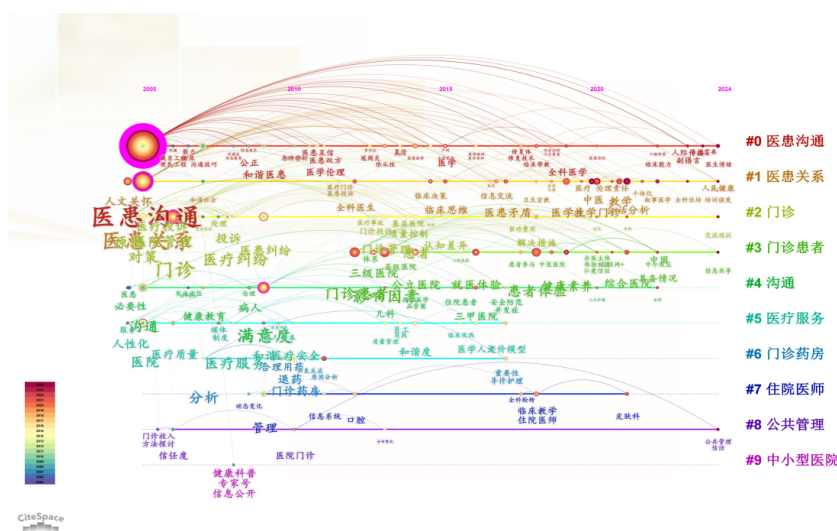
3.4.1 Analysis of Cutting-Edge Trends in Domestic Chinese Keywords

A timeline visualization analysis of keywords, conducted using CiteSpace software, reveals an evolutionary trend in the research hotspots concerning outpatient physician-patient communication within China. This trend shifts from the macro to the micro level, from a problem-oriented to a patient-centered approach, and from traditional topics to emerging interdisciplinary themes; it can be broadly categorized into three distinct stages. The timeline chart primarily illustrates the activity levels of keywords across various time intervals, serving as a tool to analyze the periodic shifts in research focus. It should be noted that while the distribution along the timeline reflects changes in thematic activity, it does not directly represent the hierarchical progression of theoretical development.

During the early stage (2005-2012), research centered on keywords such as “医患关系 ((physician-patient relationship))”, “医患沟通 ((physician-patient communication))”, “满意度 ((satisfaction))”, and “原因 ((causes))”. Studies largely revolved around communication issues within the context of physician-patient disputes, addressing the origins of conflicts and pathways for their mitigation^[26]. A subset of the literature explored topics such as communication techniques and the optimization of medical processes, thereby reflecting a characteristic driven by practical realities.

During the intermediate phase (2013–2018), keywords gradually expanded to encompass terms such as “门诊患者 (outpatients)”, “医疗服务 (medical services)”, and “医患关系 (physician-patient relations)”. Research began to focus on outpatient operational efficiency, service quality, and medical safety, reflecting a trend toward institutionalization and process standardization. This phase mirrors the transition in the medical model from a singular biomedical approach to a biopsychosocial model, shifting the research focus from conflict resolution to service improvement and relationship building. In the recent period (2019–2024), emerging keywords such as “humanistic care,” “patient experience,” “Traditional Chinese Medicine,” “small and medium-sized hospitals,” “clinical competence,” “collaborative design,” and “public administration” have appeared. This indicates that research is gradually transcending the scope of traditional communication studies, expanding into interdisciplinary and multi-level themes. Current research places greater emphasis on patient-centered philosophies, highlights cultural differences and the diversity of healthcare settings, and regards communication skills as a vital component of healthcare professionals’ professional competence. See Figure 6 for details.

Figure 6: A Knowledge Graph of Frontier Trends in Keywords for Outpatient Physician-Patient Communication Research in China over the Past Two Decades



Overall, domestic sample studies exhibit three major characteristic trends: First, a patient-centered approach is becoming increasingly prominent, with a focus on patient engagement and experience; second, the dimensions of research are continuously expanding, extending from individual-level communication to institutional development, humanistic medicine, and interdisciplinary collaboration; and third, application scenarios are diversifying, extending from outpatient settings to small and medium-sized hospitals, Traditional Chinese Medicine (TCM) diagnosis and treatment, and digitalised outpatient environments.

3.4.2 Analysis of Frontier Trends in International Keywords

Based on the CiteSpace timeline view (see Figure 7), the temporal distribution of keyword activity within the WOSCC sample from 2005 to 2024 can be observed. A timeline visualization reveals the phased evolutionary trajectory of research in this field abroad: exploration of fundamental communication models → shared decision-making and patient-centered care → narrative medicine and empathy research → digitalization and the expansion of diverse communication scenarios.

During the early stage (2005-2010), keywords primarily centered on terms such as “primary care,” “general practice,” and “doctor-patient relationship,” indicating that international scholars were focusing on doctor-patient communication within the context of primary healthcare settings. Research during this period emphasized the functional role of communication within basic clinical practice, thereby laying the groundwork for subsequent theoretical expansion. However, communication was still predominantly viewed as a unidirectional transmission of information by the physician.

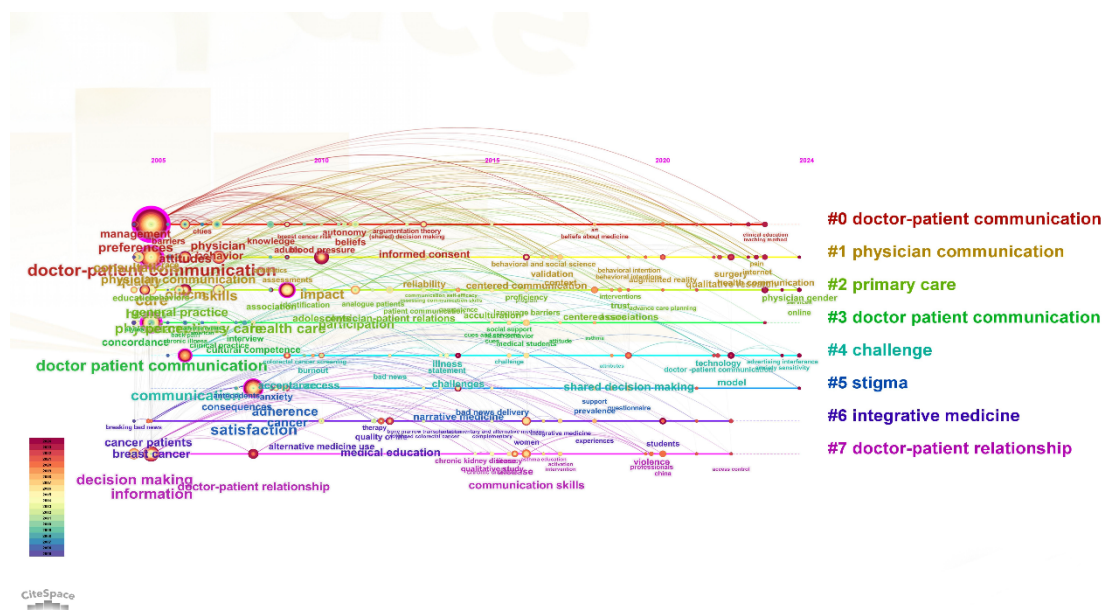
During the intermediate phase (2010-2015), keywords such as “shared decision making,” “adherence,” and “health communication” gradually gained prominence, signaling that a patient-centered approach had emerged as a core theme. Research emphasized that physician-patient communication is not merely a means of information transmission, but rather a mechanism for empowering patients to participate in clinical decision-making; particularly in contexts involving long-term treatment-such as oncology and chronic disease management-communication was regarded as a pivotal factor in enhancing both the treatment experience and health outcomes.

During the Narrative and Empathy Phase (2015-2020), keywords such as “narrative medicine,” “trust,” and “communication skills” emerged, marking a shift in research focus from rational exchange toward an emphasis on individual patient stories and emotional expression^[18]. Research during this period highlighted how physicians can rebuild trust with patients through active listening and empathy, thereby moving beyond the traditional “inform-and-accept” model; consequently, communication became a vital avenue for repairing the physician-patient relationship and providing psychological support. The clustering of keywords such as “oncology,” “quality of life,” and “cancer patients” in the accompanying visualization indicates that the quality of life and psychological adjustment of cancer patients have become key areas of application for narrative-based communication.

During the Digitalization and Multi-Scenario Phase (2020-2024), emerging keywords such as “digital health communication,” “online services,” and “physician-gender” appeared, reflecting the shift of research into a stage characterized by multi-scenario applications and digital transformation. With the widespread adoption of telemedicine and e-health platforms, scholars have focused on how to maintain communication effectiveness and humanistic care in non-face-to-face settings-specifically addressing communication strategies in online consultations and video follow-ups, as well as the impact of gender and cultural differences on digital communication^[25]. See Figure 7 for details.

Overall, studies on physician-patient communication involving international samples exhibit three key characteristics: First, the scope has expanded beyond traditional face-to-face clinical encounters to encompass multi-scenario, multi-channel health communication. Second, the research focus has shifted from mere information transmission toward shared decision-making, narrative medicine, and empathy. Third, against the backdrop of healthcare digitalization and artificial intelligence, how to sustain physician-patient trust and interaction within emerging models of medical care has become an area of sustained attention. These trends hold significant implications for research on outpatient physician-patient communication in China: drawing upon insights from shared decision-making and narrative communication, future research should focus more closely on the adaptability of communication models and their localization within digital healthcare environments, with the aim of enhancing the patient experience and alleviating tensions between physicians and patients.

Figure 7: A Knowledge Graph of Frontier Trends in Keywords from International Research on Outpatient Physician-Patient Communication over the Past Two Decades



Through cross-database bibliometric analysis and keyword evolution analysis, this study systematically examined the distribution of research hotspots and their temporal dynamics in the field of outpatient physician-patient communication, both domestically and internationally, spanning the period from January 1, 2005, to December 31, 2024. The results indicate that while both domestic and international samples revolve around the core theme of physician-patient communication, distinct differences exist regarding the directions of thematic expansion, the pace of temporal distribution, and the structural interconnections among themes. International research-based on samples from abroad-has long since completed the iterative shift from a paradigm of “information transmission” to one centered on “patient-centered care, shared decision-making, and narrative medicine,” thereby establishing a closed-loop system encompassing theoretical models, methodological tools, and educational training. In contrast, while domestic research is growing rapidly, it generally remains in a “problem-oriented, solution-seeking” phase; this is characterized by weak chains of evidence, insufficient coverage at the grassroots level, a lack of standardized protocols, and limited efficacy in clinical translation and dissemination.

At the methodological level, this study innovatively constructed a relatively comprehensive knowledge graph through cross-database bibliometric analysis, thereby expanding both the sources of data samples and the temporal scope of the investigation. This approach provides robust data support for understanding the structural characteristics of research on outpatient physician-patient communication. Furthermore, the integration of topics such as narrative medicine, shared decision-making, and digital communication into an evolutionary analysis framework helps to illustrate the thematic expansion of this field across diverse contexts. It is important to note, however, that while bibliometric analysis primarily reveals patterns in thematic distribution and shifts in research attention, the assessment of intervention efficacy and practical outcomes still requires corroboration through empirical research.

Overall, research on outpatient physician-patient communication - both domestically and internationally-is characterized by an expansion of research topics and a diversification of contexts; however, differences persist regarding structural distribution and areas of focus. Future research should, while maintaining contextual sensitivity, prioritize the integration of interdisciplinary approaches and empirical validation to further deepen our understanding of the mechanisms and practical pathways of outpatient physician-patient communication.

Only when physician-patient communication is truly transformed into an organizational capability that is measurable, replicable, and capable of continuous improvement can the outpatient setting achieve a dynamic equilibrium among efficiency, patient experience, and trust. The deep integration of narrative medicine, humanistic education, and digital tools will not only drive improvements in the quality of outpatient physician-patient communication but also holds the promise of

serving as a pivotal breakthrough in the reform of China's healthcare system.

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Conflict of Interests

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Construction of a Standardized Management System for VTE in Elderly Stroke Patients based on a Nursing Quality Improvement Project

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Abstract: Aiming at the weak links in the prevention and management of venous thromboembolism (VTE) in elderly stroke patients, a standardized VTE management system was constructed based on a nursing quality improvement project. By adopting multidisciplinary collaboration, comprehensive evidence-based evidence, and PDCA cycle methods, it deeply integrated the particularities of geriatric medicine and the pathological and physiological changes after stroke, breaking through the limitations of traditional single-dimensional nursing. A closed-loop management system was formed, consisting of six modules: organizational management, standardized risk assessment, graded prevention strategies, path-based health education, information support systems, and quality control and continuous improvement. This system is prevention-oriented and evidence-driven, aiming to achieve homogeneity and high quality in VTE protection, providing a scientific and operational theoretical framework for clinical practice and promoting the continuous improvement of nursing quality.

Keywords: Elderly; Stroke; Venous Thromboembolism; Nursing Quality Improvement; Standardized System

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1. Introduction

Stroke is a common critical illness in clinical practice, with a high incidence rate among the elderly population ^[1]. Venous thromboembolism (VTE) is a common and dangerous complication after cerebrovascular surgery. According to statistics, stroke patients are at high risk of VTE. If not intervened properly and effectively, the probability of VTE in stroke patients is 30% to 40%, and the incidence rate of VTE in patients with long-term bedridden due to loss of self-care ability is 60% to 75% ^[2]. Elderly stroke patients are often at extremely high risk of VTE due to consciousness disorders, limb paralysis, long-term bedridden, vascular endothelial injury, hypercoagulable state of blood, and age-related venous wall degenerative changes. Once VTE occurs, the difficulty of treatment and mortality rate are significantly higher than those of young patients, so it requires special attention. VTE includes deep vein thrombosis and pulmonary embolism ^[3]. Once it occurs, it not only significantly increases the patient's suffering, prolongs the hospital stay, and increases the economic burden, but also directly threatens the patient's life. However, currently, VTE is often prevented through combined prevention or simple mechanical prevention in clinical practice ^[4]. There are still many weak links in the prevention and management of VTE in elderly stroke patients, such as inconsistent risk assessment tools, untimely risk stratification, low compliance with preventive measures, incomplete multi-disciplinary collaboration mechanisms, and lack of age-specific health education. This leads to uneven

quality of VTE protection among different institutions and wards. How to build a scientific, standardized, and operable VTE management system through systematic means has become an urgent clinical nursing problem to be solved.

In recent years, nursing quality improvement projects, as an important method for enhancing clinical care levels, have been widely introduced into nursing management practices. Nursing quality improvement projects aim to center on the physical and mental health of patients, based on evidence, continuously explore the deficiencies in clinical work, apply scientific thinking methods, improve the patient's medical experience, and enhance the quality of care. Through scientific measurement methods, sufficient evidence is used to prove the actual effects of the improvement projects^[5]. Applying nursing quality improvement projects to the VTE management of elderly stroke patients can systematically identify loopholes, integrate cutting-edge evidence, break professional barriers, and form a dynamic improvement management loop. Although some studies have explored bundled measures or risk prediction models for VTE prevention in stroke patients^[6-8], most of them focus on a single aspect and have not established a comprehensive and standardized system that deeply integrates risk assessment, stratified prevention, health education, information-based early warning, and quality evaluation feedback. In particular, there is still a lack of consideration for the complex issues of elderly patients, such as multiple comorbidities, cognitive decline, and special drug tolerance. Therefore, based on nursing quality improvement projects, this study attempts to construct a standardized VTE management system covering the entire process and multiple dimensions for elderly stroke patients, with the aim of providing a theoretical framework and practical guidance for clinical practice and promoting the homogenization and high quality of VTE protection.

2. System Construction Method

The construction of this system is based on the framework of the nursing quality improvement project, adhering to the three-dimensional quality theory of structure, process, and outcome, and comprehensively applying evidence-based methodology and the concept of continuous quality improvement to advance step by step.

2.1 Formation of a Multidisciplinary Collaboration Team

Led by the Nursing Department, a multidisciplinary VTE management team was formed by joining forces with professionals from the Neurology Department, Geriatrics Department, Rehabilitation Medicine Department, Vascular Surgery Department, Pharmacy Department, and Information Technology Department. The responsibilities of each member were clearly defined: nurses were responsible for initial risk screening, implementation of preventive measures, and health education; physicians were responsible for risk assessment confirmation, issuance of preventive and treatment orders; pharmacists provided individualized medication advice; rehabilitation therapists developed early activity plans; and IT engineers were responsible for the development and maintenance of information modules. The team established a regular communication and consultation mechanism for difficult cases, providing organizational support for the system construction.

2.2 Current Situation Analysis and Key Problem Identification

Using flowchart and root cause analysis methods, a complete value stream map was drawn from patient admission, disease progression, order issuance to nursing execution. Combining the concept of comprehensive geriatric assessment, we further conducted a detailed review of the current VTE management process for elderly stroke patients. Through a step-by-step review of each link, including admission assessment, issuance of preventive orders, nursing execution, disease monitoring, and discharge follow-up, the weak points affecting the management quality were identified, including: delayed or missed risk screening, non-standard use of physical prevention equipment, overly conservative or aggressive anticoagulation regimens, excessive concerns of elderly patients and their families about early activities, inappropriate health education methods for the elderly, and lack of real-time early warning and quality control loops. These key issues became the sources of evidence retrieval and system construction.

2.3 Evidence Retrieval and Synthesis

Focusing on the key issues, a systematic search was conducted for the best practice guidelines, evidence summaries, systematic reviews, and expert consensuses related to VTE prevention in stroke and elderly patients both domestically and internationally. Using recognized evidence quality evaluation tools, the included literature was strictly screened and graded, and high-quality recommendations applicable to elderly stroke patients were extracted. The key contents such as risk

factors, prevention strategies, drug selection and monitoring, indications and contraindications of physical prevention, health education elements, and quality evaluation indicators were integrated to form a structured evidence summary, providing a scientific basis for the drafting of the system.

2.4 Drafting of the System and Expert Argumentation

Based on the evidence summary and problem list, a framework for a standardized management model and corresponding standardized processes were initially drafted. Subsequently, through multiple rounds of expert consultation, multidisciplinary experts with rich experience in the treatment of elderly stroke and nursing management were invited to review each item of the draft in terms of completeness, scientificity, and clinical operability. According to the expert feedback, the model structure, measure details, and execution forms were continuously revised until the expert opinions tended to be consistent, and the final content of the model was determined. The entire establishment process demonstrated the systematic planning in the “planning” stage of the nursing quality improvement project.

3. Standardized Management System for VTE in Elderly Stroke Patients

The constructed system consists of six modules, which are interconnected and work in synergy to form a closed-loop management.

3.1 Organizational Management System

Establish a three-level management structure consisting of the hospital, departments, and wards. At the hospital level, a VTE management committee is established, whose functions include formulating relevant regulations, reviewing quality indicators, and conducting supervision. At the department level, a VTE prevention team is formed, which is responsible for training, quality control, organizing key case discussions, and ensuring the implementation of standardized operations such as assessment, prevention, and education. In the ward, the responsible nurses are responsible for implementing the assessment, prevention, and education procedures. Based on this structure, a multidisciplinary consultation process is integrated to ensure that complex elderly cases can quickly receive support from vascular surgery, pharmacology and other specialties. Through clear hierarchical responsibilities and communication paths, VTE protection is integrated into the daily nursing process.

3.2 Standardized Risk Assessment

Standardize the timing of risk screening for elderly stroke patients during their admission process. Conduct the first assessment in the early stage of admission, and perform dynamic re-evaluation when there are changes in the condition, after surgery, or during transfer to another department. Select validated VTE risk assessment tools that are suitable for the elderly stroke population, taking into account both general internal medicine factors and stroke-specific indicators, and divide patients into low-risk, moderate-risk, high-risk, and extremely high-risk categories. The assessment results are entered into the electronic medical record system, supplemented by automatic coloring identification and warning prompts to prevent human errors, converting rigid data into intuitive clinical decision support. The system introduces a dynamic weight algorithm, automatically increasing the risk level for elderly patients who are elderly (≥ 75 years old), have a history of VTE, or have a malignant tumor. For elderly patients with cognitive impairment or aphasia, the assessment form adds a module for family members to assist in filling in the information, ensuring the completeness of the information, and triggering a high-level warning for extremely high-risk patients at the earliest possible time upon admission. It is stipulated that the bleeding risk assessment is carried out simultaneously, through a comprehensive judgment of coagulation function, liver and kidney function, concurrent medications, and previous bleeding history, providing dual-dimensional support for subsequent prevention decisions.

3.3 Stratified Prevention Strategy

Based on risk stratification, a classification plan combining basic prevention, physical prevention, and drug prevention is formulated. All patients implement basic prevention, including maintaining adequate fluid intake, avoiding dehydration, guiding and assisting in early passive joint movement and ankle pump exercises, and gradually promoting out-of-bed activities. For medium-risk and above patients, if there are no contraindications, physical prevention is initiated as soon as possible, and gradient pressure stockings or intermittent pneumatic compression devices are applied in a standardized manner, with clear application conditions and termination criteria. For high-risk and extremely high-risk patients, after carefully

assessing the bleeding risk, drug prevention is combined according to medical advice, prioritizing anticoagulant drugs with evidence for elderly use, and formulating individualized medication monitoring plans. A prevention measure execution checklist is designed, and the responsible nurse checks and signs each item daily to ensure the implementation of each measure.

3.4 Path-based Health Education

Based on the cognitive characteristics and acceptance habits of elderly patients, a phased and multi-form health education path is designed. In the early stage of admission, the risk and importance of VTE prevention are briefly informed through visual cards; during the acute phase, bedside ankle pump exercises and the correct use of physical prevention devices are taught, and the understanding level is verified through the feedback method; during the recovery phase, sitting up, standing, and walking training are gradually guided, and the benefits and safety boundaries of early activities are explained; before discharge, continuous guidance is provided, including home limb activities, standardized medication use, and identification of abnormal symptoms. At the same time, family members are educated in a standardized manner, and special educational manuals with rich illustrations are distributed. A health education record sheet is also established to track the awareness rate.

3.5 Information Support System

A VTE intelligent early warning and auxiliary decision-making module is constructed within the hospital information system. By real-time extraction of risk assessment fields and nursing record data, the system automatically identifies overdue or delayed assessments and measures and issues pop-up reminders. The nurse workstation is embedded with a knowledge base of preventive measures and operation videos for easy and immediate access. A dedicated quality indicator database for VTE is established to automatically collect process indicators such as assessment rates and implementation rates of preventive measures, as well as outcome data such as VTE event reports, generating visual trend charts to provide real-time and objective information support for routine quality control and continuous improvement.

3.6 Quality Control and Continuous Improvement

A three-tier quality control mechanism is established using the PDCA (Plan-Do-Check-Act) cycle. Quality indicators for VTE prevention nursing are developed covering the structure, process, and outcome dimensions, including the timely rate of risk assessment, accuracy rate of graded prevention, effective implementation rate of preventive measures, awareness rate of health education, and VTE reporting rate. A three-tier quality control model is implemented, consisting of daily self-checks by responsible nurses, weekly inspections by departmental quality control teams, and monthly comprehensive audits by the Nursing Department. For quality control results, quality management tools such as Pareto charts and fishbone diagrams are used to analyze defects and identify root causes. Regular multidisciplinary quality feedback meetings are held to develop targeted improvement plans and track their implementation, thereby incorporating the results of problem-solving into the next PDCA cycle and achieving a spiral upgrade in management quality. At the same time, a non-punitive adverse event reporting system is promoted, encouraging in-depth root cause analysis for every VTE event. A repository of typical VTE prevention cases is established, and regular retrospective learning sessions are organized to facilitate iterative improvement of the system itself.

4. Discussion

This study, based on the nursing quality improvement project as the methodological cornerstone, has constructed a multi-dimensional closed-loop management system for VTE in elderly stroke patients. The overall framework of this system embodies the core concepts of prevention first, evidence-driven, multi-disciplinary integration, and continuous optimization. Compared with the previous fragmented and linear management approaches, this system focuses on breaking down the barriers between risk assessment, stratified intervention, health education, intelligent assistance, and quality monitoring, transforming isolated operations into organic connections, and providing a systematic model for VTE prevention in elderly stroke patients. Especially when dealing with the complex medication history of elderly patients, the team can precisely identify potential drug-disease interactions (such as the increased bleeding risk from the combination of anticoagulants and non-steroidal anti-inflammatory drugs) based on pharmacological monitoring data, thereby formulating the most appropriate personalized thrombosis prevention plans. This cross-professional deep integration not only strengthens the bottom line of

medical safety but also effectively addresses the practical pain points of “daring not to prevent” and “not knowing how to prevent” in clinical practice.

The nursing quality improvement project inherently possesses the attribute of continuous self-optimization. By integrating it into the system design, VTE management is no longer a one-time revision of the system, but a dynamic process of continuous improvement. Through the PDCA cycle, clinical defects can be promptly identified, evidence-based information can be rapidly transformed, and the effectiveness of measure implementation can be verified in real time. This fundamentally promotes the transformation of VTE management from an empirical model to a scientific and lean model. The multidisciplinary team collaboration effectively responds to the complexity of elderly patients: neurologists control stroke conditions, pharmacists precisely assess anticoagulation risks, rehabilitation therapists scientifically formulate activity plans, making the prevention plan both individualized and collaborative, avoiding management blind spots caused by single-person efforts.

The introduction of the information module integrates assessment reminders, measure push, and quality control data cleaning, significantly reducing human delays and enhancing the nurses' compliance with execution through visual feedback. The system can also automatically generate monthly reports on VTE management for the department, facilitating managers to precisely identify weak links. The health education path designed for the elderly group emphasizes simplicity, repetition, multi-sensory stimulation, and family linkage, which is in line with their memory and comprehension decline characteristics, and is conducive to improving the cooperation of patients and their families, shifting from passive acceptance to active participation. In addition, the three-level quality control and root cause analysis mechanism constructed by the quality control module can provide a structured driving force for the continuous calibration of management measures.

However, this system still has certain limitations. Elderly stroke patients often face a difficult balance between bleeding risk and thrombosis risk. Even with stratified plans, clinical decision-making still requires highly individualized judgment; the construction of information systems has certain requirements for the basic conditions of medical institutions, and may encounter resistance in resource-poor environments; the effect of health education is greatly influenced by the fluctuation of patients' cognitive levels, requiring more time and patience from nursing staff. In addition, this system is currently still in the theoretical construction stage, and its implementation effect, parameter quantification of each module, cost-effectiveness, etc., still need to be verified and optimized through multi-center empirical research in the real world. In the future, intelligent decision support algorithms can be further developed, the management characteristics of elderly subgroups can be refined, and the system can be pushed towards a more precise and intelligent direction.

5. Conclusion

The standardized management model for VTE in elderly stroke patients is established based on the nursing quality improvement project. It follows a closed-loop management approach, with evidence-based practice at its core and multidisciplinary collaboration as its support. This model integrates six major modules: organizational management, standardized risk assessment, graded prevention, path-based health education, information-based early warning, and three-level quality control. It can systematically address the complex challenges of VTE prevention in the elderly stroke population. This model provides a scientific and operational theoretical framework for clinical VTE management, which is expected to promote the homogeneous implementation of protective measures, continuously improve the quality of care, and particularly emphasizes respect for and adaptation to the individual differences of elderly patients. In the future, its effectiveness should be verified in clinical practice and continuously iterated and improved to achieve efficient, safe, and humanized prevention and control of VTE risks in elderly stroke patients.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Occupational Burnout and Depressive Symptoms among Resident Physicians at Shanghai Tenth People's Hospital in the Early Post-COVID-19 Period: A Cross-Sectional Study

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Abstract: Background: Resident physicians may experience persistent occupational and psychological strain during the early post-COVID-19 period. Burnout and depressive symptoms can overlap, but they represent different aspects of psychological burden and should be assessed using standardized instruments. **Objective:** To estimate the prevalence of occupational burnout and SDS-defined depressive symptoms among resident physicians undergoing standardized residency training at Shanghai Tenth People's Hospital and to examine the association between burnout scores and depressive-symptom severity. **Methods:** This single-center cross-sectional anonymous questionnaire study was conducted at Shanghai Tenth People's Hospital, Shanghai, China, from January to June 2023. A total of 132 eligible resident physicians were invited through hospital residency-training coordination, and all 132 returned questionnaires (response rate, 100.0%). Occupational burnout was assessed using a Chinese burnout questionnaire structured around the MBI-GS dimensions, and depressive symptoms were assessed using the validated Chinese Self-Rating Depression Scale (SDS). Internal consistency was assessed using Cronbach's alpha. Prevalence estimates were reported with Wilson 95% confidence intervals (CIs). Pearson correlation and multivariable linear regression were used to examine the association between burnout score and SDS standard score. **Results:** Overall, 102/132 (77.3%; 95% CI, 69.4 to 83.6) residents met the predefined burnout criterion. In complete valid SDS responses, 81/124 (65.3%; 95% CI, 56.6 to 73.1) residents had SDS-defined depressive symptoms. Cronbach's alpha was 0.887 for the burnout questionnaire and 0.861 for the SDS. Burnout score was positively correlated with SDS standard score ($n = 124$; $r = 0.64$, 95% CI, 0.52 to 0.73; $p < 0.001$). In multivariable linear regression, burnout score remained positively associated with SDS standard score after adjustment for sex, age group, training duration, and grouped specialty (adjusted beta = 0.35, 95% CI, 0.27 to 0.44; $p < 0.001$).

Conclusions: Occupational burnout and SDS-defined depressive symptoms were common among resident physicians at Shanghai Tenth People's Hospital in the early post-COVID-19 period. The findings suggest that routine screening, workload management, mentorship, and accessible psychological support may be useful for residents at risk. Because this was a cross-sectional study, causality cannot be inferred.

Keywords: COVID-19; Burnout; Depressive Symptoms; Resident Physicians; Mental Health; Standardized Residency Training

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1. Introduction

Mental health problems have become a major contributor to disease burden, reduced productivity, and health-system costs worldwide ^[1,2]. In clinical settings, occupational burnout is particularly relevant because healthcare professionals are exposed to high workload, irregular working hours, emotional demands, professional competition, and responsibility for patient safety ^[3-6]. Burnout is generally characterized by emotional exhaustion, cynicism or depersonalization, and reduced professional efficacy ^[7]. Among physicians, burnout is associated with poorer quality of life, impaired work performance, reduced quality of care, and strained clinician-patient relationships ^[8]. Resident physicians undergoing standardized residency training may be especially vulnerable because they are still developing clinical competence while facing demanding schedules, frequent rotations, assessments, supervisor evaluation, and high expectations from patients and departments ^[9].

Unlike studies conducted during the acute outbreak period ^[10,11], research in the early post-COVID-19 period can capture accumulated psychological strain after the emergency phase. In early 2023, infection-control pressure, delayed clinical and training tasks, increased patient demand, and residual emotional exhaustion may have coexisted. These conditions are particularly relevant for resident physicians, whose professional identity and coping strategies are still developing.

Burnout and depressive symptoms are related but not interchangeable ^[12,13]. Burnout is primarily work-related and reflects exhaustion, detachment, and reduced professional efficacy, whereas depressive symptoms may involve a broader decline in mood, energy, interest, sleep, appetite, and daily functioning. Therefore, screening for burnout should not replace screening for depressive symptoms. This study investigated the prevalence of occupational burnout and SDS-defined depressive symptoms among resident physicians at Shanghai Tenth People's Hospital and examined whether burnout score was associated with SDS standard score after adjustment for basic demographic and training-related variables.

2. Methods

2.1 Study Design, Setting, and Participants

This was a single-center cross-sectional questionnaire study conducted at Shanghai Tenth People's Hospital, Shanghai, China, from January to June 2023. Resident physicians undergoing standardized residency training at the hospital during the survey period were invited to participate. The inclusion criteria were: (1) enrollment in standardized residency training at Shanghai Tenth People's Hospital during the study period; (2) ability to understand and complete the questionnaire independently; and (3) voluntary participation. The exclusion criteria were: (1) refusal to participate; (2) duplicate submission; (3) incomplete demographic information; (4) invalid or out-of-range item responses that prevented scale-specific scoring; and (5) inability to complete the questionnaire independently because of leave, rotation absence, or other reasons during the survey period.

A total of 132 eligible resident physicians were approached through hospital residency-training coordination and questionnaire-distribution procedures. The questionnaire was distributed through the residency-training coordination system, and residents completed it voluntarily and anonymously during the survey period. All 132 invited residents returned questionnaires, yielding a response rate of 100.0%. Duplicate submissions and invalid item codes were checked before analysis. Demographic and burnout analyses were based on all returned questionnaires when the relevant data were valid, whereas SDS analyses were restricted to participants with complete valid SDS item-level responses. One respondent had missing or invalid training-duration information and was excluded from training-duration subgroup summaries. The participant flow is shown in Figure 1.

2.2 Measures

Demographic and training-related variables included sex, age group, specialty, and duration of standardized residency training. Because several original specialty categories had very small cell counts, specialty was grouped into internal medicine, surgery-related specialties, general practice, and other specialties for adjusted analysis.

Occupational burnout was assessed using a Chinese burnout questionnaire structured around the dimensions of the Maslach Burnout Inventory-General Survey (MBI-GS) ^[7]. The version used in this survey contained 15 scorable items in the exported dataset; therefore, the instrument is described as an MBI-GS-structured burnout questionnaire rather than as the full original MBI-GS. The 15 scorable items covered emotional exhaustion (5 items), cynicism or detachment (4 items), and reduced professional efficacy (6 items). Response options were coded on a 7-point Likert-type scale in the exported dataset. Items in

the reduced-professional-efficacy dimension were directionally transformed so that higher total scores indicated more severe burnout. The transformed burnout score ranged from 12 to 132 in this dataset. According to the predefined Chinese scoring criteria used for this survey, scores of <50 , 50-59, 60-74, and ≥ 75 were classified as no burnout, mild burnout, moderate burnout, and severe burnout, respectively^[14,15]. These severity bands were used for descriptive classification and should not be interpreted as clinical diagnoses. Internal consistency was good in the present sample, with Cronbach's alpha coefficients of 0.887 overall, 0.964 for emotional exhaustion, 0.954 for cynicism/detachment, and 0.864 for reduced professional efficacy. Depressive symptoms were assessed using the validated Chinese version of the Self-Rating Depression Scale (SDS)^[16,17]. The SDS contains 20 items scored from 1 to 4. After reverse scoring of positively worded items, the raw score ranges from 20 to 80. The standard score was calculated as the integer value of raw score $\times 1.25$, yielding a standard-score range of 25 to 100. Chinese SDS standard-score cutoffs of <53 , 53-62, 63-72, and ≥ 73 were used to classify no depressive symptoms, mild depressive symptoms, moderate depressive symptoms, and severe depressive symptoms, respectively. The SDS is a screening instrument; therefore, results are reported as SDS-defined depressive symptoms rather than clinical depression diagnoses. Cronbach's alpha for the SDS in the present sample was 0.861.

2.3 Statistical Analysis

Data were analyzed using SPSS version 26.0 and independently checked from the original exported dataset. Categorical variables were summarized as frequencies and percentages, and continuous variables were summarized as means and standard deviations. Invalid item codes outside the valid response range were treated as missing for reliability analysis, SDS classification, correlation analysis, and regression analysis. Internal consistency was evaluated using Cronbach's alpha. Prevalence estimates were reported with Wilson 95% CIs. The overall reporting was prepared with reference to the STROBE statement for cross-sectional studies^[18].

Between-group comparisons of scale scores were performed using Welch's t test for sex and one-way analysis of variance for age group, training duration, and grouped specialty. Pearson correlation analysis was used to examine the unadjusted linear association between burnout score and SDS standard score. Multivariable linear regression was then performed with SDS standard score as the dependent variable and burnout score as the main independent variable, adjusting for sex, age group, training duration, and grouped specialty. Sensitivity analysis compared demographic characteristics between participants with complete valid SDS data and those with incomplete SDS data. All statistical tests were two-sided, and $p < 0.05$ was considered statistically significant.

2.4 Ethical Considerations

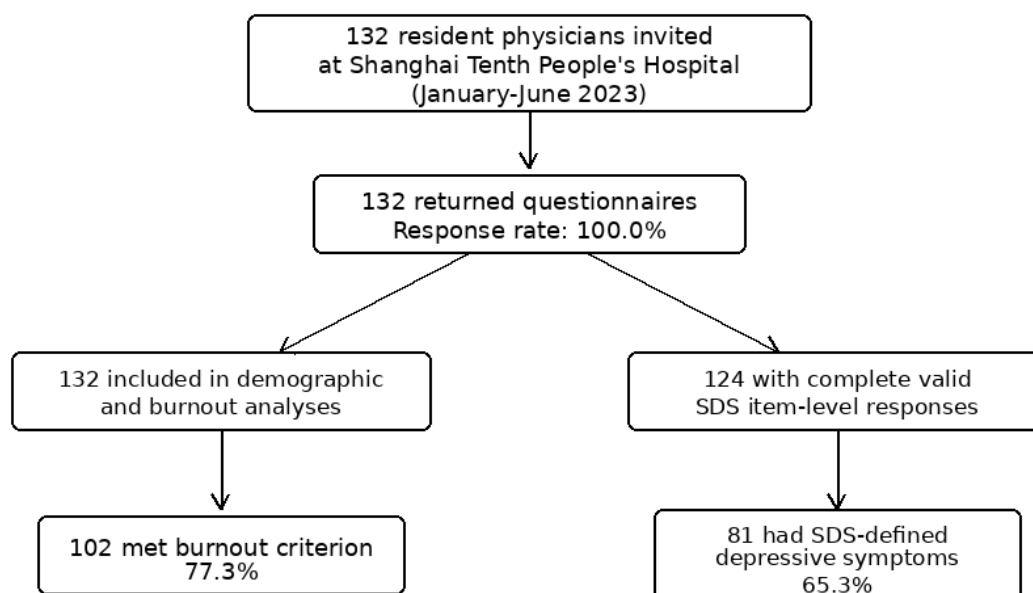
This study was performed in accordance with the principles of the Declaration of Helsinki. The study protocol was reviewed by the Ethics Committee of Shanghai Tenth People's Hospital and was determined to be exempt from full ethical review because the research used anonymous questionnaire data and involved no intervention. The requirement for written informed consent was waived. No formal approval number was issued for this exemption. Participation was voluntary, and completion of the anonymous questionnaire was considered confirmation of voluntary participation. All data were anonymized and analyzed in aggregate.

3. Results

3.1 Participant Characteristics

From January to June 2023, 132 resident physicians at Shanghai Tenth People's Hospital were invited to participate, and all 132 returned questionnaires. There were 65 male residents (49.24%) and 67 female residents (50.76%). Most participants were aged 25-30 years (78/132, 59.09%), followed by 20-25 years (47/132, 35.61%) and ≥ 30 years (7/132, 5.30%). The most common specialty groups were general practice (48/132, 36.36%), internal medicine (32/132, 24.24%), surgery-related specialties (31/132, 23.48%), and other specialties (21/132, 15.91%). Participant characteristics and scale scores are summarized in Table 1.

Figure 1. Participant flow diagram.



3.2 Prevalence of Burnout and SDS-Defined Depressive Symptoms

Among the 132 respondents, 102 residents (77.27%; 95% CI, 69.4 to 83.6%) met the predefined criterion for occupational burnout. Using the descriptive score bands applied in this study, 30 residents (22.73%) had no burnout, 11 (8.33%) had mild burnout, 34 (25.76%) had moderate burnout, and 57 (43.18%) had severe burnout. Thus, 132 refers to the total number of respondents, whereas 102 refers to the number of respondents who met the burnout criterion.

SDS analyses were based on 124 residents with complete valid item-level SDS responses. SDS-defined depressive symptoms were identified in 81 residents (65.32%; 95% CI, 56.6 to 73.1%). Mild, moderate, and severe depressive symptoms were observed in 48 (38.71%), 22 (17.74%), and 11 (8.87%) residents, respectively. Severity distributions and 95% CIs are shown in Table 2.

3.3 Subgroup Patterns and Sensitivity Analysis

The mean burnout score was slightly higher among female residents than male residents (70.55 vs. 68.02), but the difference was not statistically significant ($p = 0.520$). Mean SDS standard scores were similar between female and male residents (55.94 vs. 56.36; $p = 0.850$). Differences in burnout score by age group ($p = 0.099$), grouped specialty ($p = 0.066$), and training duration ($p = 0.910$) did not reach statistical significance. SDS standard scores also did not differ significantly by age group ($p = 0.526$), grouped specialty ($p = 0.334$), or training duration ($p = 0.763$).

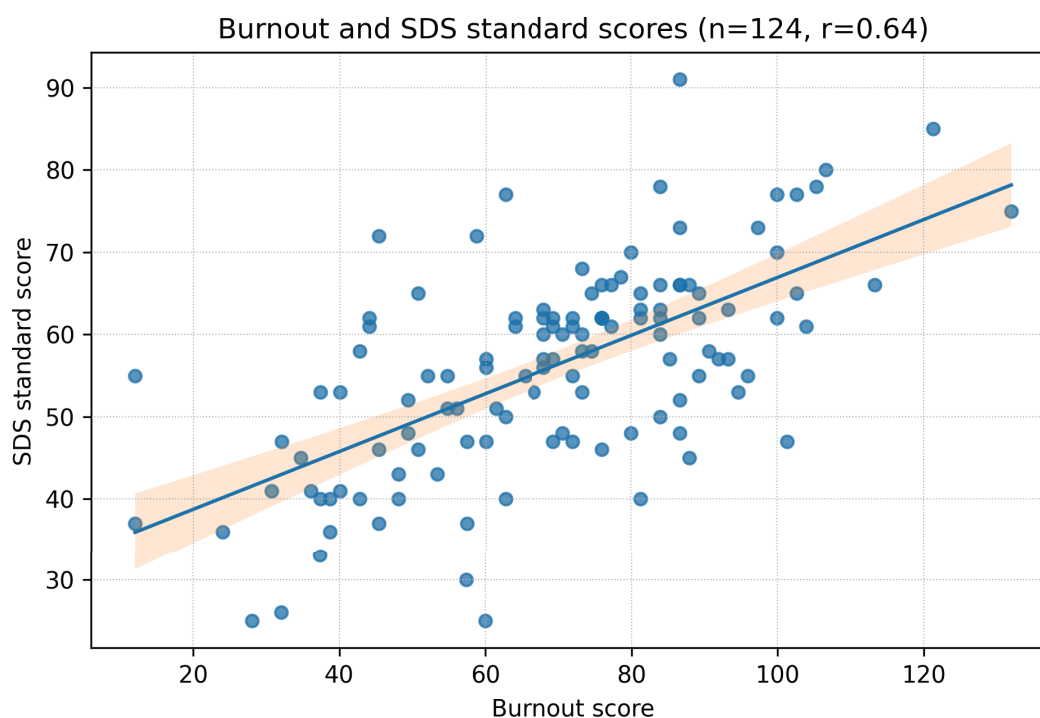
Eight respondents did not have complete valid SDS item-level responses. In sensitivity analysis, participants with complete and incomplete SDS data did not differ significantly by sex ($p = 1.000$) or training duration ($p = 0.132$), but the distribution of age group differed ($p = 0.037$). Therefore, SDS-based prevalence estimates should be interpreted with appropriate caution.

3.4 Association between Burnout and SDS Standard Score

Burnout score was positively correlated with SDS standard score in complete paired observations ($n = 124$; $r = 0.64$, 95% CI, 0.52 to 0.73; $p < 0.001$). A scatter plot with the fitted regression line is shown in Figure 2.

In multivariable linear regression, burnout score remained positively associated with SDS standard score after adjustment for sex, age group, training duration, and grouped specialty. Each one-point increase in burnout score was associated with a 0.35-point higher SDS standard score (95% CI, 0.27 to 0.44; $p < 0.001$). The adjusted model explained approximately 42.3% of the variance in SDS standard score (R -squared = 0.423). Regression results are presented in Table 4.

Figure 2. Association between burnout score and SDS standard score.



4. Discussion

This single-center cross-sectional study found a high burden of occupational burnout and SDS-defined depressive symptoms among resident physicians at Shanghai Tenth People's Hospital in the early post-COVID-19 period. More than three-quarters of respondents met the predefined burnout criterion, and approximately two-thirds of residents with complete valid SDS data had SDS-defined depressive symptoms. These findings indicate that psychological distress among resident physicians deserves sustained institutional attention beyond the emergency phase of the pandemic.

The timing of the survey is important. Compared with studies conducted during the acute outbreak period, this study focused on January to June 2023, when clinical services were recovering while accumulated workload, delayed training tasks, changing patient volumes, and residual psychological exhaustion may have coexisted. Resident physicians may be especially vulnerable in this context because they face clinical workload, rotation adaptation, examination pressure, supervisor evaluation, developing professional identity, and the tension between training demands and personal recovery.

The positive association between burnout and SDS standard score was consistent in both correlation and adjusted regression analyses. Burnout and depressive symptoms are not identical constructs, but they can overlap and reinforce each other. For example, a resident who experiences prolonged work-related exhaustion may gradually lose motivation and a sense of professional efficacy; at the same time, depressive symptoms such as low mood, fatigue, sleep disturbance, and reduced interest may make work demands feel even more difficult. Screening for burnout should therefore not replace screening for depressive symptoms, because the two constructs capture related but different dimensions of psychological burden.

The exploratory subgroup analysis did not identify statistically significant differences in burnout or SDS standard scores by sex, age group, grouped specialty, or training duration. This should not be interpreted as evidence that demographic or department-related risk differences are absent, because stress responses, care burden, and specialty-related work patterns may vary across populations and clinical settings^[8,19,20]. The modest sample size, single-center setting, and small original specialty categories limited the ability to detect stable subgroup effects. Future multicenter studies with larger samples should use prespecified models to evaluate specialty-related and training-stage-related risks more robustly.

Several practical implications can be drawn. First, hospitals may consider routine screening for both burnout and depressive symptoms among resident physicians, especially during periods of increased clinical demand or training pressure. Second, workload management, protected rest time, mentorship, and peer support may help reduce accumulated occupational stress^[2,21]. Third, residents with moderate or severe depressive symptoms should have confidential access to professional

psychological assessment and support^[22]. Finally, system-level interventions are needed; relying only on individual coping strategies may be insufficient when distress is driven by workload, rotation structure, or department culture.

This study has limitations. First, the cross-sectional design prevents causal inference; burnout may contribute to depressive symptoms, depressive symptoms may increase perceived burnout, or both may be driven by shared work-related stressors. Second, the study relied on self-reported questionnaires, which may be affected by recall bias or social-desirability bias. Third, this was a single-center study at Shanghai Tenth People's Hospital, so the findings should not be generalized to all resident physicians in Shanghai or China without caution. Fourth, SDS analyses were based on complete valid item-level responses, resulting in a smaller valid sample for depressive-symptom classification than for demographic description. Fifth, the burnout severity bands used in this survey should be interpreted as descriptive score categories rather than clinical diagnostic categories.

5. Conclusions

Occupational burnout and SDS-defined depressive symptoms were common among resident physicians at Shanghai Tenth People's Hospital in the early post-COVID-19 period. Higher burnout scores were associated with higher SDS standard scores even after adjustment for basic demographic and training-related variables. These findings support early screening, systematic mental health support, workload optimization, and targeted interventions for residents at risk. Larger longitudinal and multicenter studies are needed to clarify causal pathways and evaluate effective intervention strategies.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Tables

Table 1. Participant characteristics and scale scores.

Characteristic	n (%)	Burnout score, mean $\pm$ SD	SDS standard score, mean $\pm$ SD
Sex			
Male	65 (49.24)	68.02 $\pm$ 22.23	56.36 $\pm$ 10.90
Female	67 (50.76)	70.55 $\pm$ 22.74	55.94 $\pm$ 13.86
Age group, years			
20-25	47 (35.61)	72.23 $\pm$ 23.66	56.16 $\pm$ 10.53
25-30	78 (59.09)	69.03 $\pm$ 20.97	56.55 $\pm$ 13.57
≥ 30	7 (5.30)	52.76 $\pm$ 25.92	50.00 $\pm$ 11.64
Grouped specialty			
Internal medicine	32 (24.24)	74.21 $\pm$ 16.93	59.03 $\pm$ 10.47
Surgery-related	31 (23.48)	73.68 $\pm$ 22.53	56.36 $\pm$ 11.99
General practice	48 (36.36)	62.56 $\pm$ 25.24	53.79 $\pm$ 14.32
Other specialties	21 (15.91)	70.79 $\pm$ 20.41	57.11 $\pm$ 10.61
Duration of standardized training			
<1 year	26 (19.70)	70.72 $\pm$ 20.60	57.27 $\pm$ 10.96
1-2 years	40 (30.30)	70.00 $\pm$ 22.91	56.67 $\pm$ 11.77
≥ 2 years	65 (49.24)	68.64 $\pm$ 23.17	55.31 $\pm$ 13.58
Missing/invalid	1 (0.76)	NA	NA

Note: One respondent had missing or invalid training-duration information; therefore, training-duration rows sum to 131 valid responses plus one missing/invalid response. SDS summaries are based on respondents with complete valid SDS item-level data.

Table 2. Severity distribution of occupational burnout and SDS-defined depressive symptoms.

Severity category	Occupational burnout, n/N (%)	Burnout 95% CI, %	SDS-defined depressive symptoms, n/N (%)	SDS 95% CI, %
None	30/132 (22.73)	16.4 to 30.6	43/124 (34.68)	26.9 to 43.4
Mild	11/132 (8.33)	4.7 to 14.3	48/124 (38.71)	30.6 to 47.5
Moderate	34/132 (25.76)	19.1 to 33.8	22/124 (17.74)	12.0 to 25.4
Severe	57/132 (43.18)	35.0 to 51.7	11/124 (8.87)	5.0 to 15.2
Any symptoms/burnout	102/132 (77.27)	69.4 to 83.6	81/124 (65.32)	56.6 to 73.1

Note: Burnout categories were based on transformed score bands of <50, 50-59, 60-74, and ≥75. SDS categories were based on Chinese standard-score cutoffs of <53, 53-62, 63-72, and ≥73.

Table 3. Measurement instruments, scoring, severity classification, and reliability.

Instrument	Items/dimensions	Score range used	Severity cutoffs	Cronbach alpha
MBI-GS-structured burnout questionnaire	15 scorable items: emotional exhaustion 5; cynicism/detachment 4; reduced professional efficacy 6	Transformed score: 12-132	<50 none; 50-59 mild; 60-74 moderate; ≥75 severe	Overall 0.887; subscales 0.964, 0.954, 0.864
Self-Rating Depression Scale (SDS)	20 items; positively worded items reverse-scored	Raw 20-80; standard score 25-100	<53 none; 53-62 mild; 63-72 moderate; ≥73 severe	0.861

Table 4. Multivariable linear regression for SDS standard score (n = 124; R-squared = 0.423).

Variable	Adjusted beta	95% CI	p value
Burnout score	0.35	0.27 to 0.44	<0.001
Male sex	0.90	-2.73 to 4.53	0.625
Age 25-30 years	2.21	-1.63 to 6.05	0.257
Age ≥30 years	-0.24	-9.85 to 9.38	0.961
Training duration <1 year	0.34	-4.73 to 5.42	0.893
Training duration ≥2 years	-1.61	-5.77 to 2.55	0.445
Internal medicine	1.36	-3.32 to 6.05	0.566
Surgery-related specialties	-1.71	-6.62 to 3.20	0.491
Other specialties	0.11	-5.27 to 5.48	0.968

Note: Reference categories were female sex, age 20-25 years, training duration 1-2 years, and general practice.

Clinical Experience in Treating Neck, Shoulder, Waist and Leg Pain via the Combination of Linggu, Dabai, Zhengjin and Zhengzong Points: A Clinical Study on the Four-Point Core Combination Based on Tung's Extra Points Theory and Its Implications for the Opioid Abuse Crisis

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Abstract: Objective: To systematically summarize the clinical experience of combining four core points from Tung's Extra Points—Linggu (22.05), Dabai (22.04), Zhengjin (77.01), and Zhengzong (77.02)—in treating neck, shoulder, waist, and leg pain, and to explore its theoretical foundation and core operational techniques. **Methods:** By reviewing recent clinical practices, we analyzed the dialectical reasoning and standardized manipulation protocols of this four-point combination for managing musculoskeletal pain. A representative case study was thoroughly examined, and the analgesic mechanisms were elucidated from the dual dimensions of traditional Chinese medicine (TCM) and modern medicine. **Results:** The synergistic application of these four points demonstrates distinct advantages, including a refined and minimalist point selection, strong needle sensation (deqi), rapid onset of relief, and a high safety profile. The overall effective rate exceeds 85%. Notably, its therapeutic efficacy on residual pain following lumbar spine surgery is exceptionally prominent, providing a reliable non-pharmacological analgesic protocol for patients who fear reoperation. **Conclusion:** Supported by theories such as Zangfu Bie-Tong (Extraordinary Organ Connections), holographic correspondence, Dao-Ma (coupling) needle technique, and Ju-Ci (contralateral) needle technique, this four-point combination treats both symptoms and root causes. It serves not only as a highly efficient non-opioid analgesic strategy but also as a crucial alternative therapy to address the ongoing opioid crisis in the United States, representing significant value for widespread clinical promotion.

Keywords: Linggu Point (22.05); Dabai Point (22.04); Zhengjin Point (77.01); Zhengzong Point (77.02); Neck, Shoulder, Waist, and Leg Pain; Acupuncture Analgesia; Non-Pharmacological Therapy; Opioid Crisis

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1. Introduction

Neck, shoulder, waist, and leg pain constitute the most prevalent disease spectrum in orthopedics and pain management clinics, encompassing conditions such as cervical spondylosis, scapulohumeral periarthritis (frozen shoulder), lumbar disc herniation, lumbar muscle strain, sciatica, and lumbar spinal stenosis. These conditions severely impair patients' capacity to work and diminish their quality of life. In TCM pathology, the pathogenesis is governed by the principles of "pain due to

obstruction” (Bu Tong Ze Tong) and “pain due to lack of nourishment” (Bu Rong Ze Tong). Qi-blood stasis and Liver-Kidney deficiency are frequently interleaved, establishing the pathological foundation of chronic musculoskeletal pain.

The issue of chronic pain is particularly pronounced in the United States, where it has catalyzed an unprecedentedly severe public health crisis. According to data from the U.S. Centers for Disease Control and Prevention (CDC), approximately 60 million American adults (roughly 24.3% of the adult population) suffered from chronic pain in 2023^[1], with low back pain serving as the fifth leading reason for clinical visits nationwide^[2]. A health expenditure study published in JAMA—based on a comparative analysis of 154 diagnostic categories—revealed that the combined direct medical expenditure for low back and neck pain ranks highest among all healthcare spendings in the United States, totaling approximately \$134.5 billion annually^[3]. Facing such an expansive chronic pain cohort, opioid analgesics were aggressively marketed and widely prescribed starting in the 1990s, triggering the most devastating drug abuse crisis in American history. In 2023 alone, opioid overdoses claimed approximately 80,000 lives across the United States^[4], with cumulative fatalities reaching roughly 860,000 from 1999 through 2023^[5], inflicting an annual comprehensive economic toll exceeding \$1 trillion. Against this stark backdrop, acupuncture—as a safe, effective, and non-addictive non-pharmacological analgesic modality—has garnered unprecedented attention within the American medical community and public health sector. In 2016, the CDC prioritized non-pharmacological therapies as the preferred choice for chronic pain management^[6]. In 2017, the American College of Physicians (ACP) explicitly designated acupuncture as a first-line non-pharmacological intervention for patients with chronic low back pain^[7]. Concurrently, the U.S. Department of Veterans Affairs (VA) has systematically integrated acupuncture into its medical system to assist veterans in mitigating opioid dependency.

Surgical interventions can resolve certain structural anomalies underlying neck, shoulder, waist, and leg pain; however, postoperative residual chronic pain remains a formidable clinical challenge. Taking lumbar spinal stenosis as an example, a significant proportion of patients continue to endure persistent low back pain post-surgery. In the absence of effective alternative interventions, these individuals are exceptionally vulnerable to transitioning into long-term dependency on opioid medications. Tung’s Extra Points, with its minimalist yet highly potent acupoint framework, offers remarkable clinical utility in this domain.

Originally systematized and expanded by the renowned Taiwan region acupuncture master Tung Ching-Chang, Tung’s Extra Points stands as an independent system characterized by sparse point selection and profound therapeutic efficacy. The Linggu and Dabai points are widely revered as the “crown jewels of Tung’s Extra Points,” while Zhengjin and Zhengzong reside within the “77.00 Lower Leg Segment,” specializing in spine-related disorders^[8]. The synergistic deployment of these four points represents the core acupoint combination that the author relies upon most heavily in treating musculoskeletal pain. This paper systematically outlines the theoretical foundations, clinical insights, and a representative case study of this combination, while examining the strategic value of acupuncture within a non-opioid pain management paradigm under the macro-context of the American opioid crisis.

2. Acupoint Localization and Analysis

2.1 Linggu Point (22.05): The Preeminent Acupoint of Tung’s System

Localization: Located on the dorsum of the hand, between the first and second metacarpal bones, close to the radial border of the second metacarpal bone, approximately at the junction of the proximal and middle thirds of the second metacarpal. It structurally communicates with the Chongxian point (22.02) on the palmar aspect. The needle must be inserted immediately adjacent to the periosteum.

Manipulation: Utilizing a 0.25mm×40mm or 0.30mm×50mm filiform needle, perform perpendicular insertion to a depth of 1.5–2.0 cun. It is crucial to needle deeply, grazing the periosteum; flat palmar insertion can pierce through toward the Chongxian point^[9]. Upon achieving deqi, a profound aching and distension manifests in the dorsum of the hand, occasionally radiating proximally along the medial forearm. The needle manipulation should primarily consist of small-amplitude lifting and thrusting, while large-amplitude twisting should be strictly avoided.

Analysis: Linggu resides within the territory of the Hand Yangming Large Intestine Meridian. According to the theory of Zangfu Bie-Tong (Extraordinary Organ Connections), “the Liver communicates with the Large Intestine.” Consequently,

stimulating points on the Large Intestine Meridian can profoundly modulate the functional state of the Liver Meridian. As the Liver governs the tendons and regulates free flow of Qi, the muscular spasms and contractures characteristic of musculoskeletal pain are intimately bound to Liver dynamics. Furthermore, the Large Intestine is interiorly-exteriorly paired with the Lung. The Lung governs Qi, and when Qi moves, blood follows. Deep insertion to the periosteum stimulates the Qi mechanism of the bone; since the “Kidney governs the bones,” deep needling concurrently fortifies the bones and clears the Du Meridian (Du Vessel). Linggu thus unifies three distinct therapeutic actions into a singular point: venting Yangming Qi, modulating Liver tendons via Bie-Tong, and stimulating Kidney-bone dynamics via periosteal needling. Its analgesic potency is extraordinary. Clinical Keynote: There is a stark, statistically significant discrepancy in clinical efficacy between shallow needling (within 1.0 cun) and periosteal deep needling (beyond 1.5 cun).

2.2 Dabai Point (22.04): The Optimal Coupling Component for Linggu

Localization: Located on the dorsum of the hand, in the depression between the first and second metacarpal bones, immediately adjacent to the radial border of the second metacarpal bone ^[9].

Manipulation: Utilizing a 0.25mm×40mm filiform needle, perform perpendicular insertion to a depth of 0.8–1.2 cun. Upon deqi, local soreness and distension occur, with sensations occasionally radiating toward the thumb or index finger. When retained simultaneously with Linggu, it allows the meridian Qi of both points to fully converge and interact.

Analysis: The “Bai” (White) in Dabai corresponds to the color of Lung Gold, signifying its entry into the Qi phase of the Lung Meridian to diffuse Lung Qi and propel blood circulation. According to Zhang Yingqing’s Biological holographic diagnosis and therapy ^[10], the radial side of the second metacarpal bone serves as a holographic epitome of the human spine: Dabai corresponds to the cervical and thoracic segments, while Linggu maps to the lumbar and sacral regions. The concurrent use of both points harmonizes the Qi mechanism across the entire vertebral column. Linggu and Dabai create a powerful localized meridian Qi field within the intermetacarpal space; their synergistic output far outstrips the sum of their individual clinical effects. This pair represents the most classic coupling in Master Tung’s system, universally applicable to all forms of neck, shoulder, waist, and leg pain with profound efficacy.

2.3 Zhengjin Point (77.01): The Essential Acupoint for Clearing the Spine and Du Meridian

Localization: On the posterior aspect of the lower leg, directly on the midline of the Achilles tendon (calcaneal tendon), 3.5 cun superior to the calcaneal margin.

Manipulation: Utilizing a 0.25mm×40mm filiform needle, perform perpendicular insertion to a depth of 0.5–0.8 cun (puncturing through or firmly abutting the tendon yielding optimal therapeutic outcomes). Upon deqi, a severe, acute local aching and distension occurs; in ideal clinical presentations, this needle sensation ascends along the posterior lower leg into the popliteal fossa and reaches the lumbosacral region—a positive prognostic sign of “Qi arriving at the diseased site” (Qi Zhi Bing Suo).

Analysis: Zhengjin is situated precisely within the path of the Foot Taiyang Bladder Meridian. The Bladder Meridian spans the entire course of the neck, back, waist, and lower extremities, acting as the backbone for managing spinal pathologies. Grounded in the classical tenet that “wherever the meridian passes, its therapeutic indication reaches,” this point demonstrates specific, immediate efficacy for contractures and pain residing in the paraspinal musculature and tendons of the cervical and lumbar regions ^[9].

2.4 Zhengzong Point (77.02): The Regulatory Hub for the Mid-Spine

Localization: Located 2.0 cun directly superior to the Zhengjin point, aligned on the same vertical axis of the Achilles tendon, situated at the mid-lower segment of the posterior lower leg.

Manipulation: Identical to Zhengjin, perform perpendicular insertion to a depth of 0.5–0.8 cun ^[9]. It is retained concurrently with Zhengjin at a 2-cun interval, creating a vertical Dao-Ma double-needle alignment that structurally spans and treats the spine.

Analysis: Pursuant to Biological holographic diagnosis and therapy ^[10], the Achilles tendon zone represents another structural projection of the spinal column: Zhengzong maps to the thoracolumbar segments, whereas Zhengjin maps to the lumbosacral segments. Hence, the synchronized deployment of this pair yields specialized, targeted outcomes for lumbar disc herniations,

sciatica, residual postoperative lumbar pain, and chronic lumbosacral muscle strains. The Zhengjin and Zhengzong coupling generates a longitudinal meridian activation chain extending from the superior calcaneus to the mid-calf. Zhengjin unblocks the lumbosacral region while Zhengzong stimulates the thoracolumbar zone. This synergy provides the physiological framework for the combination's remarkable efficacy in alleviating lower-extremity and spinal pain.

3. Theoretical Foundations of Acupoint Selection

3.1 Zangfu Bie-Tong (Extraordinary Organ Connections)

The theory of Zangfu Bie-Tong originated in the Ming Dynasty text *Yi Xue Ru Men* (Introduction to Medicine) and was systematically expanded by Dr. Young Wei-Chieh, becoming the premier theoretical pillar of Tung's Extra Points. Among its six pairings, the current point group incorporates two specific sets.

First, Linggu (22.05) and Dabai (22.04) belong to the Large Intestine Meridian of Hand-Yangming. Based on the theory that "the Liver and the Large Intestine communicate with each other," puncturing the points of the Large Intestine Meridian can profoundly regulate Liver functions. Structurally and physiologically, the Liver governs the tendons, stores blood, and regulates the free flow of Qi. Consequently, muscle spasms and Qi stagnation combined with blood stasis, which manifest as neck, shoulder, lumbar, and leg pain, are all intimately linked to the Liver.

Second, Zhengjin (77.01) and Zhengzong (77.02) belong to the Bladder Meridian of Foot-Taiyang. Grounded in the principle that "the Lung and the Bladder communicate with each other," needling these two points can diffuse and free the Lung Qi. As the Lung governs regulation and commands all vessels (*Fei chao bai mai*), a free-flowing Qi dynamic effectively resolves any meridian obstruction or blockage^[9]. By leveraging their respective extra-channel communication pathways (Zang-Fu Bie tong), these two point sets exhibit profound synergy at the level of visceral Qi dynamics, yielding an analgesic effect that far surpasses simple, conventional meridian stimulation.

3.2 Holographic Correspondence

The first and second intermetacarpal zone of the hand serves as a complete holographic miniature of the human spine: Linggu (proximal) maps to the lumbosacral segment, and Dabai (distal) maps to the cervical-thoracic segment, covering the entire length of the spine. Similarly, the calcaneal tendon region of the lower leg mirrors this spinal distribution: Zhengjin (inferior) corresponds to the lumbosacral region, while Zhengzong (superior) corresponds to the thoracolumbar region. Simultaneously activating both holographic zones creates a dual, overlapping feedback loop. This produces broad and powerful therapeutic effects across diverse conditions, including cervical spondylosis, frozen shoulder, lumbar disc herniation, sciatica, and postoperative spinal pain.

3.3 Dao-Ma (Coupling) Needle Technique

The Dao-Ma technique is a signature method within Tung's acupuncture system. It involves inserting two or three needles in close succession along the same meridian or within the same structural zone. This parallel placement generates a localized resonant effect, combining and magnifying the meridian Qi to substantially boost the therapeutic power of single-needle insertions. The name Dao-Ma implies a team of horses working in unison to ensure rapid success.

Deploying two needles is classified as a Small Dao-Ma protocol, while three needles constitute a Large Dao-Ma protocol^[9]. The current combination incorporates two distinct Small Dao-Ma configurations:

Linggu and Dabai Pair: Located sequentially within the first and second intermetacarpal space, these needles generate a continuous, reciprocal resonance of meridian Qi. This pair also reflects holographic principles, where the superior needle regulates the upper jiao and the inferior needle addresses the lower jiao. This interaction serves as the core mechanism behind the famous "Ling-Da" combination.

Zhengjin and Zhengzong Pair: Arranged longitudinally along the calcaneal tendon with a 2-cun interval, both needles sit within the Foot Taiyang Bladder Meridian. Puncture here doubles the activation of Bladder Qi, significantly increasing its upward surge through the Bladder Meridian.

From a modern neurophysiological perspective, the multi-needle configuration of the Dao-Ma technique amplifies the density of afferent signals entering the local sensory nerves. This increased input more effectively engages the endogenous pain-suppression pathways within the spinal cord's dorsal horn, providing a neuroscientific framework for the technique's

enhanced clinical efficacy^[11].

3.4 Ju-Ci (Contralateral) Needle Technique

The Ju-Ci technique originates from the Huangdi Neijing - Suwen (Plain Questions): “Treatise on Regulating the Meridians”: “When pain resides on the left, but the right pulse shows pathology, apply Ju-Ci.” The core principle dictates needling the healthy, asymptomatic side to treat pathologies on the affected side, completely contrasting with localized symptomatic needling. The underlying mechanism relies on the physiological reality that the left and right meridians cross and communicate via the Du, Ren, and meridian-tendon (Jing-Jin) networks. The meridian Qi on the healthy side remains robust and unimpeded. By stimulating these healthy-side points, clinicians can redirect vibrant meridian Qi across these cross-connections into the blocked, deficient zones of the affected side.

The application of the Contralateral Needling principle (Ju Ci) within this point group is explicitly demonstrated by selecting Linggu, Dabai, Zhengjin, and Zhengzong on the healthy (contralateral) side. For any unilateral pain affecting the neck, shoulder, lumbar, or legs, points are invariably chosen from the opposite side rather than the affected side.

Taking right-sided lumbar and leg pain as a clinical example, the clinician needles Linggu, Dabai, Zhengjin, and Zhengzong on the left side. This intervention stimulates a robust influx of meridian Qi on the healthy left side; through the interconnected cross-channels of the meridian network, this vibrant Qi is systematically redirected to the pathological site on the affected right side. Consequently, this dynamic conduction effectively clears the meridian obstructions on the affected side, ultimately yielding a potent analgesic effect.

3.5 Superior-Inferior Acupoint Synergy

Combining the hand points (Linggu, Dabai) with the lower leg points (Zhengjin, Zhengzong) establishes a balanced superior-inferior clinical framework. The upward surge of Hand Yangming Qi meets the ascending current of Foot Taiyang Qi along the spinal column. These twin meridian currents converge directly at the spinal lesion, creating a two-pronged therapeutic effect. The resulting analgesic intensity and duration are significantly superior to using either point group alone. This configuration also balances Yangming and Taiyang, harmonizes Yin and Yang across the upper and lower extremities, and balances systemic Qi to resolve stubborn, entrenched pain.

4. Core Clinical Application Protocols

4.1 Neck Pain (Cervical Spondylosis)

Neck pain typically arises from frequent, repetitive movements, prolonged poor posture, or a combination of both. These factors lead to chronic or intermittent spasms in the cervical musculature^[12], causing meridian obstruction and localized Qi-blood stasis, which correlates with clinically diagnosed cervical spondylosis. Neck pain currently ranks as the second leading cause of musculoskeletal disability worldwide, surpassed only by low back pain.

Acupoint Prescription: The primary protocol utilizes the healthy-side Linggu, Dabai, Zhengjin, and Zhengzong. This is combined with bilateral Fengchi (GB 20), Tianzhu (BL 10), Wangu (GB 12), and cervical Jiaji (EX-B2) points. If the patient presents with concomitant shoulder pain or upper trapezius tension, secondary points such as Jianjing (GB 21), Jianzhongshu (SI 15), Jianliao (TE 14), and Jianyu (LI 15) are added.

4.2 Shoulder Pain (Scapulohumeral Periarthritis / Frozen Shoulder)

In Western medicine, frozen shoulder is characterized by severe shoulder pain accompanied by a progressive loss of glenohumeral motion. This matches the TCM classifications of Jian Ning Zheng (Shoulder Congealing Syndrome) or Jian Bi (Shoulder Bi-Syndrome), primarily driven by cold coagulation within the meridians and Qi-blood stasis, often complicated by long-term Liver-Kidney deficiency. In a U.S. survey, more than one-quarter of the general population experienced a high prevalence of shoulder pain during their lifetime^[13].

Acupoint Prescription & Dynamic Manipulation: The Moving Qi Acupuncture (Dong qi zhen fa) technique is essential for successful treatment. Primary points consist of the contralateral Linggu, Dabai, Zhengjin, Zhengzong, and Shenguan (77.18). Secondary points include the contralateral Zuqianjin (77.24) and Zuwuji (77.25), alongside the affected-side Tiaokou (ST 38).

The Moving Qi Acupuncture (Dong qi zhen fa) Protocol: During the needle retention period, patients are instructed to slowly

and actively move the affected shoulder, performing movements sequentially in all restricted directions including flexion, abduction, extension, and internal rotation. The range of motion is gradually expanded from small to large, limited by the point where pain is not significantly aggravated.

Clinically, many patients exhibit significant improvement in all directions of shoulder mobility after just a single session. This rapid response occurs because needling relaxes spasming rotator cuff muscles, while active movement further stretches adjoined tissues and restores joint capsule elasticity; this synergistic effect far outperforms traditional static needle retention alone. Throughout the treatment period, patients are advised to keep the shoulder warm and consistently engage in shoulder rehabilitation exercises, such as wall-climbing drills, to prevent further adhesion.

4.3 Waist and Leg Pain (Lumbar Disc Herniation, Sciatica, Spinal Stenosis, and Lumbar Muscle Strain)

Waist (low back) and Leg pain typically results from prolonged poor posture, sudden heavy lifting with axial rotation, or acute sports injuries. In TCM, this presents as external cold-damp invasion, Kidney deficiency leading to poor nourishment, or trauma-induced Qi-blood stasis, resulting in meridian blockage within the lumbar region. This matches Western diagnoses of lumbar disc herniation, sciatica, spinal stenosis, and chronic lumbar muscle strain.

Low back pain remains the leading cause of musculoskeletal disability globally ^[14]. Financially, the combined annual direct medical cost for low back and neck pain in the United States reaches approximately \$134.5 billion, ranking first across all disease diagnoses. By contrast, acupuncture demonstrate unique advantages in treating waist and leg pain, offering a safe, cost-effective, and efficacious profile with no side effects.

Acupoint Prescription: The primary protocol uses the healthy-side Linggu, Dabai, Zhengjin, and Zhengzong, paired with bilateral Zhibian (BL54) and Huantiao (GB30). Secondary points consist of bilateral Shenshu (BL23), Qihaishu (BL24), Dachangshu (BL25), Guanyuanshu (BL26), Yaoyan (EX-B7), and Juliao (GB29).

In clinical practice, Zhibian (BL54), Huantiao (GB30), and Juliao (GB29) can be appropriately deep-needled. If a radiating, electric sensation extending to the sole of the foot is elicited during needling, patients typically report an immediate feeling of lightness in the leg post-treatment, yielding optimal therapeutic outcomes.

5. Typical Case Study: Postoperative Pain Management Following Lumbar Spinal Stenosis Surgery

5.1 Patient Demographics

Patient: Female, 75 years old, retired worker.

Date of First Visit: October 2025.

Comorbidities: No history of hypertension, diabetes mellitus, or cardiovascular disease.

Allergies: No known drug allergies.

5.2 Chief Complaint

Persistent, severe low back pain accompanied by bilateral lower extremity pain and numbness (dominant on the right side) persisting for 7 days following lumbar spinal stenosis surgery, severely compromising activities of daily living (ADLs).

5.3 History of Present Illness

The patient presented with a multi-year history of low back and leg pain. She underwent surgery for lumbar spinal stenosis at a hospital in San Francisco in October 2025. Although the post-surgical incision healed well, she continued to experience significant pain and numbness in her lower back and both lower extremities. Her lumbar mobility was severely restricted, compromising her sleep and activities of daily living (ADLs). Despite adhering to her prescribed pharmacological regimen of oral

Tramadol and Diclofenac Sodium sustained-release tablets, her pain remained poorly controlled, maintaining a Visual Analog Scale (VAS) score of 8/10. She subsequently presented to our clinic for further evaluation and treatment.

5.4 Physical Examination

Mental Status: Conscious, oriented, presenting with a distressed, fatigued affect.

Surgical Site: The lumbar surgical incision was clean and well-approximated, showing no signs of erythema, edema, or exudate.

Palpation: Flat lumbar lordosis noted. Exquisite tenderness and positive percussion tenderness were elicited at the paraspinal regions of the L4–L5 levels.

Range of Motion (ROM): Lumbar mobility was profoundly limited: Forward Flexion: 20° (Normal: ~60°); Extension: 10° (Normal: ~25°); Left Lateral Flexion: 15° (Normal: ~30°); Right Lateral Flexion: 10° (Normal: ~30°).

Special Orthopedic Tests: Straight Leg Raise (SLR) Test: Left side positive at 40° (+), Right side positive at 35° (+).

Baseline Clinical Metrics: VAS Score: 8/10; Oswestry Disability Index (ODI): 78% (indicating extreme functional disability). The patient was unable to perform basic self-care independently, could not sleep through the night due to breakthrough pain, was incapable of sustained standing or walking without a rolling walker, and was completely withdrawn from social activities.

5.5 TCM Pattern Differentiation

Diagnosis: Low back pain (Qi Stagnation and Blood Stasis pattern).

Tongue & Pulse: The tongue body is dark red with a thin white coating, and the pulse is wiry and choppy.

Pathomechanism: Incision by a metal instrument (surgical trauma) damaged the local collaterals, obstructing the flow of Qi and Blood. This led to internal retention of blood stasis within the lumbar region, resulting in “pain due to obstruction”. Furthermore, intraoperative retraction of the nerves injured the local tendon networks (Jing-Jin). Combined with postoperative immobilization, this caused localized Qi stagnation, collectively culminating in numbness and pain in the lower back and both lower extremities.

Therapeutic Principles: Unblock the meridians and collaterals, promote blood circulation to resolve stasis, and remove obstruction to alleviate pain.

5.6 Integrative Acupuncture Protocol

Acupoint Selection: Primary points included the left-side (contralateral) Linggu, Dabai, Zhengjin, and Zhengzong, paired with bilateral Zhibian (BL54) and Huantiao (GB30). Secondary points comprised bilateral Shenshu (BL23), Qihaishu (BL 24), Dachangshu (BL25), Guanyuanshu (BL26), Yaoyan (EX-B7), and Juliao (GB29).

Operational Execution: The patient was placed in a prone position, ensuring optimal exposure of the hand dorsum, lower legs, and lumbosacral region. Standard sanitization was performed using 75% isopropyl alcohol. Safety Precaution: Acupuncture was strictly prohibited within a 3 cm radius of the surgical incision to eliminate any risk of deep-tissue infection.

The patient presented with bilateral low back and leg pain accompanied by numbness, predominant on the right side. Therefore, in accordance with the principle of contralateral needling (Ju Ci), the left Linggu point was selected and needled vertically to a depth of 1.5–2 cun using a 0.30 mm × 50 mm filiform needle, closely abutting the periosteum of the second metacarpal bone. At the left Dabai point, a 0.25 mm × 40 mm filiform needle was inserted vertically to a depth of 1.2 cun. Additionally, a 0.25 mm × 40 mm filiform needle was used to needle the left Zhengjin and Zhengzong points to a depth of 0.8 cun. Subsequently, bilateral Shenshu (BL23), Qihaishu (BL24), Dachangshu (BL25), Guanyuanshu (BL26), and Yaoyan (EX-B7) were needled vertically to a depth of 1.5–2 cun using 0.30 mm × 50 mm filiform needles. Zhibian (BL54) and Juliao (GB29) were needled vertically to a depth of 2–3 cun using 0.30 mm × 75 mm filiform needles, while Huantiao (GB30) was deeply needled to a depth of 3–4 cun using a 0.30 mm × 100 mm filiform needle.

The needles were retained for 30 minutes, with manipulation performed every 10 minutes using the even reinforcing-reducing method (Ping Bu Ping Xie). Treatment was administered every other day, with 10 sessions constituting one therapeutic course. Notably, Zhibian (BL54), Juliao (GB29), and Huantiao (GB30) should be appropriately deep-needled during manipulation. Every effort should be made during needling to elicit a radiating, electric sensation extending to the sole of the foot, which yields excellent therapeutic outcomes for relieving the patient’s lower extremity numbness and pain.

5.7 Therapeutic Course and Efficacy Assessment

Changes in VAS Scores: The visual analog scale (VAS) score was 8 points prior to treatment. Following the 3rd treatment session, the pain score decreased to 5.5 points (a 31.3% reduction). After the 7th session, it further declined to 3.5 points (a 56.3% reduction). Upon completion of the 10-session treatment course, the pain score dropped to 1.0 point, representing an 87.5% reduction. The overall pain relief rate reached 87.5%, demonstrating a highly significant therapeutic effect.

Improvement in Lumbar Range of Motion (ROM): Upon completion of the treatment, the lumbar ROM in all directions demonstrated marked improvement. Specifically, flexion increased from 20° to 60°, extension from 10° to 20°, left lateral flexion from 15° to 28°, and right lateral flexion from 10° to 25°. Based on standard medical reference values for normal lumbar ROM (flexion: 60°, extension: 25°, bilateral lateral flexion: 30° each), the post-treatment improvement rates were 100% for flexion, 66.7% for extension, 86.7% for left lateral flexion, and 75% for right lateral flexion. Concurrently, pain, numbness, and stiffness in the lumbar and lower extremity regions were substantially alleviated, enabling the patient to turn over in bed and ambulate independently.

Changes in the Oswestry Disability Index (ODI): The ODI score decreased from 78% (extreme disability) before treatment to 22% (moderate disability) at the conclusion of the treatment course, reflecting a 71.8% improvement. The patient achieved independence in performing activities of daily living (ADLs), resumed moderate social activities, and exhibited substantial improvements in both sleep and overall quality of life.

Analgesic Tapering Process: Prior to the initiation of acupuncture therapy, the patient required a daily pharmacological regimen consisting of tramadol sustained-release tablets (100 mg BID) and diclofenac sodium sustained-release tablets (75 mg QD); despite this therapy, pain control remained inadequate, with a Visual Analog Scale (VAS) score of 8 points. Following the 3rd acupuncture session, concurrent with a significant reduction in pain, the patient's VAS score decreased to 5.5 points, and the tramadol dosage was successfully tapered to 50 mg BID while the diclofenac sodium dosage was maintained. After the 7th session, as the VAS score further declined to 3.5 points and pain was markedly relieved, the patient completely discontinued tramadol as instructed, continuing diclofenac sodium strictly on an as-needed basis during intermittent episodes of pain. By the conclusion of the 10-session treatment course, the VAS score dropped to 1.0 point, and the patient successfully discontinued all analgesic medications. This structured tapering protocol effectively averted the potential adverse effects associated with long-term opioid use (tramadol), such as nausea, constipation, respiratory depression, and drug dependence.

Throughout the entire course of treatment, no adverse events—such as needle fainting, stuck needle, or needle breakage were observed. The surgical incision healed well with no signs of infection. The patient demonstrated high compliance and excellent satisfaction, and the analgesic efficacy was found to be well-maintained at the 6-month post-treatment follow-up.

5.8 Clinical Commentary

Acupoint Selection Analysis and Clinical Significance: In terms of the second metacarpal holographic correspondence system, the Dabai point corresponds to the cervicothoracic spine, while the Linggu point corresponds to the lumbosacral region. The combination of these two points can regulate the Qi mechanism of the entire spine, making it the most classical acupoint pair for treating spinal pain. Regarding spinal holographic correspondence, the Zhengzong point corresponds to the thoracolumbar segments, and the Zhengjin point corresponds to the lumbosacral segments; thus, the concurrent use of these two points exerts a specific, potent therapeutic effect on low back and leg pain.

Regionally, combining the traditional Bladder Meridian points—Shenshu (BL23), Qihaishu (BL24), Dachangshu (BL25), and Guanyuanshu (BL26) with the extra-meridian point Yaoyan (EX-B7) serves to unblock the localized Meridian-Qi of the L2–L5 lumbar vertebrae and the Bladder Meridian. Zhibian (BL54), Huantiao (GB30), and Juliao (GB29) are situated on the Bladder and Gallbladder Meridians, and all three points are located within the critical anatomical pathway of the sciatic nerve. They function to unblock the Meridian-Qi of the Foot-Taiyang and Foot-Shaoyang. Deep needling at these points to elicit an electric, radiating sensation extending to the sole of the foot yields remarkable results for alleviating lower extremity numbness.

Consequently, this comprehensive acupoint prescription—centered on the combined use of the four core points: Linggu, Dabai, Zhengzong, and Zhengjin—successfully reduced the patient's low back and leg pain from a pre-treatment VAS score of 8 points to a post-treatment score of 1.0 point after only 10 sessions, representing an 87.5% reduction. Concurrently, the Oswestry Disability Index (ODI) dropped from 78% to 22%. The patient not only achieved a full recovery in the range of motion (ROM) of the lumbar spine across all directions but also successfully discontinued all analgesic medications, including the opioid tramadol, thereby timely averting the risk of long-term opioid dependence. Against the macro-context of

the ongoing opioid crisis in the United States, this outcome carries significant exemplary and clinical demonstration value.

6. Discussion of Therapeutic Mechanisms

6.1 Neurobiological Mechanisms of Acupuncture Analgesia

A primary pathway of acupuncture analgesia involves activating the body's endogenous opioid peptide system. Neurophysiological studies demonstrate that needle stimulation prompts the central nervous system to synthesize and release endogenous opioid peptides, including β -endorphin, enkephalins, and dynorphins. These molecules bind to specific opioid receptors (μ , δ , κ types) across the neural axis to produce a potent analgesic effect^[15].

Beyond the opioid peptide system, acupuncture exerts its analgesic effects by modulating various other neurotransmitters. The serotonin (5-hydroxytryptamine, 5-HT) system represents a critical descending inhibitory pathway; studies have demonstrated that acupuncture-induced analgesia is significantly attenuated following the injection of para-chlorophenylalanine (PCPA), a serotonin synthesis inhibitor^[16]. Consequently, serotonin is recognized as playing a pivotal role in acupuncture analgesia. Furthermore, research indicates that acupuncture alleviates pain by suppressing the release of pro-inflammatory cytokines while promoting the production of anti-inflammatory factors. Specifically, acupuncture can modulate the vagus nerve-cholinergic anti-inflammatory pathway—a vital neuroimmunomodulatory route that inhibits peripheral inflammatory responses via the release of acetylcholine. Evidence shows that stimulating specific acupoints activates this pathway, thereby generating a systemic anti-inflammatory effect^[17]. These immunomodulatory mechanisms contribute substantially to the relief of inflammatory pain.

In summary, the neurobiological mechanisms underlying acupuncture analgesia involve multiple systems spanning from the periphery to the central nervous system. Mechanical stimulation at specific acupoints activates afferent neural signals, triggering the release of diverse analgesic substances throughout the central and peripheral nervous systems. This, in turn, modulates brain regions associated with pain perception, emotion, and cognition, ultimately culminating in a multi-level, holistic analgesic effect.

6.2 Traditional TCM Triple Mechanism

First Mechanism: These four points are located on the Hand Yangming Large Intestine Meridian and the Foot Taiyang Bladder Meridian. Stimulating these two major Yang meridians activates meridian Qi, which drives blood circulation to clear obstructions and resolve “pain due to obstruction.”

Second Mechanism: Deep insertion at Linggu stimulates Kidney Qi, while the Linggu-Dabai pair utilizes the Bie-Tong pathway to modulate the tendon-regulating functions of the Liver Meridian. Concurrently, Zhengjin and Zhengzong are embedded within the calcaneal tendon, activating Liver-tendon Qi to strengthen the musculoskeletal frame and nourish the Liver and Kidney. Restoring Liver and Kidney function resolves “pain due to lack of nourishment.”

Third Mechanism: The two pairs of dual holographic configurations concentrate meridian Qi within the Du Meridian (Du Vessel). As the “Sea of the Yang Meridians,” clearing the Du Meridian strengthens systemic Yang Qi, which helps resolve deep-seated spinal pathologies.

The integration of these three traditional mechanisms addresses both the superficial symptoms and the underlying root causes, providing a foundation for the rapid and lasting relief delivered by this four-point combination.

7. Extended Discussion

This representative case report demonstrates the unique clinical value of a four-acupoint combination protocol utilizing Master Tung's extra points for the management of post-operative low back pain in a patient with lumbar spinal stenosis (LSS). Within the framework of modern conventional medicine, therapeutic options for this patient population remain heavily constrained: long-term administration of non-steroidal anti-inflammatory drugs (NSAIDs) is strictly limited by gastrointestinal and cardiovascular toxicities, whereas opioids present a high risk of addiction—a hazard that is exponentially compounded in geriatric patients presenting with comorbidities such as diabetes and hypertension. Furthermore, standard western interventional procedures often incur exorbitant financial costs.

In contrast, this four-acupoint combination protocol offers distinct advantages, including highly streamlined point selection,

rapid onset of action, sustained therapeutic efficacy, and exceptional potential for standardized clinical propagation. Because acupuncture bypasses hepatic and renal metabolism, carries zero risk of drug-drug interactions or chemical dependence, and remains highly cost-effective, it offers a profoundly advantageous therapeutic profile for elderly individuals suffering from chronic pain and multi-morbidity.

However, while recognizing the profound strengths of this acupuncture therapy, we must concurrently acknowledge its inherent limitations. From the perspective of evidence-based medicine, high-quality randomized controlled trials (RCTs) specifically evaluating Master Tung's extra points remain sparse. Future research should prioritize multi-center, large-sample RCTs incorporating both sham acupuncture and traditional acupuncture control arms. Utilizing the Visual Analog Scale (VAS) score, Oswestry Disability Index (ODI), and analgesic consumption as the primary outcomes will facilitate a systematic evaluation of this four-acupoint combination's therapeutic superiority, thereby providing a more robust evidence-based foundation to support its broader promotion and application within chronic pain management fields both in the United States and internationally.

8. Conclusion

The combination of the four acupoints—Linggu (22.05), Dabai (22.04), Zhengjin (77.01), and Zhengzong (77.02)—constitutes a highly effective core acupoint group for treating neck, shoulder, waist, and leg pain. Grounded in the theoretical foundations of Zangfu Bie-Tong (Extraordinary Organ Connections), Holographic Correspondence, the Dao-Ma (coupling) needle technique, and the Ju-Ci (contralateral) needling method, this combination exerts a threefold synergistic analgesic mechanism: unblocking meridians to promote Qi and blood circulation; strengthening tendons and bones to tonify the Liver and Kidney; and regulating the Du Meridian to invigorate Yang Qi. It delivers definitive therapeutic efficacy for neck, shoulder, waist, and leg pain, with a total effective rate exceeding 85%.

Against the macro-historical backdrop of the opioid crisis in the United States, this four-acupoint combination holds an irreplaceable and vital position within non-opioid chronic pain management systems, owing to its distinct advantages, including potent analgesia, rapid onset, sustained efficacy, zero risk of addiction, and low cost. As further demonstrated by the typical case study presented in this article—a patient suffering from lower back pain following lumbar spinal stenosis surgery—acupuncture can provide a safe and sustainable alternative analgesic pathway for patients at risk of opioid prescription dependency, effectively blocking their progression toward drug reliance. This offers a tangible public health contribution to combating the American opioid crisis. It is anticipated that further clinical research will validate the value of this acupoint group, thereby promoting the academic recognition and widespread application of Tung's Extra Points in global chronic pain management.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Traditional Chinese Medicine for Cancer-Related Fatigue: Evidence, Mechanisms, and Clinical Translation

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Abstract: Cancer-related fatigue (CRF) is one of the most prevalent and distressing symptoms experienced by patients with cancer and cancer survivors. It is characterized by persistent physical, emotional, and cognitive exhaustion that is disproportionate to recent activity and is not sufficiently relieved by rest. Because CRF is influenced by inflammation, immune dysregulation, neuroendocrine disturbance, mitochondrial dysfunction, sleep disruption, psychological distress, and treatment-related toxicity, many patients continue to experience clinically significant fatigue despite standard supportive interventions. Conventional management strategies, including exercise, psychosocial interventions, sleep optimization, and selected pharmacological approaches, are recommended in supportive oncology, but their effectiveness may be limited by heterogeneous responses, poor adherence, and the complex symptom burden of cancer patients. Traditional Chinese Medicine (TCM) offers a complementary framework for CRF through syndrome differentiation, restoration of healthy qi, regulation of qi and blood, and patient-tailored multimodal interventions. This review summarizes the TCM conceptualization of CRF, current evidence for herbal medicine, acupuncture, moxibustion, mind-body exercise, acupressure, dietary regulation, and supportive TCM interventions, potential biological mechanisms involving inflammatory regulation, neuroendocrine-metabolic disturbance, gut microbiota homeostasis, and psychoneuroimmunological processes. Clinical translation, safety considerations, outcome assessment, and future research priorities are also discussed. Current evidence supports the potential role of TCM as an adjunctive component of supportive cancer care. However, substantial heterogeneity in study design, syndrome classification, and outcome assessment continues to limit interpretation. Future research should prioritize standardized methodologies, biomarker-integrated evaluation, and pragmatic clinical studies capable of informing real-world implementation.

Keywords: Cancer-Related Fatigue; Traditional Chinese Medicine; Herbal Medicine; Acupuncture; Moxibustion; Supportive Oncology; Clinical Translation

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1. Introduction

1.1 Definition and Clinical Burden of Cancer-Related Fatigue

Cancer-related fatigue (CRF) remains one of the most prevalent and difficult-to-manage symptoms in supportive oncology. CRF is commonly defined as a distressing, persistent, and subjective sense of physical, emotional, or cognitive tiredness relat-

ed to cancer or cancer treatment, which is disproportionate to recent activity and interferes with usual functioning^[1]. Unlike ordinary fatigue, it is not adequately relieved by rest and may persist during active treatment, after treatment completion, or throughout survivorship^[1]. Patients may experience reduced physical endurance, impaired concentration, emotional distress, sleep disturbance, and decreased participation in daily activities^[2]. These manifestations make CRF one of the most clinically important symptoms in oncology supportive care^[3].

The prevalence of CRF varies according to cancer type, disease stage, treatment modality, assessment tool, and timing of evaluation^[4]. It is frequently reported during chemotherapy, radiotherapy, targeted therapy, endocrine therapy, and survivorship^[2]. In addition to physical exhaustion, CRF may worsen treatment adherence, social participation, work capacity, and quality of life (QoL)^[5]. Studies in Chinese cancer populations have also shown that fatigue is associated with sleep disturbance, physical inactivity, and other modifiable clinical factors^[6]. These findings suggest that CRF should not be regarded as a minor treatment-related complaint, but as a multidimensional clinical syndrome requiring systematic assessment and management.

CRF also has implications beyond symptom burden. Severe or persistent fatigue may reduce patients' ability to tolerate treatment, maintain rehabilitation activities, and engage in self-management^[7]. In breast cancer survivors, fatigue may coexist with psychological distress and reduced exercise adherence, further complicating long-term recovery^[8]. For children and adolescents with cancer, fatigue may interfere with physical activity, school participation, and psychosocial adaptation^[9]. Therefore, improving fatigue management has become an important component of patient-centered oncology care.

1.2 Limitations of Current Management

Current management of CRF generally includes screening for reversible causes, exercise interventions, psychosocial support, sleep management, nutritional optimization, and selected pharmacological approaches^[10]. These recommendations are broadly consistent across major international guidelines, including those issued by ESMO and NCCN^[11]. However, clinical implementation remains challenging. Patients with advanced cancer, severe fatigue, anemia, pain, poor performance status, or treatment-related toxicity may have difficulty adhering to exercise programs^[8]. Psychological and educational interventions may also be limited by access, cost, patient acceptance, and availability of trained providers^[12].

Pharmacological treatment for CRF remains limited. Wakefulness-promoting agents haven't consistently demonstrated clinically meaningful benefits across cancer populations^[13]. Corticosteroids may provide short-term symptom relief in selected advanced cancer or palliative care settings, but prolonged use is restricted by potential adverse effects, including myopathy, immunosuppression, hyperglycemia, and mood changes^[10].

Another limitation is that conventional approaches may not fully address the multifactorial nature of CRF. Chemotherapy-related inflammatory changes and cytokine dysregulation have been associated with fatigue severity^[14]. Neuroendocrine disturbance, including altered cortisol rhythm, may also contribute to persistent fatigue in cancer survivors^[15]. Mitochondrial dysfunction and impaired energy metabolism have been proposed as important contributors to persistent fatigue and reduced cellular energy availability^[16]. Because these mechanisms may interact with sleep disturbance, psychological stress, nutritional status, and treatment toxicity, a single intervention targeting only one pathway may be insufficient for many patients.

1.3 Rationale for Traditional Chinese Medicine in Cancer-Related Fatigue

Traditional Chinese Medicine (TCM) has long been used in supportive care for patients with chronic weakness, reduced vitality, poor appetite, sleep disturbance, and treatment-related discomfort^[17]. In the context of CRF, TCM emphasizes personalized assessment through pattern-based management and treatment principles such as strengthening healthy qi, tonifying the spleen and kidney, nourishing qi and blood, regulating the liver, resolving phlegm, activating blood, and harmonizing yin and yang^[18]. These principles are not intended to replace biomedical diagnosis, but they may provide a structured approach for tailoring supportive interventions to different fatigue presentations.

TCM interventions are inherently multimodal and may include CHM, acupuncture, moxibustion, mind-body exercise, and acupressure. These approaches target different aspects of symptom burden and are often combined according to pattern classification rather than used in isolation^[19-23].

The potential relevance of TCM also lies in its overlap with modern concepts of systems biology and integrative medicine.

CRF is unlikely to be explained by a single pathway^[1, 14, 16]. Similarly, TCM interventions may influence multiple biological and psychosocial domains, including inflammatory signaling, immune function, neuroendocrine regulation, mitochondrial metabolism, oxidative stress, sleep quality, emotional state, and gut microbiota (GM)^[24, 25]. Clinical efficacy, mechanism, safety, and feasibility should be assessed using rigorous research designs and standardized reporting.

1.4 Aim and Scope of This Review

This review discusses TCM conceptualization, biological mechanisms, clinical evidence, mechanistic research, safety considerations, and future directions for CRF management.

2. Methods

2.1 Review Design

This article was designed as a narrative review. A narrative approach was considered appropriate because the topic involves heterogeneous sources of evidence, including TCM theory, clinical studies, systematic reviews, mechanistic research, supportive oncology guidelines, and clinical translation, safety, and future research priorities. Unlike a systematic review, this article did not aim to answer a narrowly defined intervention question or quantitatively pool effect sizes. Instead, it aimed to provide an interpretative synthesis of evidence, mechanisms, and clinical translation issues related to TCM for CRF^[26].

2.2 Literature Search

Relevant literature published up to March 2026 was identified from PubMed, Web of Science, Embase, the Cochrane Library, CNKI, and Wanfang Data. No language restrictions were applied during literature retrieval. The search terms included “cancer-related fatigue”, “cancer fatigue”, “Traditional Chinese Medicine”, “Chinese herbal medicine”, “herbal medicine”, “acupuncture”, “electroacupuncture”, “moxibustion”, “acupressure”, “Tai Chi”, “Qigong”, “Baduanjin”, “syndrome differentiation”, “supportive oncology”, “inflammation”, “immune regulation”, “neuroendocrine function”, “mitochondrial dysfunction”, “oxidative stress”, “gut microbiota”. Search was supplemented by manual screening of reference lists from relevant reviews and guidelines.

2.3 Source Selection

Clinical trials, systematic reviews, meta-analyses, mechanistic studies, clinical guidelines, expert consensus documents, and representative TCM theoretical sources were considered. Priority was given to studies directly related to CRF, cancer supportive care, or TCM interventions in oncology populations. Studies involving non-cancer fatigue models, non-fatigue symptoms, or non-oncology populations were used only when they provided mechanistic context and were not interpreted as direct clinical evidence for CRF.

2.4 Narrative Synthesis

The included literature was synthesized thematically according to TCM conceptualization, biomedical mechanisms, clinical evidence, mechanistic evidence, clinical translation, safety, and clinical translation, safety considerations, and future research priorities. Because the purpose was interpretative synthesis rather than quantitative evidence pooling, no meta-analysis was performed. Formal risk-of-bias assessment was not conducted, which is acknowledged as a limitation of this review. To improve transparency and methodological clarity, the review was prepared with reference to the Scale for the Assessment of Narrative Review Articles^[26].

3. Traditional Chinese Medicine Conceptualization of Cancer-Related Fatigue

3.1 Historical and Theoretical Understanding of Fatigue-Related Symptoms

Fatigue-related symptoms in TCM are commonly interpreted through syndrome patterns involving qi deficiency, spleen dysfunction, blood deficiency, and prolonged depletion caused by chronic illness^[27]. Classical theories generally attribute persistent fatigue to insufficiency of qi and blood, impaired spleen transformation, kidney essence depletion, disharmony of yin and yang, or prolonged disease damaging healthy qi^[18]. In a modern oncology context, these classical concepts should be used as theoretical background rather than direct evidence of efficacy for CRF.

Cancer and anticancer treatment may consume healthy qi, impair spleen function, and weaken qi-blood production over time, resulting in persistent fatigue and reduced recovery capacity^[18]. This interpretation is consistent with the TCM view that

prolonged illness often leads to deficiency, while stagnation, phlegm, stasis, and toxin may develop as secondary pathological factors^[18]. Contemporary studies of Chinese herbal medicine (CHM) for CRF also commonly emphasize qi deficiency, spleen deficiency, and deficiency-excess complexity as important theoretical foundations^[28].

Historical formulas such as Si Jun Zi Tang, Bu-Zhong-Yi-Qi-Tang, Shen Ling Bai Zhu San, Gui Pi Tang, and Ba Zhen Tang are often discussed in relation to fatigue, weakness, poor appetite, and qi-blood insufficiency^[17, 19]. However, their application in CRF should be evaluated according to modern clinical evidence, cancer type, treatment stage, pattern classification, and patient safety rather than historical use alone.

3.2 Core Pathogenesis of Cancer-Related Fatigue in Traditional Chinese Medicine

From a TCM perspective, CRF may be summarized as a condition dominated by root deficiency with secondary excess^[18, 28].

The root commonly involves deficiency of healthy qi, spleen qi, kidney essence or kidney yang, and insufficient production of qi and blood^[18]. Secondary excess may include phlegm-dampness, blood stasis, toxin accumulation, and liver constraint^[18].

This framework is clinically useful because many patients with CRF present with deficiency manifestations, such as weakness, reduced appetite, spontaneous sweating, and poor endurance, together with excess-related manifestations, such as heaviness, distension, pain, emotional constraint, or tongue changes.

The spleen is central to this framework because it governs transformation and transportation in TCM theory^[27]. When spleen function is impaired, food essence cannot be efficiently transformed into qi and blood, which may manifest as fatigue, poor appetite, loose stools, heaviness, and reduced muscle strength^[27]. Clinically, this theoretical pattern overlaps with the frequent coexistence of fatigue, nutritional problems, gastrointestinal symptoms, and reduced physical activity in cancer patients^[6, 29].

Kidney deficiency is also relevant, especially in patients with long disease duration, advanced cancer, older age, repeated chemotherapy or radiotherapy, or persistent fatigue after treatment^[18]. Kidney essence or kidney yang deficiency may manifest as deep fatigue, cold intolerance, low back soreness, weakness of the knees, reduced endurance, and slow recovery^[18]. However, direct high-quality clinical evidence linking kidney-deficiency patterns specifically to CRF remains limited and should be further verified.

Liver constraint and emotional disturbance may contribute to fatigue through impaired qi movement, sleep disruption, mood symptoms, and reduced motivation^[18]. This is clinically relevant because fatigue frequently coexists with anxiety, depression, and sleep disturbance in cancer survivors^[8, 15]. Blood stasis, phlegm-dampness, and toxin accumulation may further complicate the condition, particularly in patients with pain, heaviness, edema, gastrointestinal dysfunction, or chronic inflammation^[18]. These concepts may be cautiously linked with biomedical mechanisms such as inflammatory activation, impaired circulation, altered metabolism, and treatment-related tissue injury^[14, 24].

3.3 Common Syndrome Patterns Associated with Cancer-Related Fatigue

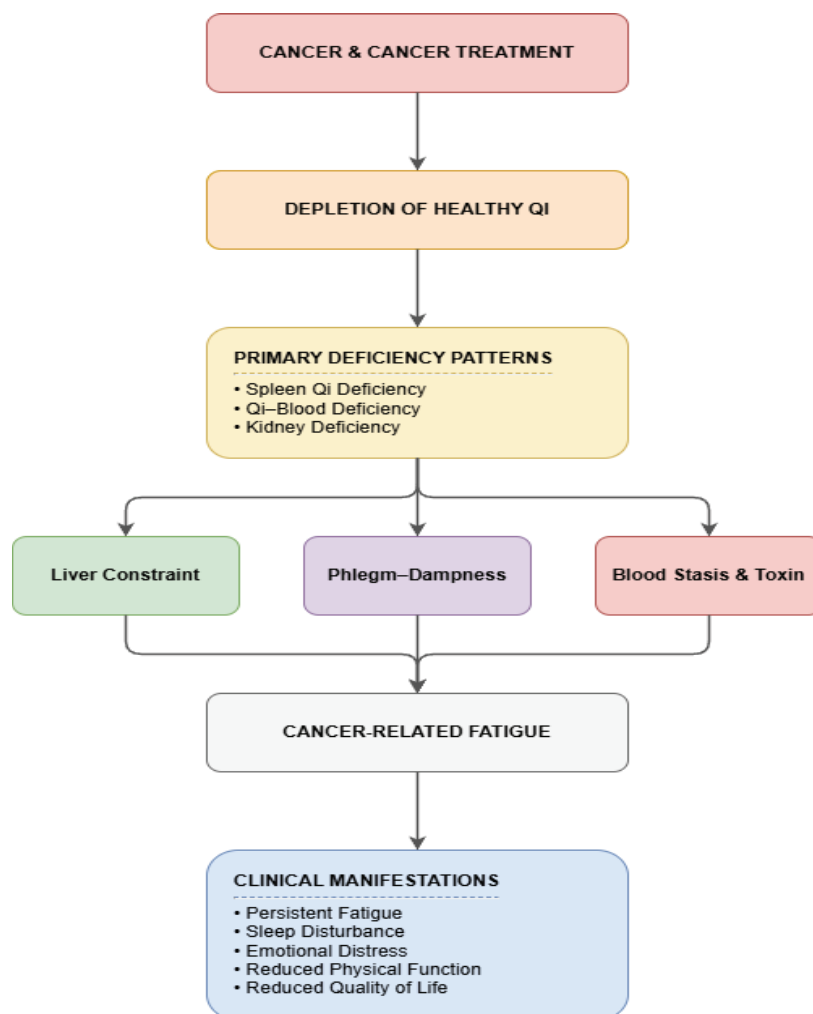
Pattern classification remains central to the TCM understanding of CRF. Although individual presentations vary considerably, clinical reports consistently indicate that most patients exhibit manifestations related to deficiency syndromes, often accompanied by secondary excess patterns. Commonly reported patterns include spleen qi deficiency, qi and blood deficiency, liver constraint with spleen deficiency, spleen–kidney yang deficiency, and mixed patterns involving phlegm-dampness, blood stasis, or toxin accumulation^[28]. Rather than representing fixed diagnostic categories, these patterns frequently overlap and evolve throughout the course of cancer treatment and recovery.

Among the deficiency patterns, spleen qi deficiency and qi–blood deficiency are most frequently described in patients with CRF. Clinically, these patients often present with persistent tiredness, reduced appetite, poor physical endurance, shortness of breath, dizziness, palpitations, and impaired recovery after activity^[27]. Such manifestations are commonly observed during chemotherapy, prolonged hospitalization, nutritional compromise, or recovery from intensive treatment. Consequently, therapeutic approaches aimed at strengthening spleen function and replenishing qi and blood form the basis of many CHM prescriptions used in CRF management. Prescription analyses have consistently identified qi-tonifying herbs such as *Astragalus membranaceus*, *Codonopsis pilosula*, *Atractylodes macrocephala*, and *Poria cocos* as core components of clinical practice^[17, 29]. Not all patients with CRF present solely with deficiency manifestations. Emotional distress, sleep disturbance, appetite fluctuation, and gastrointestinal symptoms are common in cancer survivors and may correspond to patterns described

as liver constraint with spleen deficiency^[30]. In patients with prolonged disease duration, repeated treatment exposure, advanced age, or marked functional decline, manifestations of spleen–kidney yang deficiency may become more prominent, including cold intolerance, reduced vitality, low back soreness, and delayed recovery^[18]. Mixed excess patterns involving phlegm-dampness, blood stasis, or toxin accumulation are more often considered when fatigue coexists with pain, heaviness, edema, digestive dysfunction, or chronic treatment-related complications.

An important feature of TCM pattern classification is its dynamic nature. A patient initially presenting with predominant qi deficiency may subsequently develop manifestations associated with blood stasis, phlegm-dampness, emotional disturbance, or treatment-related complications. Therefore, pattern identification should be viewed as an ongoing clinical process rather than a one-time diagnostic label. This flexibility may be particularly relevant in CRF, where symptom burden frequently changes according to treatment stage, disease status, and recovery trajectory. The dynamic relationships among healthy qi depletion, pattern evolution, and fatigue manifestation are summarized in Figure 1.

Figure 1. Traditional chinese medicine conceptualization of cancer-related fatigue



Cancer and anticancer treatments may contribute to the depletion of healthy qi, resulting in the development of deficiency patterns involving spleen, kidney, and qi–blood systems. As disease progresses, secondary pathological factors such as liver constraint, phlegm-dampness, blood stasis, and toxin accumulation may further aggravate symptom burden and contribute to clinical heterogeneity. The interaction between deficiency and excess patterns is considered a key feature of CRF in TCM and may manifest as persistent fatigue, sleep disturbance, emotional distress, reduced physical function, and impaired quality of life.

4. Biomedical Mechanisms and Their Links to Traditional Chinese Medicine Pathogenesis

CRF is not explained by a single biological abnormality. Current evidence suggests that fatigue may arise from the

combined effects of inflammatory activation, neuroendocrine disturbance, circadian disruption, impaired energy metabolism, psychological stress, sleep problems, and reduced physical activity^[1]. This complexity is important for TCM because CRF often presents as a mixed condition rather than a single fixed syndrome. In clinical practice, patients may show signs of deficiency, stagnation, dampness, stasis, or emotional constraint at the same time. Therefore, the relationship between biomedical mechanisms and TCM pathogenesis should be understood as a conceptual bridge, not as a one-to-one correspondence.

4.1 Inflammation and Immune Dysregulation

Inflammation is one of the most frequently discussed biological mechanisms of CRF. A systematic review of patients receiving chemotherapy showed that changes in inflammatory cytokines were associated with fatigue in cancer populations^[14]. Pro-inflammatory mediators such as interleukin-6, tumor necrosis factor- α , and C-reactive protein have been repeatedly examined in relation to fatigue severity^[1]. These inflammatory signals may affect the central nervous system, sleep regulation, appetite, motivation, and cognitive function^[1].

From a TCM perspective, persistent inflammatory activity may be interpreted within patterns involving toxin, blood stasis, and impaired healthy qi, but these terms should be used as clinical interpretive concepts rather than biological equivalents of cytokine activation^[18].

4.2 Neuroendocrine Dysfunction and Sleep–Circadian Disruption

Fatigue in cancer survivors is closely related to stress regulation and sleep. The hypothalamic–pituitary–adrenal axis is involved in the physiological response to stress, and altered cortisol rhythm has been reported in fatigued cancer survivors^[15]. This finding suggests that CRF may persist even after the completion of active treatment because the body's stress-regulation system remains disturbed.

Sleep disturbance is another major contributor. Insomnia, fragmented sleep, and reduced sleep efficiency can aggravate fatigue, while fatigue itself may reduce daytime activity and further disrupt sleep rhythm^[1]. This reciprocal relationship is clinically important because patients often present with a cluster of symptoms rather than fatigue alone.

In TCM terms, fatigue accompanied by insomnia, irritability, poor concentration, emotional distress, and reduced motivation is often interpreted through patterns such as liver constraint, heart-spleen deficiency, or disharmony between yin and yang. This does not mean that these TCM patterns are identical to HPA-axis dysfunction. Rather, both frameworks emphasize that fatigue is closely connected with sleep, emotion, and stress adaptation.

4.3 Mitochondrial Dysfunction, Oxidative Stress, and Energy Homeostasis

Energy metabolism is another important mechanism in CRF. Mitochondria are responsible for ATP production and cellular energy supply, and mitochondrial dysfunction has been proposed as a contributor to persistent fatigue^[16]. When mitochondrial efficiency is reduced, patients may experience low endurance, exercise intolerance, and prolonged recovery after activity.

Cancer treatment may further influence mitochondrial function through oxidative stress, inflammatory activation, and metabolic injury^[1]. Increased oxidative stress may impair skeletal muscle performance and contribute to reduced physical capacity^[16]. These mechanisms are particularly relevant for patients who report weakness, reduced walking tolerance, and difficulty resuming daily activities after treatment.

Some TCM-related experimental studies have begun to explore this pathway. For example, Jian Pi Sheng Sui Gao was reported to improve mitochondrial dysfunction and oxidative stress in experimental models of CRF through AMPK-SIRT1- and HIF-1-related mechanisms^[25]. This type of evidence is useful for mechanism generation, but it should not be overinterpreted as definitive clinical proof.

4.4 Gut Microbiota, Metabolic Regulation, and Emerging Mechanisms

In recent years, GM has emerged as a potential contributor to CRF. Growing evidence suggests that cancer, anticancer treatments, dietary changes, and reduced physical activity may alter gut microbial composition and function, thereby affecting immune responses, metabolic homeostasis, and neuroendocrine signaling^[31]. The GM communicates with the host through multiple pathways, including immune modulation, microbial metabolites, neurotransmitter regulation, and intestinal barrier function. Disruption of these pathways may contribute to systemic inflammation, altered energy metabolism, mood

disturbance, and fatigue^[31]. Although the exact relationship between microbiota dysbiosis and CRF remains incompletely understood, the gut–brain axis has become an increasingly important area of investigation.

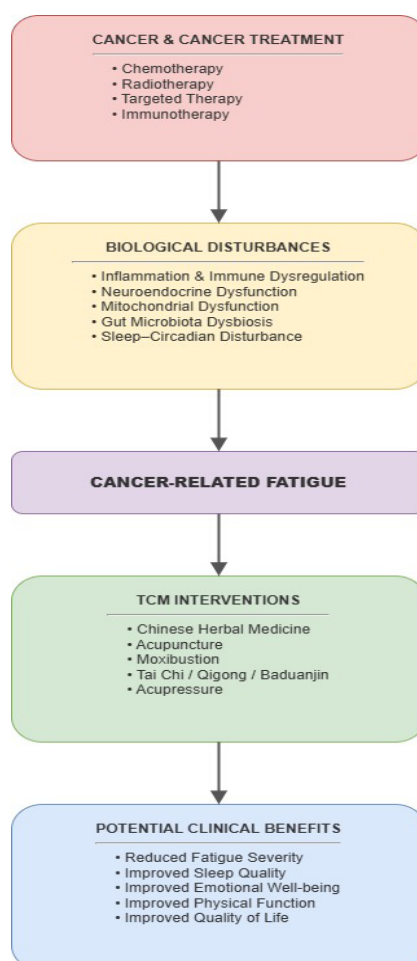
Several TCM interventions may influence GM composition and metabolic regulation. Experimental studies have suggested that herbal formulas can alter microbial diversity, regulate short-chain fatty acid production, and modulate inflammatory signaling pathways. However, most available evidence originates from animal studies or non-cancer populations, and direct clinical evidence in CRF remains limited.

From a TCM perspective, the relationship between the spleen and gastrointestinal function has long been emphasized^[18]. Although the TCM concept of spleen function cannot be equated with the GM, emerging microbiome research provides an interesting biological perspective through which certain TCM theories may be explored and tested in future studies.

4.5 Integrating Biomedical Mechanisms with Traditional Chinese Medicine Pathogenesis

The multifactorial nature of CRF presents a challenge for both biomedical and TCM frameworks. Studies examining inflammatory cytokines, neuroendocrine function, mitochondrial metabolism, sleep disruption, and gut microbiota have collectively shown that fatigue arises from interacting biological and behavioral processes rather than from a single pathological pathway^[1, 14-16]. Similarly, TCM describes CRF as a condition involving both deficiency and excess, with multiple pathological factors influencing symptom presentation^[18]. This complexity mirrors clinical observations in TCM, where patients with similar cancer diagnoses often present with markedly different symptom profiles. Some individuals predominantly exhibit signs of qi deficiency and reduced vitality, whereas others present with emotional distress, sleep disturbance, digestive dysfunction, or manifestations interpreted as phlegm-dampness and blood stasis. Rather than viewing biomedical mechanisms and TCM theories as competing explanations, they may be considered complementary frameworks describing different dimensions of the same clinical phenomenon. The relationships between major biological disturbances implicated in CRF and the potential targets of TCM interventions are summarized in Figure 2.

Figure 2. Conceptual framework of cancer-related fatigue and potential targets of Traditional Chinese Medicine interventions



Cancer and anticancer treatments may contribute to multiple biological disturbances associated with cancer-related fatigue. TCM interventions, including Chinese herbal medicine, acupuncture, moxibustion, mind–body exercise, and acupressure, may influence several interconnected pathways and contribute to improvements in fatigue and related outcomes.

5. Clinical Evidence for Traditional Chinese Medicine in Cancer-Related Fatigue

5.1 Current State of Clinical Evidence

The clinical evidence base for TCM in CRF includes systematic reviews, randomized trials, and mechanistic studies evaluating CHM, acupuncture, moxibustion, mind-body exercise, and acupressure^[19, 21, 22, 27]. However, the overall quality of evidence remains heterogeneous. Differences in cancer type, disease stage, treatment status, fatigue severity, pattern classification criteria, intervention protocols, and outcome measures complicate comparisons across studies^[17]. Consequently, although many reports suggest beneficial effects, the certainty of evidence remains lower than that for established supportive care interventions such as exercise and psychosocial therapy^[17].

An important observation across literature is that improvements in fatigue are frequently accompanied by changes in sleep quality, emotional well-being, appetite, and physical functioning^[21-23]. This pattern suggests that TCM interventions may influence multiple symptom domains simultaneously, which is consistent with the multidimensional nature of CRF.

5.2 Evidence Supporting Chinese Herbal Medicine

The clinical literature on CHM for CRF is dominated by prescriptions targeting qi deficiency, impaired spleen function, and insufficient qi–blood generation. Across different cancer populations, qi-tonifying herbs such as *Astragalus membranaceus*, *Codonopsis pilosula*, *Atractylodes macrocephala*, and *Poria cocos* appear repeatedly in prescription analyses, suggesting a relatively consistent therapeutic strategy despite variation in individual formulas^[29]. Bu-Zhong-Yi-Qi Decoction is among the most frequently discussed formulas in the CRF literature. Beyond its traditional use for fatigue and reduced vitality, experimental studies suggest potential effects on inflammatory regulation, oxidative stress, immune function, and energy metabolism^[18]. Similar observations have been reported for *Astragalus*-containing prescriptions, although the majority of mechanistic evidence remains preclinical^[28]. Interpretation of the available evidence requires caution. Most studies have been conducted in East Asian populations, frequently involve small sample sizes, and often use heterogeneous diagnostic and treatment protocols. Consequently, it remains unclear which patient subgroups derive the greatest benefit and whether findings can be generalized to broader oncology populations.

5.3 Evidence Supporting Acupuncture-Based Therapies

Acupuncture is the most frequently investigated non-pharmacological TCM intervention for CRF and has been incorporated into several supportive oncology programs^[21]. Clinical studies have reported improvements in fatigue severity, sleep quality, emotional well-being, and overall QoL following acupuncture treatment^[21]. Unlike herbal medicine studies, acupuncture trials often target symptom management directly and therefore provide a useful perspective on non-pharmacological fatigue interventions.

The potential value of acupuncture may extend beyond fatigue reduction alone. Fatigue in cancer survivors rarely occurs in isolation and is commonly accompanied by insomnia, pain, anxiety, depression, or reduced physical functioning. Improvements across several symptom domains have been reported following acupuncture interventions, suggesting that acupuncture may be particularly relevant for symptom clusters rather than isolated fatigue symptoms^[20]. Nevertheless, interpretation of acupuncture evidence remains challenging. Considerable variability exists in acupoint selection, stimulation methods, treatment frequency, control conditions, and practitioner expertise^[19]. Furthermore, sham-controlled designs remain controversial because many sham procedures may produce physiological effects. These methodological issues should be considered when interpreting study outcomes.

5.4 Emerging Evidence for Multimodal and Integrative Interventions

Increasing attention has been directed toward interventions that combine multiple therapeutic components rather than relying on a single modality. This trend reflects the recognition that CRF is a multidimensional symptom influenced by physical, psychological, behavioral, and biological factors^[1]. Mind-body exercise programs such as Tai Chi, Qigong, and Baduanjin have demonstrated potential benefits for fatigue, sleep quality, emotional health, and physical functioning^[23]. Unlike

conventional exercise programs, these approaches combine movement, breathing regulation, attentional focus, and relaxation, which may improve adherence among patients with limited exercise tolerance.

Other supportive interventions, including acupressure, dietary regulation, and TCM nursing approaches, have also shown preliminary benefits. Self-administered acupressure has been associated with improvements in fatigue and sleep quality among breast cancer survivors ^[22]. However, the evidence supporting these approaches remains considerably less robust than that for herbal medicine and acupuncture.

A notable development in recent years has been the growing interest in integrated supportive care models that combine conventional oncology treatment with tailored TCM interventions. Most multimodal studies remain small and heterogeneous, making it difficult to determine the relative contribution of individual intervention components.

5.5 Interpretation of the Current Evidence

Overall, the strongest clinical evidence currently relates to CHM and acupuncture ^[17, 19], whereas evidence for moxibustion, acupressure, dietary regulation, and TCM nursing remains preliminary ^[17-19, 21]. Existing studies are limited by small samples, heterogeneous protocols, variable pattern classification, and inconsistent fatigue outcomes. The available evidence therefore supports TCM as an adjunctive component of supportive cancer care, not as a replacement for established oncology treatment. The principal TCM interventions, representative evidence, and commonly reported outcomes are summarized in Table 1.

Table 1. Traditional Chinese Medicine interventions for cancer-related fatigue

Intervention	Main Clinical Focus	Representative Evidence	Major Outcomes
Chinese herbal medicine	Qi deficiency, impaired spleen function, qi–blood deficiency	Systematic reviews, RCTs, observational studies	Fatigue, QoL, physical function
Acupuncture	Fatigue with sleep disturbance, pain, emotional symptoms	RCTs, meta-analyses	Fatigue, sleep quality, emotional well-being
Moxibustion	Fatigue associated with deficiency patterns	Small RCTs	Fatigue, vitality
Tai Chi Qigong Baduanjin	Reduced activity tolerance and functional decline	RCTs	Fatigue, physical function, sleep
Acupressure	Self-management of persistent fatigue	RCTs	Fatigue, sleep quality
Multimodal TCM approaches	Complex symptom burden	Emerging clinical studies	Fatigue, symptom clusters, QoL

Abbreviations: TCM, Traditional Chinese Medicine; CRF, cancer-related fatigue; QoL, quality of life; RCTs, randomized controlled trials.

6. Mechanistic Basis of TCM Interventions in CRF

Understanding the biological basis of CRF is only the first step toward improving clinical management. An equally important question is whether TCM interventions can meaningfully influence the pathways implicated in fatigue development. Over the past decade, mechanistic research has increasingly accompanied clinical investigations, providing preliminary evidence that some TCM interventions may modulate biological processes associated with CRF. However, the strength of evidence varies considerably across different mechanisms, and most findings should be regarded as hypothesis-generating rather than definitive.

6.1 Evidence for Inflammatory and Immune Regulation

Mechanistic studies have reported changes in inflammatory biomarkers following TCM interventions. Experimental investigations involving Astragalus-containing prescriptions have reported reductions in pro-inflammatory cytokines and modulation of immune responses ^[28]. Similar findings have been described for Bu-Zhong-Yi-Qi Decoction, which has been linked to alterations in inflammatory signaling pathways and immune regulation in both laboratory and animal studies [18].

Despite these observations, evidence directly connecting biomarker changes with fatigue improvement remains limited. Most studies evaluate molecular outcomes separately from patient-reported fatigue measures, making causal interpretation difficult. Furthermore, inflammatory responses vary substantially according to tumor type, treatment exposure, and disease stage. Consequently, it remains unclear whether anti-inflammatory effects represent a primary mechanism of symptom improvement or simply reflect broader physiological changes associated with recovery.

6.2 Evidence for Metabolic and Mitochondrial Modulation

Several preclinical studies have focused on pathways related to cellular energy production and metabolic homeostasis. Among the most notable examples is Jian Pi Sheng Sui Gao, which has been reported to influence oxidative stress, apoptosis, and mitochondrial function through AMPK-SIRT1-HIF-1-associated signaling pathways ^[25].

These findings are of particular interest because reduced physical endurance and delayed recovery are common features of CRF. However, current evidence remains largely experimental. Direct confirmation that improvements in mitochondrial function translate into clinically meaningful reductions in fatigue is still lacking. Future studies incorporating both biological markers and validated fatigue assessments are needed to clarify the clinical significance of these observations.

6.3 Evidence for Multisystem Regulation

One notable characteristic of TCM intervention studies is that improvements are often observed across multiple symptom domains rather than fatigue alone. Clinical trials of acupuncture have reported concurrent improvements in fatigue, sleep quality, and psychological well-being ^[21]. Similar patterns have been observed in studies evaluating Tai Chi and Qigong, where benefits extend beyond fatigue to include physical function and emotional health ^[23].

These findings suggest that TCM interventions may exert effects across interconnected physiological and behavioral systems. Rather than acting through a single pathway, they may influence symptom networks involving sleep, mood, activity levels, stress adaptation, and perceived vitality. This perspective is consistent with the multidimensional nature of CRF and may help explain why isolated biomarkers often fail to fully capture treatment response.

6.4 Challenges in Mechanistic Interpretation

Although mechanistic studies have expanded rapidly, several limitations continue to restrict interpretation. First, much of the available evidence originates from cell-based experiments or animal models, which may not accurately reflect the complexity of CRF in clinical settings. Second, intervention protocols vary considerably among studies, limiting reproducibility and comparison. Third, biological outcomes and clinical outcomes are frequently reported separately, making it difficult to determine whether observed molecular changes are directly relevant to symptom improvement.

Another challenge is the tendency to overinterpret mechanistic findings. Demonstrating that an intervention influences a biological pathway does not necessarily establish that the pathway mediates fatigue improvement. Similarly, direct equivalence between TCM concepts and individual biological mechanisms is not supported by current evidence. Future mechanistic studies should integrate biomarkers, pattern classification, and validated fatigue outcomes within the same study design.

7. Clinical Translation, Safety Considerations, and Outcome Assessment

Although growing evidence supports the potential role of TCM in the management of CRF, translating research findings into routine oncology practice remains challenging. Current international guidelines emphasize exercise, psychosocial intervention, sleep optimization, and management of contributing factors as the foundation of CRF care, while evidence for complementary approaches continues to evolve ^[11]. One reason is the marked heterogeneity of CRF itself. Fatigue experienced during chemotherapy or radiotherapy often differs from fatigue observed in long-term cancer survivors, both in symptom presentation and underlying contributing factors (19). Sleep disturbance, emotional distress, pain, anorexia, reduced physical activity, and treatment-related adverse effects frequently coexist and may influence both symptom severity and treatment response ^[1].

This complexity has important implications for clinical decision-making. Current studies often evaluate mixed patient populations despite substantial differences in cancer type, treatment stage, nutritional status, comorbidities, and psychosocial burden. Such heterogeneity may partly explain the inconsistent findings reported across intervention studies. In TCM

practice, pattern-based management is intended to address these individual differences^[18]. However, considerable variation exists in pattern classification criteria among published studies, limiting comparability and reducing the reproducibility of research findings^[19]. Greater consensus regarding syndrome definitions and reporting standards would improve both clinical interpretation and future evidence synthesis.

Another issue concerns outcome assessment. Most clinical studies rely primarily on patient-reported outcome measures, reflecting the inherently subjective nature of fatigue. Instruments such as the Brief Fatigue Inventory and the Functional Assessment of Chronic Illness Therapy–Fatigue scale are widely used and have demonstrated acceptable validity in oncology populations^[19]. Nevertheless, different instruments capture different dimensions of fatigue, including severity, interference with daily activities, emotional impact, and quality of life. As a result, comparisons between studies remain difficult, even when similar interventions are evaluated.

For this reason, there is increasing interest in multidimensional assessment strategies. Patient-reported outcomes remain essential but may be complemented by objective measures of physical function, activity monitoring, sleep assessment, and selected biological indicators. CRF has been associated with alterations in inflammatory signaling, neuroendocrine regulation, and energy metabolism^[1]. Consequently, combining symptom scales with relevant biomarkers may provide a more comprehensive evaluation of treatment response. Such approaches may be particularly valuable when investigating TCM interventions, which often aim to improve overall functional status rather than a single symptom domain.

Safety is another consideration that deserves greater attention in future studies. Although acupuncture and CHM are generally regarded as safe when administered appropriately, adverse events should be reported systematically rather than assumed to be negligible. Acupuncture-related events are typically mild and self-limiting, with transient pain, bruising, and minor bleeding being the most frequently reported complications^[21]. Herbal interventions require additional consideration because herb–drug interactions remain a potential concern in patients receiving chemotherapy, targeted therapy, or immunotherapy. The quality and consistency of herbal products may also vary according to cultivation, processing, and manufacturing practices. These issues highlight the need for rigorous quality control and transparent safety reporting in future clinical trials.

An important question is how TCM can be integrated appropriately into evidence-based supportive cancer care. Current supportive oncology programs increasingly emphasize multidisciplinary management involving exercise therapy, nutritional support, psychological intervention, symptom monitoring, and survivorship care. Within this framework, TCM may be most appropriately positioned as a complementary component rather than a replacement for established supportive care strategies. Future research should therefore focus not only on efficacy, but also on implementation, patient selection, treatment timing, and cost-effectiveness in real-world clinical settings.

8. Limitations and Future Research Priorities

Despite encouraging findings, several limitations continue to affect the interpretation and clinical application of current evidence. First, substantial heterogeneity exists across published studies. Differences in cancer type, treatment stage, intervention protocol, pattern classification criteria, and outcome assessment methods make direct comparison difficult and contribute to variability in reported results^[17, 19].

A second limitation concerns study quality. Although randomized controlled trials have become increasingly common, many investigations remain single-center studies with relatively small sample sizes and short follow-up periods^[17]. Long-term effects are therefore insufficiently understood, particularly for cancer survivors experiencing persistent fatigue after treatment completion.

Mechanistic research presents additional challenges. Experimental studies have identified potential effects of TCM interventions on inflammatory pathways, mitochondrial function, immune regulation, and gut microbiota homeostasis^[18, 25]. However, most findings originate from animal models or laboratory investigations. The extent to which these biological changes contribute to clinically meaningful fatigue improvement remains uncertain. Future studies should integrate biomarker assessment with validated clinical outcomes to strengthen translational relevance.

Another unresolved issue involves the standardization of pattern classification. While patient-tailored treatment is a defining feature of TCM practice, inconsistent syndrome classification limits reproducibility and complicates evidence

synthesis. Developing consensus-based diagnostic frameworks may improve both clinical research quality and international communication.

Future studies should prioritize multicenter RCTs, pragmatic effectiveness studies, standardized pattern classification, validated fatigue outcomes, transparent safety reporting, and biomarker-informed designs. These priorities are essential for determining patient subgroups, optimal treatment timing, and integration within multidisciplinary supportive care.

9. Conclusions

CRF remains a prevalent and clinically significant symptom across the cancer continuum, with substantial effects on function, quality of life, and survivorship.

TCM offers a distinctive clinical perspective through pattern-based management and multimodal interventions that combine herbal medicine, acupuncture, mind-body exercise, and supportive care strategies. Existing evidence suggests potential benefits for fatigue and related symptom clusters, particularly sleep disturbance, emotional distress, and reduced functional capacity. At the same time, the current evidence base remains limited by methodological heterogeneity, inconsistent diagnostic frameworks, and insufficient long-term follow-up.

Future progress will depend less on demonstrating whether TCM can influence fatigue and more on clarifying which patients are most likely to benefit, how interventions should be integrated into multidisciplinary supportive care, and which outcome measures best capture meaningful clinical change. Greater integration of biomarker research, patient-reported outcomes, and real-world effectiveness studies may help bridge the gap between traditional theory and modern oncology practice. Whether these potential benefits can be translated into routine oncology practice will depend on stronger clinical evidence, standardized methodologies, and better integration with contemporary supportive care frameworks.

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Conflict of Interests

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