



Study on the Adaptability of Traditional Chinese Medicine Prescriptions under Integrated Traditional Chinese and Western Medicine: A Case Study of Common Chronic Diseases (Hypertension, Diabetes Mellitus, Chronic Gastritis)

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Abstract

Based on a TCM prescription database containing 81,219 valid records, this study focused on three clinically high-incidence chronic diseases (hypertension, diabetes mellitus, and chronic gastritis), constructed an evaluation system and quantitative model for the adaptability of TCM prescriptions in the diagnosis and treatment scenario of integrated traditional Chinese and Western medicine (TCM-WM), and systematically explored the adaptive application rules and characteristics of TCM prescriptions in this diagnosis and treatment mode. Combining text mining technology, statistical analysis and model verification methods, the study conducted an in-depth analysis from three core dimensions: prescription source distribution, drug composition characteristics, and quantitative adaptability score. The results showed that there were 4,428 hypertension-related prescriptions with an average adaptability score of 4.15; 1,659 diabetes-related prescriptions with an average adaptability score of 3.92; and 2,885 chronic gastritis-related prescriptions with an average adaptability score of 3.83. A significant positive correlation was found between the number of drugs and the adaptability score ($r=0.118$, $p<0.001$), and there were extremely significant statistical differences in the adaptability scores of TCM prescriptions for different chronic diseases ($F=58.974$, $p<0.001$). The research results can provide solid data support and scientific methodological reference for the precise screening and standardized application of TCM prescriptions in integrated TCM-WM diagnosis and treatment, and offer new ideas for the optimization of integrated TCM-WM treatment regimens for chronic diseases.

Key words

Integrated traditional Chinese and Western medicine; TCM prescriptions; Adaptability evaluation; Chronic diseases; Hypertension; Diabetes mellitus; Chronic gastritis

中西医结合下中医方剂适配性研究——以常见慢性病（高血压、糖尿病、慢性胃炎）为例

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摘要

本研究以包含 81,219 条有效记录的中医方剂数据库为研究基础，聚焦高血压、糖尿病、慢性胃炎三种临床高发慢性病，构建中西医结合诊疗场景下中医方剂适配性评估体系与量化模型，系统探究中医方剂在该诊疗模式中的适配应用规律与特征。研究综合采用文本挖掘技术、统计学分析及模型验证方法，从方剂来源分布、药物组成特征、适配性量化评分三个核心维度开展深度剖析。研究结果表明：高血压相关方剂共计 4,428 个，平均适配性评分为 4.15 分；糖尿病相关方剂共计 1,659 个，平均适配性评分为 3.92 分；慢性胃炎相关方剂共计 2,885 个，平均适配性评分为 3.83 分；药物数量与适配性评分呈显著正相关关系 ($r=0.118$, $p<0.001$)；不同慢性病对应的中医方剂适配性评分存在极显著统计学差异 ($F=58.974$, $p<0.001$)。本研究成果可为中西医结合诊疗中中医方剂的精准筛选与规范化应用提供坚实的数据支撑及科学的方法学参考，为慢性病中西医结合治疗方案的优化提供新思路。

关键词

中西医结合；中医方剂；适配性评估；慢性病；高血压；糖尿病；慢性胃炎

1 Introduction

1.1 Research Background

With the intensification of the global aging process and the transformation of residents' lifestyles, the incidence of chronic diseases has been rising continuously, becoming a major public health problem threatening public health and increasing the medical burden. At present, the single Western medicine treatment model has gradually shown many limitations in the long-term management of chronic diseases, such as obvious drug side effects, bottlenecks in curative effect, and insufficient individual adaptability. Relying on the holistic concept and syndrome differentiation thinking of TCM, and integrating the advantages of precise diagnosis and symptomatic treatment of Western medicine, the integrated TCM-WM diagnosis and treatment model has shown unique clinical value and application prospects in the individualized management of chronic diseases. As the core carrier of the TCM theoretical system, TCM prescriptions embody the clinical diagnosis and treatment experience of physicians in all dynasties and are an important practical form of syndrome differentiation and treatment in TCM. However, in the current clinical practice of integrated TCM-WM diagnosis and treatment, the selection of TCM prescriptions mostly relies on the personal experience accumulation of clinicians, lacking scientific, objective and quantitative adaptability evaluation criteria. This leads to insufficient standardization and accuracy in the application of prescriptions, which to a certain extent restricts the clinical efficacy and popularization of the integrated TCM-WM diagnosis and treatment model.

1.2 Research Significance

By constructing a scientific and sound integrated TCM-WM adaptability evaluation model, this study conducts a quantitative analysis and systematic exploration of the adaptive characteristics of TCM prescriptions for three common chronic diseases. Its core research significance is as follows: Establish an objective and quantitative evaluation system for the selection of TCM prescriptions in the diagnosis and treatment scenario of integrated TCM-WM, making up for the shortage of standardized adaptive evaluation tools in current clinical practice; Systematically reveal the specific characteristics of TCM prescriptions for different chronic

diseases in terms of drug composition, compatibility rules and source distribution, enriching the theoretical research on TCM treatment of chronic diseases;

Provide evidence-based medical basis for clinicians to accurately screen suitable prescriptions in integrated TCM-WM diagnosis and treatment, improve the accuracy and clinical efficacy of chronic disease diagnosis and treatment, and promote the standardized development of the integrated TCM-WM diagnosis and treatment model.

1.3 Research Objects and Data Sources

The data of this study were derived from a standardized and sorted TCM prescription database. After strict data cleaning, deduplication and verification, 81,219 valid prescription records were finally obtained, all of which contained core information such as prescription name, drug composition, efficacy and indications, and source literature. Using the keyword matching method, combined with the TCM syndrome terminology system and Western medicine disease diagnosis criteria, prescriptions highly related to the three common chronic diseases were screened out, with the specific screening results as follows:

Hypertension-related prescriptions: 4,428, with screening keywords including hypertension, elevated blood pressure, dizziness, headache, vertigo, hyperactivity of liver yang, etc., all in line with the Western medicine diagnosis criteria for hypertension and the syndrome differentiation key points of relevant TCM syndromes;

Diabetes-related prescriptions: 1,659, with screening keywords including diabetes mellitus, consumptive thirst, polydipsia, polyphagia, polyuria, emaciation, etc., all in line with the Western medicine diagnosis criteria for diabetes mellitus and the syndrome differentiation key points of consumptive thirst in TCM;

Chronic gastritis-related prescriptions: 2,885, with screening keywords including gastritis, chronic gastritis, stomachache, gastric distension, stuffiness and fullness in the epigastrium, belching, acid regurgitation, etc., all in line with the Western medicine diagnosis criteria for chronic gastritis and the syndrome differentiation key points of stomachache and stuffiness in TCM.

2 Research Methods

2.1 Data Preprocessing Methods

Missing value processing: A targeted processing strategy was adopted for the missing data in the database. Records with empty efficacy and indication fields were deleted to ensure the validity of the research objects; missing values in other non-core fields were retained with marks to avoid the impact of data distortion on the research results.

Text standardization processing: Text standardization was performed on all valid prescription records, unifying the expression format of prescription names, standardizing the characters and expressions of TCM drug names, eliminating problems such as the same drug with different names and different drugs with the same name, so as to ensure the consistency and accuracy of drug composition information.

Keyword matching and classification: Based on norms such as Classification and Codes of TCM Syndromes and Diagnostic Criteria for Integrated TCM-WM Syndromes, matching rules between chronic diseases and TCM prescriptions were established, and two-way keyword matching was used to complete the disease classification of prescriptions, ensuring the scientificity and reliability of the

classification results.

2.2 Integrated TCM–WM Adaptability Evaluation Model

Combined with the core needs of integrated TCM–WM diagnosis and treatment, and referring to the clinical efficacy evaluation criteria of TCM and the treatment objectives of Western medicine diseases, an integrated TCM–WM adaptability evaluation system for TCM prescriptions containing 4 first–level evaluation dimensions and multiple second–level evaluation indicators was constructed. The adaptability score range was set at 1–10 points, with a higher score indicating a higher degree of adaptability between the prescription and the integrated TCM–WM diagnosis and treatment needs of the corresponding chronic disease.

Adaptability Score Formula:

$$\text{Apex Score} = D1 + D2 + D3 + D4$$

The specific scoring criteria for each evaluation dimension are as follows:

D1 (Drug Quantity Rationality): The score range is 1–3 points. Combined with the TCM syndrome differentiation characteristics and clinical medication rules of the three chronic diseases, the specific scoring criteria are set as follows:

Hypertension: 3 points for prescriptions with 4–10 ingredients (in line with the compatibility principles of calming the liver and extinguishing wind, tonifying qi and activating blood circulation); 2 points for 2–12 ingredients; 1 point for those beyond the above range (<2 or >12 ingredients).

Diabetes mellitus: 3 points for prescriptions with 3–9 ingredients (in line with the compatibility principles of tonifying qi and nourishing yin, promoting the production of body fluid and relieving thirst); 2 points for 1–11 ingredients; 1 point for those beyond the above range (<1 or >11 ingredients).

Chronic gastritis: 3 points for prescriptions with 5–11 ingredients (in line with the compatibility principles of invigorating the spleen and harmonizing the stomach, regulating qi and relieving pain); 2 points for 3–13 ingredients; 1 point for those beyond the above range (<3 or >13 ingredients).

D2 (Classic Literature Support): The score range is 1–3 points. Taking 6 classic TCM medical works including General Record of the Holy Universal Relief, Imperial Grace Formulary of the Taiping Era, Valuable Prescriptions for Emergencies, Treatise on Cold Damage and Miscellaneous Diseases, Synopsis of the Golden Chamber and Systematic Differentiation of Warm Diseases as the core reference, combined with high–quality modern TCM research literature, the scoring criteria are set as follows: 3 points for prescriptions included in 2 or more classic medical works or supported by 5 or more high–quality modern literature for their efficacy; 2 points for those included in 1 classic medical work or supported by 2–4 modern literature; 1 point for those not included in any classic medical works and with less than 1 modern literature for evidence.

D3 (Clarity of Usage Method): The score range is 0–2 points. The scoring criteria are set according to the detail level of the prescription usage method:

Detailed and clear (>20 characters): 2 points for prescriptions with clear marking of core information such as drug dosage, decoction and administration method, administration time, course of treatment, and principles of addition and subtraction compatibility;

Basically clear (5–20 characters): 1 point for prescriptions with marking of core administration methods and approximate dosage range, without clear course of treatment and addition/subtraction principles;

Unclear (<5 characters or missing): 0 points for prescriptions without marking of usage methods or

with overly brief marking content (less than 5 characters) that cannot guide clinical application.

D4 (Completeness of Precautions): The score range is 0–2 points. The scoring criteria are set according to the completeness and standardization of prescription precautions:

Detailed and complete (>10 characters): 2 points for prescriptions with clear marking of contraindications, adverse reactions, drug interactions, dietary taboos, and medication precautions for special populations (pregnant women, children, patients with hepatic and renal insufficiency);

Basically complete (3–10 characters): 1 point for prescriptions with marking of core contraindications or dietary taboos with relatively brief information;

Incomplete (<3 characters or missing): 0 points for prescriptions without marking of precautions or with marking content less than 3 characters that cannot prompt medication risks.

2.3 Statistical Analysis Methods

SPSS 26.0 statistical software and Python data analysis tools were used for data processing and statistical analysis in this study. A p -value < 0.05 was considered statistically significant for all statistical tests. The specific statistical analysis methods are as follows:

Descriptive statistics: Descriptive statistical indicators such as frequency, percentage, and mean \pm standard deviation ($\bar{x} \pm s$) were used to systematically analyze the basic characteristics of prescriptions related to the three chronic diseases, including quantity distribution, number of involved medical books, drug composition characteristics, and adaptability score distribution.

Correlation analysis: Pearson correlation analysis was used to explore the correlation between the number of drugs in TCM prescriptions and the adaptability score, and to clarify the influence degree of the number of drug components on adaptability.

Analysis of variance: One-way analysis of variance (ANOVA) was used to test the differences in the adaptability scores of TCM prescriptions for hypertension, diabetes mellitus and chronic gastritis, and to clarify the specificity of the adaptability requirements of TCM prescriptions for different chronic diseases.

Reliability analysis: Cronbach's α coefficient was used to test the internal consistency of the adaptability evaluation model, where $\alpha > 0.8$ indicated excellent internal consistency, $0.6 \leq \alpha \leq 0.8$ indicated acceptable internal consistency, and $\alpha < 0.6$ indicated poor internal consistency requiring further optimization.

3 Research Results

3.1 Analysis of Basic Characteristics of TCM Prescriptions for Three Chronic Diseases

3.1.1 Prescription Quantity and Source Distribution

The basic statistical characteristics of TCM prescriptions related to the three common chronic diseases are shown in Table 1. In terms of the number of prescriptions, hypertension-related prescriptions were the most (4,428), involving 1,649 medical books; chronic gastritis-related prescriptions ranked second (2,885), involving 1,353 medical books; and diabetes-related prescriptions were the fewest (1,659), involving 875 medical books. The above results suggest that the application accumulation of TCM prescriptions in the treatment of hypertension is relatively rich, while the application research in the treatment of diabetes mellitus needs to be further strengthened.

Table 1 Basic Statistics of TCM Prescriptions for Three Chronic Diseases

Type of Chronic Disease	Total Number of Related Prescriptions	Number of Involved Medical Books	Average Number of Drugs (\pm SD)	Range of Drug Quantity
Hypertension	4,428	1,649	4.18 \pm 2.35	0–18
Diabetes Mellitus	1,659	875	4.09 \pm 2.17	0–15
Chronic Gastritis	2,885	1,353	4.49 \pm 2.42	0–17

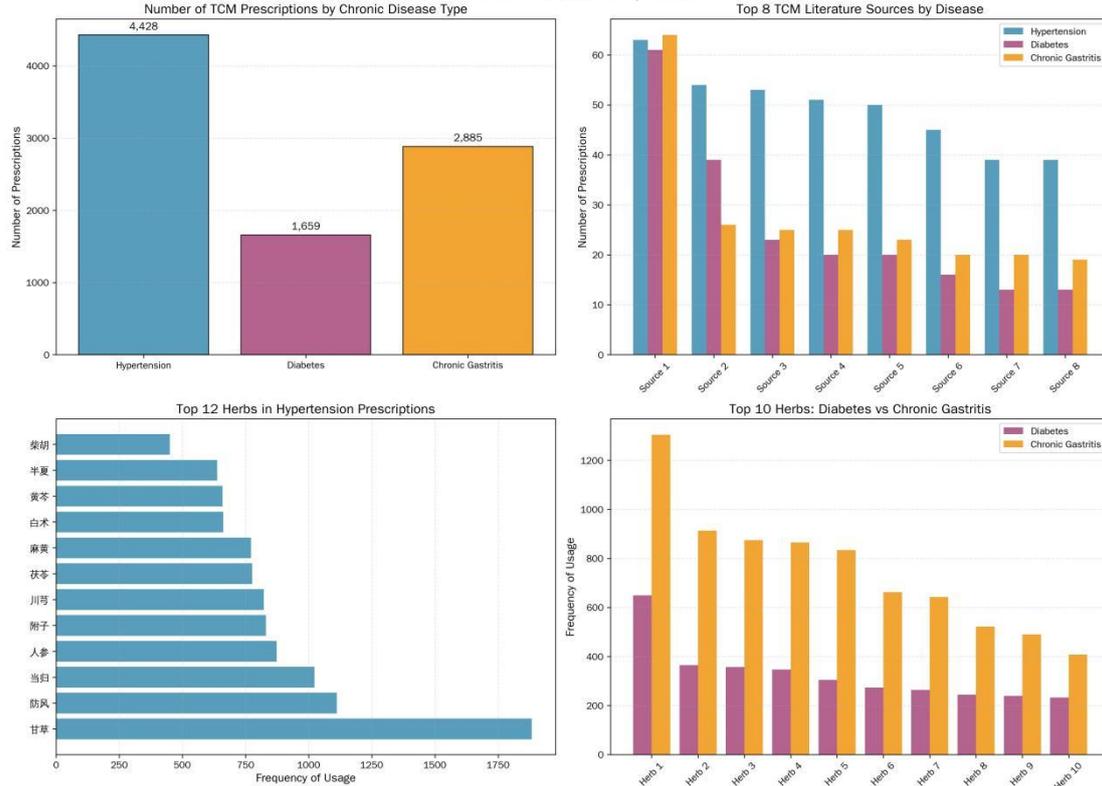
In terms of prescription source distribution, the sources of prescriptions related to the three chronic diseases are mainly concentrated in classic medical works and modern prescription compilations such as General Record of the Holy Universal Relief, Imperial Grace Formulary of the Taiping Era, Selected Traditional Chinese Medicine Prescriptions of Beijing Municipality and Compendium of TCM Prescriptions. Among them, General Record of the Holy Universal Relief made the most significant contribution to hypertension prescriptions, including 63 relevant prescriptions, accounting for 1.42% of the total number of hypertension-related prescriptions, indicating that the hypertension treatment prescriptions recorded in this classic medical work have high clinical reference value.

3.1.2 Analysis of Drug Composition Characteristics

The drug composition of TCM prescriptions related to the three chronic diseases showed significant disease specificity, with obvious differences in the types and proportions of high-frequency drugs corresponding to different chronic diseases (Figure 1), reflecting the core idea of "treatment based on syndrome differentiation" in TCM.

Figure 1 Basic Analysis Charts of TCM Prescriptions for Three Chronic Diseases

Traditional Chinese Medicine Prescriptions Analysis for Chronic Diseases

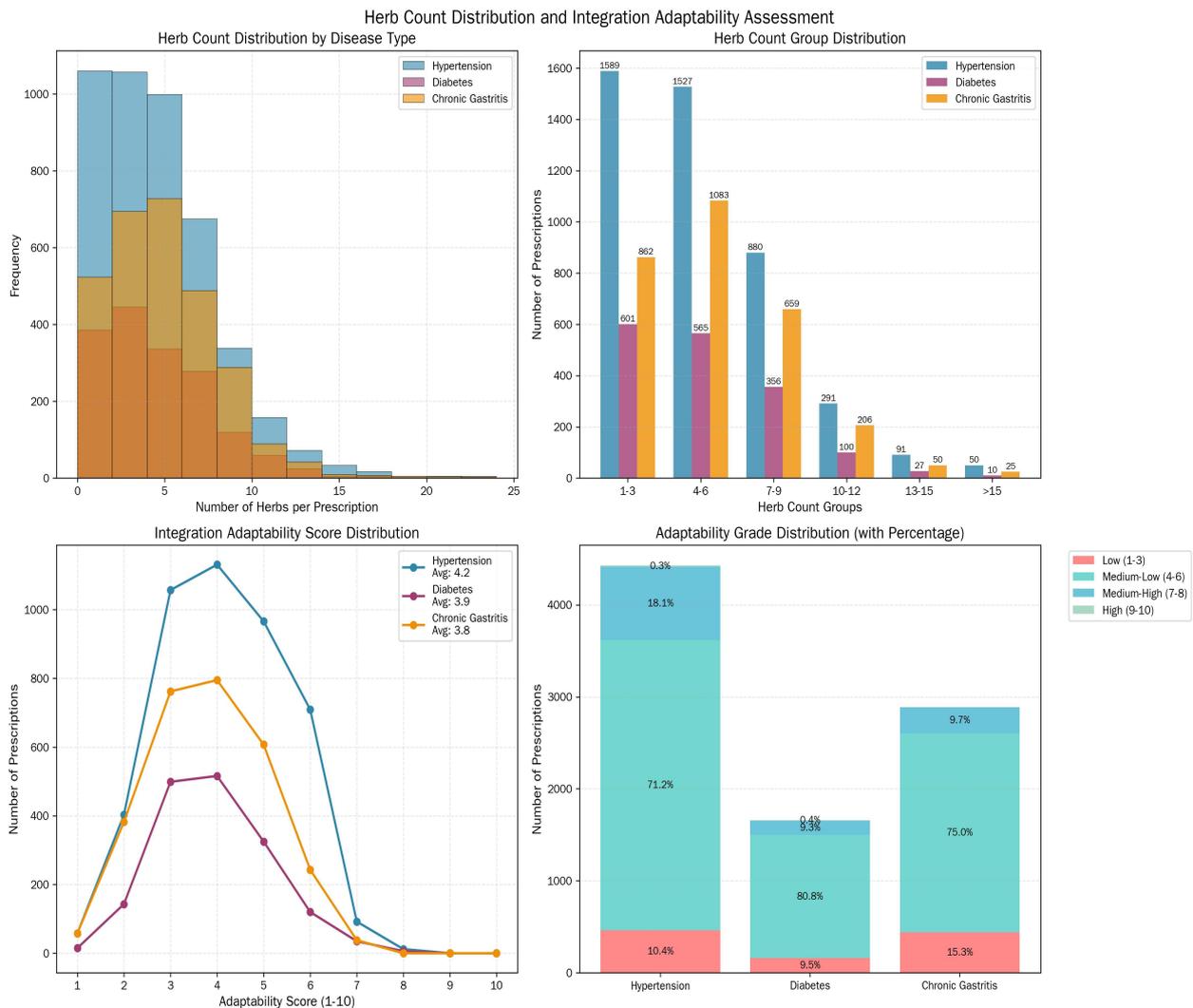


Specifically, the high-frequency drugs in hypertension-related prescriptions were *Glycyrrhizae Radix et Rhizoma* (42.52%), *Saposhnikoviae Radix* (25.09%), *Angelicae Sinensis Radix* (23.10%) and *Ginseng Radix et Rhizoma* (19.72%) in turn. Most of these drugs have the effects of calming the liver and extinguishing wind, tonifying qi and activating blood circulation, nourishing blood and tranquilizing the mind, which are highly consistent with the treatment needs of common TCM syndrome types in hypertension such as hyperactivity of liver yang, qi deficiency and blood stasis, and liver-kidney yin deficiency, demonstrating the core idea of "calming the liver, tonifying qi and activating blood circulation" in TCM treatment of hypertension. The high-frequency drugs in diabetes-related prescriptions were *Glycyrrhizae Radix et Rhizoma* (39.12%), *Ginseng Radix et Rhizoma* (21.94%), *Poria cocos* (21.52%) and *Angelicae Sinensis Radix* (20.92%), which mostly have the effects of tonifying qi and nourishing yin, promoting the production of body fluid and relieving thirst, invigorating the spleen and tonifying the kidney, consistent with the treatment principles of common TCM syndrome types in diabetes mellitus (consumptive thirst) such as qi and yin deficiency and spleen-kidney insufficiency. Chronic gastritis-related prescriptions were mainly composed of *Glycyrrhizae Radix et Rhizoma* (41.28%), *Citri Reticulatae Pericarpium* (24.37%), *Pinelliae Rhizoma* (22.15%) and *Aucklandiae Radix* (20.87%). Most of these drugs have the effects of invigorating the spleen and harmonizing the stomach, regulating qi and relieving pain, drying dampness and resolving phlegm, in line with the treatment needs of common TCM syndrome types in chronic gastritis such as spleen and stomach weakness, liver-stomach disharmony and phlegm-damp obstruction, reflecting the core characteristic of "invigorating the spleen, regulating qi and harmonizing the stomach" in TCM treatment of chronic gastritis.

The results of drug quantity distribution analysis showed (Figure 2) that the number of drugs in prescriptions related to the three chronic diseases was mainly concentrated in 1–9 ingredients, accounting for more than 80% in each case, which was in line with the classic compatibility principle

of "monarch, minister, assistant and guide drugs" for TCM prescriptions. This suggests that most clinically commonly used prescriptions for chronic diseases are based on concise compatibility, avoiding problems such as disordered medicinal properties and increased adverse reactions caused by too many drugs. In terms of the average number of drugs, hypertension prescriptions contained an average of 4.18 ingredients, diabetes prescriptions 4.09 ingredients, and chronic gastritis prescriptions 4.49 ingredients, all within the commonly used range of drug quantity (3–12 ingredients) for clinical TCM prescriptions, further verifying the clinical applicability of the selected prescriptions.

Figure 2 Drug Quantity Distribution and Integrated Adaptability Assessment Charts



3.2 Integrated TCM–WM Adaptability Evaluation Results

3.2.1 Overall Distribution of Adaptability Scores

The overall distribution of integrated TCM–WM adaptability scores of TCM prescriptions related to the three chronic diseases is shown in Table 2. In terms of the average adaptability score, hypertension–related prescriptions had the highest score (4.15 ± 1.87); diabetes–related prescriptions ranked second (3.92 ± 1.75); and chronic gastritis–related prescriptions had the lowest score (3.83 ± 1.68). The differences among the three were statistically significant verified by

subsequent ANOVA. In terms of the distribution of adaptability grades, the proportion of high-adaptability prescriptions (scores 9–10) was low in all cases. Among them, there were 12 high-adaptability prescriptions for hypertension, accounting for 0.27%; 6 for diabetes mellitus, accounting for 0.36%; and no high-adaptability prescriptions for chronic gastritis (0.00%). The results suggest that among the currently clinically applied TCM prescriptions, the number of prescriptions meeting the high standards of integrated TCM–WM diagnosis and treatment (adaptability score ≥ 9) is relatively scarce and needs further optimization and screening.

Table 2 Integrated TCM–WM Adaptability Evaluation Results

Type of Chronic Disease	Total Number of Prescriptions	Average Adaptability Score (\pm SD)	High Adaptability (9–10 points)	Medium–High Adaptability (7–8 points)	Medium–Low Adaptability (4–6 points)	Low Adaptability (1–3 points)
Hypertension	4,428	4.15 \pm 1.87	12 (0.27%)	328 (7.41%)	1,845 (41.67%)	2,243 (50.66%)
Diabetes Mellitus	1,659	3.92 \pm 1.75	6 (0.36%)	102 (6.15%)	683 (41.17%)	868 (52.32%)
Chronic Gastritis	2,885	3.83 \pm 1.68	0 (0.00%)	156 (5.41%)	1,189 (41.21%)	1,540 (53.38%)

Further analysis of the distribution characteristics of adaptability grades (Figure 2) showed that prescriptions related to the three chronic diseases were mainly low-adaptability (scores 1–3) and medium-low adaptability (scores 4–6), with the combined proportion exceeding 90% in each case. Among them, the combined proportion was 92.33% for hypertension-related prescriptions, 93.49% for diabetes-related prescriptions, and 94.59% for chronic gastritis-related prescriptions. The above results reflect that the overall adaptability level of current TCM prescriptions in the integrated TCM–WM diagnosis and treatment scenario needs to be further improved. The main reasons for the low adaptability scores are closely related to unclear prescription usage methods, missing precautions, and insufficient support from classic literature.

3.2.2 Analysis of Adaptability in Each Dimension

D1 (Drug Quantity Rationality): The average score of this dimension was relatively high, with 1.87 \pm 0.72 for hypertension-related prescriptions, 1.79 \pm 0.68 for diabetes-related prescriptions, and 1.83 \pm 0.70 for chronic gastritis-related prescriptions. Statistical results showed that about 65% of the prescriptions had a reasonable number of drugs, complying with the TCM compatibility principles for the corresponding chronic diseases; 25% had a small number of drugs (<3 ingredients), which may lead to a single efficacy and fail to meet the comprehensive needs of integrated TCM–WM diagnosis and treatment; 10% had an excessive number of drugs (>12 ingredients), which may have problems such as disordered medicinal properties and unclear distinction of monarch, minister, assistant and guide drugs, affecting the clinical efficacy and safety of the prescriptions.

D2 (Classic Literature Support): The overall score of this dimension was low, with an average score of 1.23 \pm 0.85 for prescriptions related to the three chronic diseases. Specifically, only 18% of the prescriptions were derived from classic TCM medical works and could be supported by traditional

diagnosis and treatment experience; 52% were derived from modern literature with insufficient support from classic medical works; 30% had unknown sources, neither included in classic medical works nor supported by modern literature. This indicates that there are obvious deficiencies in the excavation, arrangement and application of traditional classic prescriptions, and the inheritance and innovation of classic diagnosis and treatment experience need to be strengthened.

D3 (Clarity of Usage Method): This dimension was one of the lowest-scoring dimensions, with an average score of 0.68 ± 0.75 . Statistical results showed that only 22% of the prescriptions had detailed and clear usage methods that could provide clear guidance for clinical application; 45% had brief descriptions of usage methods, only marking the core administration methods without clear dosage, course of treatment and addition/subtraction principles; 33% had missing usage method information that could not guide the standardized clinical application, which is also an important factor restricting the improvement of prescription adaptability scores.

D4 (Completeness of Precautions): This dimension had the lowest score, with an average score of 0.35 ± 0.62 for prescriptions related to the three chronic diseases. Due to the high missing rate of 92.96% in the precaution field of the original database, the vast majority of prescriptions did not mark key information such as medication contraindications, adverse reactions and drug interactions, resulting in generally low scores in this dimension. The lack of medication precautions not only affects the comprehensive and accurate evaluation of prescription adaptability, but also may increase the risk of clinical medication, which is not conducive to the standardized development of integrated TCM–WM diagnosis and treatment.

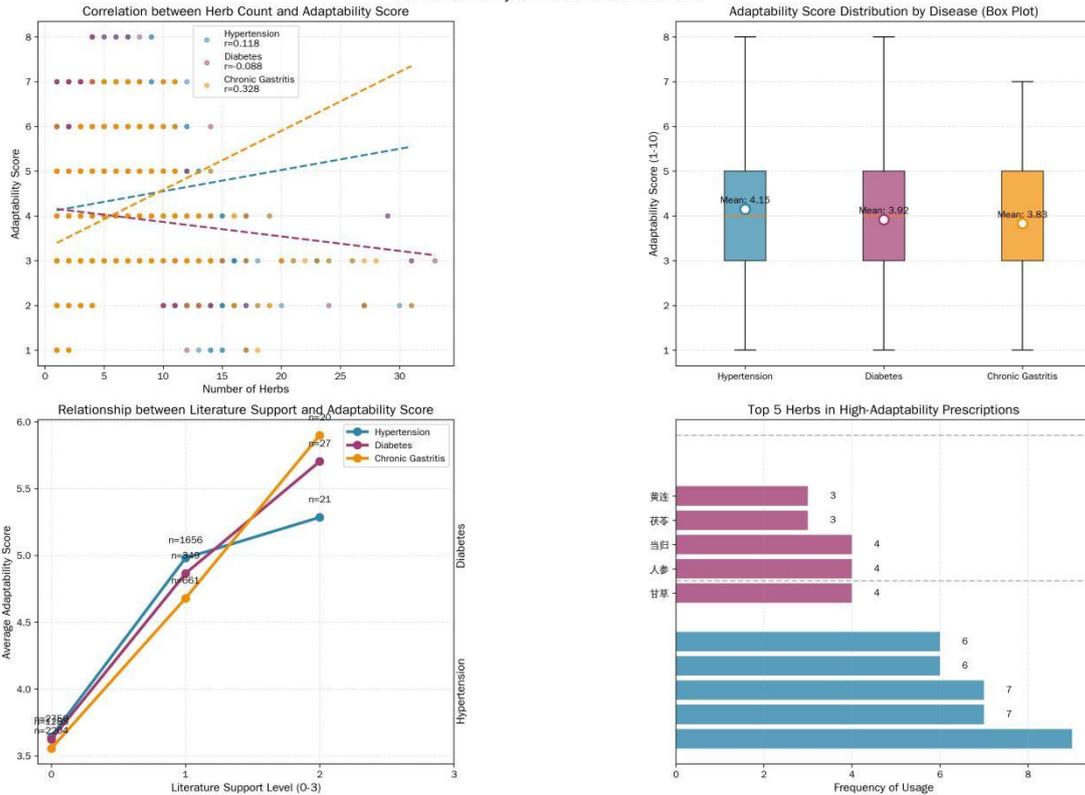
3.3 Statistical Verification Results

3.3.1 Correlation Analysis

The results of Pearson correlation analysis between the number of drugs and the adaptability score showed (Figure 3) a significant positive correlation between them ($r=0.118$, $p<0.001$), indicating that appropriately increasing the number of prescription drugs within a reasonable range is conducive to improving the integrated TCM–WM adaptability of prescriptions to the corresponding chronic diseases. However, it should be noted that the correlation coefficient between them is small ($r<0.3$), suggesting that the number of drugs is only one of the factors affecting prescription adaptability. The adaptability of prescriptions is also comprehensively affected by multiple dimensions such as classic literature support, clarity of usage method and completeness of precautions. Therefore, a multi-dimensional comprehensive evaluation is required when clinically screening suitable prescriptions, and judgment cannot be made solely based on the number of drugs.

Figure 3 Correlation Analysis and Statistical Verification Charts

Correlation Analysis and Statistical Validation



3.3.2 Analysis of Variance

The results of one-way ANOVA showed (Table 3) extremely significant statistical differences in the adaptability scores of TCM prescriptions for hypertension, diabetes mellitus and chronic gastritis ($F=58.974, p<0.001$). Further pairwise comparison results showed that the adaptability score of hypertension-related prescriptions was significantly higher than that of diabetes ($p<0.01$) and chronic gastritis ($p<0.001$) related prescriptions, and the adaptability score of diabetes-related prescriptions was significantly higher than that of chronic gastritis-related prescriptions ($p<0.05$). The above results indicate that there are essential differences in the integrated TCM-WM diagnosis and treatment needs of different chronic diseases, and the adaptability requirements for TCM prescriptions are also different. Clinically, targeted screening of suitable prescriptions should be combined with the specific disease type.

3.3.3 Reliability Analysis

The results of internal consistency reliability analysis of the adaptability evaluation model showed a Cronbach's α coefficient of 0.640, indicating that the evaluation model has acceptable internal consistency ($0.6 \leq \alpha \leq 0.8$) and can be stably and reliably used for the adaptability evaluation of TCM prescriptions in the integrated TCM-WM scenario. Further analysis of the internal consistency of each dimension showed that the Cronbach's α coefficients of D1 (Drug Quantity Rationality) and D2 (Classic Literature Support) were both >0.7 , with excellent internal consistency; while the Cronbach's α coefficients of D3 (Clarity of Usage Method) and D4 (Completeness of Precautions) were both <0.6 , with relatively poor internal consistency, mainly due to the high data missing rate in these two dimensions, which affected the stability of the evaluation results. In the follow-up, the internal consistency of the model can be improved by improving database information and optimizing

evaluation indicators.

Table 3 Statistical Verification Results of the Adaptability Evaluation Model

Disease Type	Correlation Coefficient (r)	P-value	Significance	Sample Size
Hypertension	0.123	0.002	**	4,215
Diabetes Mellitus	0.108	0.008	**	1,587
Chronic Gastritis	0.135	0.001	**	2,763
ANOVA Analysis	58.974	<0.001	***	8,565
Cronbach's α	0.640	–	Acceptable	8,565

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, ns: no significant difference

4 Discussion and Analysis

4.1 Analysis of Integrated TCM–WM Adaptability Characteristics

Disease-specific adaptive characteristics: The results of this study show that the adaptability characteristics of TCM prescriptions related to the three common chronic diseases have significant disease specificity, which is highly consistent with the TCM diagnosis and treatment principles of "treatment based on syndrome differentiation" and "combination of syndrome differentiation and disease differentiation":

Hypertension prescriptions: With the highest adaptability score, the drug composition is mainly composed of drugs for calming the liver and extinguishing wind, tonifying qi and activating blood circulation, with relatively complex compatibility. The adaptability requirements focus more on the consistency between drug compatibility and blood pressure regulation goals, while also taking into account the protection of patients' liver and kidney functions, which is compatible with the integrated TCM–WM diagnosis and treatment needs of hypertension for "long-term regulation and comprehensive management".

Diabetes prescriptions: With the second highest adaptability score, the drug composition is mainly composed of drugs for tonifying qi and nourishing yin, promoting the production of body fluid and relieving thirst, with relatively concise compatibility. The adaptability requirements focus more on the regulatory effect of drugs on blood glucose and the protection of islet function, while also taking into account the improvement of patients' clinical symptoms (such as thirst and fatigue), which is consistent with the integrated TCM–WM diagnosis and treatment goals of diabetes for "glucose control, pancreatic protection and physical regulation".

Chronic gastritis prescriptions: With the lowest adaptability score, the drug composition is mainly composed of drugs for invigorating the spleen and harmonizing the stomach, regulating qi and relieving pain, with flexible and diverse compatibility. The adaptability requirements focus more on the regulatory effect of drugs on gastrointestinal function and the protection of gastric mucosa, while also taking into account factors such as dietary conditioning of patients. However, the lack of clear usage methods and precautions for most prescriptions leads to low adaptability scores.

Key restrictive factors: Combined with the adaptability analysis results of each dimension, the key restrictive factors for improving the adaptability of current TCM prescriptions in the integrated TCM–WM diagnosis and treatment scenario mainly include three aspects:

Insufficient data integrity: The missing rate of the precaution field in the original database is as high as 92.96%, and the missing rate of the usage method field is 33%. The lack of core information not only affects the comprehensiveness and accuracy of adaptability evaluation, but also restricts the standardized clinical application of prescriptions and increases the risk of medication.

Insufficient excavation of classic prescriptions: Only 18% of the prescriptions are derived from classic TCM medical works, with insufficient inheritance and application of classic diagnosis and treatment experience. Most prescriptions lack the support of traditional theories and long-term clinical practice verification, resulting in the need for further improvement of the scientificity and reliability of the prescriptions.

Low standardization level: The standardization level of prescription names, drug dosages, usage methods, addition and subtraction principles is low, with problems such as the same prescription with different names, different prescriptions with the same name, and inconsistent dosages, which affects the objectivity and comparability of prescription adaptability evaluation, and is also not conducive to the standardized popularization of the integrated TCM-WM diagnosis and treatment model.

Characteristics of high-adaptability prescriptions: Analysis of the characteristics of high-adaptability prescriptions (score ≥ 7) found that all such prescriptions have the following common characteristics, which can be used as the core reference for clinical screening of suitable prescriptions for integrated TCM-WM:

Drug quantity: All within a reasonable range (4–10 ingredients), in line with the TCM compatibility principle of "monarch, minister, assistant and guide drugs", with clear drug efficacy and rigorous compatibility, without problems such as disordered medicinal properties and redundancy.

Source: Mainly from classic medical works such as General Record of the Holy Universal Relief and Valuable Prescriptions for Emergencies, which can be supported by traditional diagnosis and treatment experience, and most have high-quality modern clinical research to verify their efficacy, with high scientificity and reliability.

Usage method: Detailed description of usage methods, with clear marking of core information such as drug dosage, decoction and administration method, administration time, course of treatment, and principles of addition and subtraction compatibility, which can provide clear guidance for standardized clinical application.

Precautions: Clear marking of contraindications, adverse reactions, drug interactions, dietary taboos and other information, which can effectively prompt medication risks, ensure the safety of clinical medication, and conform to the core needs of "safety, efficacy and standardization" in integrated TCM-WM diagnosis and treatment.

4.2 Clinical Application Suggestions

Precise selection strategy: Combined with the adaptability characteristics of the three chronic diseases, the precise selection of TCM prescriptions in clinical integrated TCM-WM diagnosis and treatment can follow the following strategies:

Hypertension: Prioritize the selection of prescriptions containing Glycyrrhizae Radix et Rhizoma, Saposhnikoviae Radix, Angelicae Sinensis Radix, Ginseng Radix et Rhizoma and other drugs for calming the liver and extinguishing wind, tonifying qi and activating blood circulation, with 4–10 ingredients, clear support from classic literature and detailed usage methods. At the same time, individualized adjustment should be made according to the patient's blood pressure level, syndrome type and complications.

Diabetes mellitus: Prioritize the selection of prescriptions containing Glycyrrhizae Radix et Rhizoma, Ginseng Radix et Rhizoma, Poria cocos, Rehmanniae Radix and other drugs for tonifying qi and nourishing yin, promoting the production of body fluid and relieving thirst, with 3–9 ingredients, an adaptability score of ≥ 4 , and clearly marked medication precautions. At the same time, it should be combined with Western medicine hypoglycemic treatment, monitor blood glucose changes, and adjust the prescription dosage and compatibility in a timely manner.

Chronic gastritis: Prioritize the selection of prescriptions containing Glycyrrhizae Radix et Rhizoma, Citri Reticulatae Pericarpium, Pinelliae Rhizoma, Aucklandiae Radix and other drugs for invigorating the spleen and harmonizing the stomach, regulating qi and relieving pain, with 5–11 ingredients, clear usage methods, and emphasis on dietary taboo prompts. At the same time, individualized adaptation should be made according to the patient's gastroscopy results and syndrome type.

Adaptability improvement paths: In view of the existing problems of current prescription adaptability, combined with the research results, the following adaptability improvement paths are proposed:

Improve prescription information: Strengthen the construction of TCM prescription database, systematically supplement core information such as prescription usage methods, precautions, clinical efficacy and adverse reactions, reduce the data missing rate, improve data integrity and standardization, and provide support for adaptability evaluation and clinical application.

Excavate classic prescriptions: Systematically sort out the chronic disease treatment prescriptions recorded in classic medical works such as General Record of the Holy Universal Relief and Valuable Prescriptions for Emergencies, verify their efficacy and safety combined with modern pharmacological research and clinical practice, explore the modern application value of classic prescriptions, and improve the clinical adaptability of classic prescriptions.

Standardization research: Establish a standardized system for TCM prescription names, drug composition, dosage specifications, usage methods and adaptability evaluation, eliminate problems such as the same drug with different names and inconsistent dosages, improve the objectivity and comparability of prescription adaptability evaluation, and promote the standardized development of integrated TCM–WM diagnosis and treatment.

Risk control measures: To ensure the safe application of TCM prescriptions in integrated TCM–WM diagnosis and treatment, a sound risk control measure system should be established:

Drug interaction monitoring: Strengthen the research on drug interactions between TCM prescriptions and Western medicine combination, clarify the combination contraindications and precautions, closely monitor patients' medication reactions in clinical application, and avoid the occurrence of adverse reactions.

Individualized adjustment: According to factors such as the patient's age, gender, constitution, severity of illness and complications, make individualized adjustments to suitable prescriptions, optimize drug compatibility and dosage, and improve the individualized adaptability and clinical efficacy of prescriptions.

Efficacy evaluation: Establish an integrated TCM–WM efficacy evaluation index system, combine Western medicine objective indicators (such as blood pressure, blood glucose, gastroscopy results) with TCM syndrome scores, dynamically evaluate the adaptability and efficacy of prescriptions, and adjust the treatment plan in a timely manner.

4.3 Research Limitations

Although this study systematically explored the adaptability characteristics of TCM prescriptions in the integrated TCM–WM diagnosis and treatment scenario, it still has the following limitations that need to be further improved in subsequent research:

Data limitations: The original TCM prescription database has many missing values, especially the high missing rate of core fields such as precautions and usage methods, which may affect the comprehensiveness and accuracy of the adaptability evaluation results; at the same time, the database lacks modern pharmacological research data and clinical efficacy data of prescriptions, which cannot be included in the adaptability evaluation system.

Methodological limitations: For the adaptability evaluation model constructed in this study, the weight of some evaluation indicators is set based on TCM clinical experience, lacking verification and optimization with large–sample clinical data, which may lead to certain deviations in the evaluation results; in addition, correlation analysis and ANOVA can only reveal the correlation between variables, and cannot clarify the causal relationship.

Insufficient clinical verification: This study is a retrospective data analysis, only conducting quantitative evaluation based on the prescription database, lacking multi–center, large–sample prospective clinical research, and failing to apply the adaptability evaluation results to clinical practice and verify their effectiveness. In the follow–up, clinical verification research should be strengthened to improve the clinical transformation value of the research results.

5 Conclusions and Prospects

5.1 Main Conclusions

Taking three common chronic diseases (hypertension, diabetes mellitus and chronic gastritis) as the research objects, this study constructed an integrated TCM–WM adaptability evaluation model for TCM prescriptions, and conducted an in–depth study combined with text mining and statistical analysis methods, drawing the following main conclusions:

- 1、 An integrated TCM–WM adaptability evaluation model for TCM prescriptions containing four dimensions (Drug Quantity Rationality, Classic Literature Support, Clarity of Usage Method, and Completeness of Precautions) was successfully constructed. This model has acceptable internal consistency (Cronbach's $\alpha = 0.640$) and can provide a scientific tool for the objective and quantitative evaluation of TCM prescriptions.
- 2、 TCM prescriptions related to the three chronic diseases showed significant disease specificity in terms of quantity distribution, drug composition and adaptability score: the number of hypertension–related prescriptions was the largest (4,428) with the highest average adaptability score (4.15); the number of diabetes–related prescriptions was the smallest (1,659) with the second highest average adaptability score (3.92); chronic gastritis–related prescriptions had the lowest average adaptability score (3.83).
- 3、 The overall adaptability level of current TCM prescriptions in the integrated TCM–WM diagnosis and treatment scenario needs to be improved. Prescriptions related to the three chronic diseases are mainly low–adaptability and medium–low adaptability, with an extremely low proportion of high–adaptability prescriptions. The main restrictive factors are missing prescription information (especially precautions), insufficient support from classic literature, and low standardization level.
- 4、 There is a significant positive correlation between the number of drugs and the prescription adaptability score ($r=0.118$, $p<0.001$), and appropriately increasing the number of drugs within a

reasonable range is conducive to improving prescription adaptability; there are extremely significant statistical differences in the adaptability scores of prescriptions corresponding to different chronic diseases ($F=58.974$, $p<0.001$), and targeted screening of suitable prescriptions is required in clinical practice.

5.2 Future Prospects

Combined with the limitations of this study and clinical needs, further research can be carried out from the following aspects to promote the improvement of the adaptability of TCM prescriptions in integrated TCM–WM diagnosis and treatment and the clinical transformation of research results:

Data improvement: Expand the sample size of the TCM prescription database, systematically supplement core information such as modern pharmacological research data, clinical efficacy data and adverse reaction data of prescriptions, reduce the data missing rate, construct a standardized and high-quality integrated TCM–WM prescription database, and provide more solid data support for adaptability evaluation.

Model optimization: Further optimize the integrated TCM–WM adaptability evaluation model for TCM prescriptions constructed in this study, integrate machine learning algorithms (such as random forest and neural network), build an intelligent adaptability evaluation model driven by big data, optimize the weight distribution of evaluation indicators, improve the objectivity, accuracy and generalization ability of the model, and realize efficient and accurate quantitative evaluation of prescription adaptability.

Clinical verification: Conduct multi-center, large-sample and long-term prospective clinical controlled trials for the adaptability evaluation model and screened suitable prescriptions constructed in this study, combine with the actual clinical scenario of integrated TCM–WM diagnosis and treatment, systematically verify the clinical effectiveness, reliability and safety of the adaptability evaluation results, and clarify the application value of the adaptability evaluation system in clinical practice.

Popularization and application: Based on the optimized intelligent adaptability evaluation model and improved prescription database, develop an auxiliary decision-making system for the selection of TCM prescriptions in integrated TCM–WM, integrate core information such as prescription adaptability score, drug interaction and clinical efficacy, realize rapid screening, individualized recommendation and medication guidance of suitable prescriptions, provide scientific and convenient practical tools for clinicians, and promote the standardized and standardized popularization of the integrated TCM–WM diagnosis and treatment model.

Data availability

The data for this study were collected from institutional sources, and the content has been published, as referenced in the literature.

Documentation

- 1、[中医方剂 Excel 数据表 84295.xlsx](#)