Digital Inheritance of Renowned Zhuang Medicine Practitioners' Experience: Construction of a Medical Case Database and Intelligent Query System

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Abstract. Addressing the long-standing challenge that the experiential knowledge of master physicians in Zhuang medicine has relied primarily on individual memory and fragmented medical case records, resulting in difficulties in systematic organization and efficient utilization, this study explores innovative pathways for the inheritance of Zhuang medicine master physicians' experience from the perspective of digital empowerment. Taking clinical medical cases as the core carriers, the study proposes a medical case database construction approach that integrates data standardization, experience element decomposition, and semantic normalization, and further designs an intelligent query system oriented toward experience utilization. By incorporating natural language processing and semantic retrieval technologies, the proposed framework enables the structured storage, semantic understanding, and intelligent access to master physicians' diagnostic and therapeutic experience. The findings indicate that this technical pathway enhances the preservability, retrievability, and practical value of Zhuang medicine master physicians' experience, providing a feasible approach and technical reference for the digital inheritance and intelligent utilization of ethnic medicine knowledge.

Keywords: Digital Empowerment; Zhuang Medicine; Master Physician Experience; Medical Case Database; Intelligent Query System

1 Introduction

For a long time, the experiential knowledge of Zhuang medicine master physicians has relied on individual memory and fragmented case records, limiting systematic organization and effective use. The development of digital technologies, particularly Electronic Health Records (EHRs), offers new opportunities to overcome these constraints by supporting data integration, semantic processing, and intelligent knowledge extraction[1]. In modern medicine, electronic case databases and semantic-based retrieval systems have proven effective in managing complex clinical data, especially unstructured text[2]. However, such technologies remain insufficiently developed in the field

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of ethnic medicine, particularly with regard to digital organization and intelligent utilization. Based on this, the present study explores the application of digital and intelligent technologies in the field of Zhuang and Yao medicine.

2 Literature Review

With the integration of digital technologies into healthcare, digital empowerment has become a key driver of medical knowledge inheritance and innovation. Since the late 20th century, EHR systems have evolved from simple recording tools into data-driven intelligent systems, playing increasingly important roles in clinical collaboration, research, and knowledge extraction[3]. Previous studies have shown that, with technological advances, EHR databases have become critical resources for disease pattern recognition, patient trajectory analysis, and large-scale clinical research, thereby supporting data-driven experience inheritance and knowledge generation[3]. From a medical informatics perspective, data quality and interoperability of EHR are central to empowering intelligent applications, with semantic technologies and standardization recognized as key strategies for improving data usability and enabling intelligent querying[4]. These theoretical and technological foundations provide a technical framework to support the construction of digital pathways for the inheritance of master physicians' experience.

3 Construction of the Zhuang Medicine Master Physician Medical Case Database

3.1 Overall Research Concept

Under digital empowerment, the core objective of constructing inheritance pathways for Zhuang medicine master physicians' experience is to achieve systematic preservation and intelligent access through institutionalized data resources and intelligent tools. This study proposes a framework centered on medical cases, supported by semantic processing and intelligent querying, and implemented via structured databases and intelligent service systems.

3.2 Overall System Architecture

As shown in Fig. 1, a three-layer architecture—data layer, semantic layer, and application layer—is proposed to support digitalization of Zhuang medicine experience.

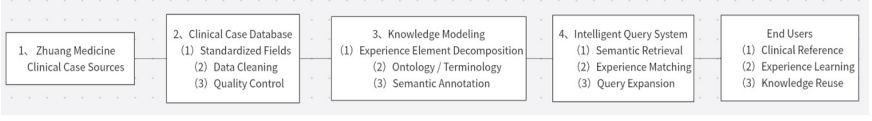

Fig. 1. Flowchart for the Establishment of a Zhuang Medicine Medical Record Database

The data layer is primarily responsible for the collection, cleaning, and standardization of medical case data. The semantic layer constitutes the core technical support of this study, undertaking semantic interpretation and standardized encoding of medical case data to establish a unified retrieval foundation across data sources and expression forms. The application layer mainly includes intelligent query interfaces and analytical service modules, designed to support knowledge access and experience inheritance under diverse user scenarios.

3.3 Analysis of Data Characteristics of Zhuang Medicine Master Physician Medical Cases

Medical cases constitute systematic records of clinical diagnosis and treatment and serve as an essential carrier for the inheritance of medical experience. Compared with medical cases in modern medicine, those documented by master physicians of Zhuang medicine exhibit distinctive characteristics in both content structure and modes of expression. Clinical records in Zhuang medicine often contain extensive experience-based diagnostic interpretations, individualized clinical judgments, and context-dependent narrative expressions. Such texts are typically unstructured or weakly structured and demonstrate a high degree of implicit semantic representation.

Existing studies indicate that unstructured text in Electronic Health Records (EHRs) plays an irreplaceable role in comprehensively reflecting clinical decision-making processes, while simultaneously increasing the complexity of data management and computational processing[5]. On this basis, scholars widely agree that structuring and semantically standardizing clinical text are prerequisites for the in-depth utilization of medical data and effective knowledge mining[6]. Therefore, in the process of digitally transforming Zhuang medicine master physicians' experience, the construction of medical case databases should fully consider the characteristics of text-dominated data and reserve sufficient capacity within database design to accommodate experiential expressions.

3.4 Data Sources of Medical Case Collection

This study uses medical case records generated during the clinical practice of Zhuang medicine master physicians as its primary data source. These data include structured information exported from electronic medical record systems as well as clinical records preserved in textual form.

3.5 Processing of Unstructured Medical Case Text and Semantic Standardization

Unstructured text represents a core challenge in the construction of Zhuang medicine medical case databases. To enhance data retrievability and analytical potential, this study introduces natural language processing (NLP) techniques to perform entity recognition, keyword extraction, and semantic annotation of medical case text.

In the field of medical informatics, extensive research has demonstrated that NLP techniques have reached a relatively high level of maturity in extracting medical entities and relationships from clinical text, significantly improving the degree of structuring in EHR[7]. By semantically annotating symptom descriptions, diagnostic and therapeutic interventions, and outcome evaluations, medical case text can be transformed from "human-readable" to "machine-computable."

3.6 Data Ethical Compliance

During data processing, this study adheres to de-identification principles, anonymizing personally identifiable information to comply with existing medical research ethical standards. With regard to ethical governance of ethnic medicine medical case data, no high-quality academic studies specifically addressing Zhuang medicine in English have yet been published. Consequently, this study primarily follows general medical data ethics frameworks in its implementation.

4 Design and Implementation of the Intelligent Query System

4.1 System Design Concept and Overall Objectives

The construction of an intelligent query system for the inheritance of Zhuang medicine master physicians' experience aims to overcome the limitations of traditional keyword-based retrieval and to achieve semantic-level understanding and retrieval. The system is designed to assist users in rapidly accessing diagnostic and therapeutic experience, semantic relationships, and pattern-based insights from a medical case database in response to clinical needs. Accordingly, the system is expected to achieve the following design objectives:

Semantic understanding: Enhance query precision through natural language processing and semantic mapping techniques;

Experience association: Support semantic queries centered on experience-specific elements of Zhuang medicine, such as syndrome differentiation reasoning and herbal prescription combinations;

User adaptability: Accommodate the needs of clinicians and educators for different retrieval strategies and levels of query granularity.

4.2 Functional Module Architecture of the Query System

To meet the needs of different user groups, the intelligent query system comprises the following functional modules:

Natural Language Input and Parsing Module This module allows users to express their query intent using natural language input. Through semantic parsing, the system identifies key entities and retrieval intentions. Such a natural language–driven query mechanism significantly reduces the complexity of query formulation, particularly when users encounter diverse and specialized clinical terminology. Previous studies on

retrieval systems have demonstrated that incorporating semantic recommendation or query expansion strategies can substantially improve the relevance of retrieval results and user satisfaction.

Semantic Retrieval and Indexing Module. This module constitutes one of the core functionalities of the system. Its primary tasks include constructing semantic indexes for the medical case database and mapping diagnostic information, symptoms, and medications in medical cases to standardized medical concept sets, enabling retrieval through semantic matching.

In the field of clinical information retrieval, semantic indexing techniques have been proven to enhance retrieval performance, especially in scenarios where user input and database records employ synonymous or hierarchically related expressions. By addressing limitations of traditional keyword-based retrieval—such as synonym mismatch and hierarchical concept recognition—semantic mapping improves retrieval accuracy. Semantic indexing further enhances the system's ability to interpret the semantic content of medical cases, thereby providing more precise clinical retrieval results.

Query Result Ranking and Intelligent Recommendation Module This module ranks preliminary retrieval results based on relevance and provides intelligent recommendations by incorporating historical query behavior or similar medical case recommendation patterns. In medical information retrieval research, the use of query recommendation algorithms has been shown to significantly improve retrieval efficiency and result quality, particularly when dealing with complex combinations of specialized clinical terms. Recommendation mechanisms effectively assist users in expanding their query perspectives and refining search outcomes.

4.3 Application Scenarios and Expected Outcomes

The system is expected to support the following typical application scenarios:

Rapid retrieval of master physician experience: Users input disease-related keywords and symptoms, and the system returns diagnostic and therapeutic elements and prescription combinations associated with Zhuang medicine master physicians' experience. Experience summarization and comparative analysis: By retrieving multiple medical cases, the system extracts commonalities and differences to support clinical education and evidence-based research. Semantic recommendation: Based on experiential semantic labels, the system intelligently recommends related medical cases or experience fragments, enhancing retrieval efficiency.

4.4 Summary

Based on existing research in medical information retrieval and intelligent query technologies, this chapter proposes a design framework and implementation strategy for an intelligent query system oriented toward the inheritance of Zhuang medicine master physicians' experience. By incorporating semantic-driven retrieval techniques, ontology mapping, and natural language parsing mechanisms, the system effectively enhances the application value of medical case databases in experience inheritance scenarios.

5 Conclusions

This study explores a digital empowerment–based pathway for the systematic inheritance and sustainable utilization of Zhuang medicine master physicians' experience, addressing challenges in medical informatization and ethnic medicine preservation. Centered on authentic medical cases, it proposes a technical framework integrating case database construction, semantic standardization, and intelligent query systems. Theoretically, on digital medical experience inheritance and medical information system construction, the study clarifies a logic in which medical cases act as core carriers, structured and semantic processing serve as key enablers, and intelligent retrieval functions as the main application interface. Methodologically, it introduces a database construction approach combining data standardization, experience element decomposition, and semantic annotation tailored to Zhuang medicine characteristics. At the application level, an intelligent query system framework is designed to support natural language search and experience utilization. However, limitations remain in large-scale data validation, advanced intelligent analysis, and real-user evaluation, indicating directions for future research. Moreover, the system has not yet undergone usability testing or effectiveness assessment involving real users, such as clinicians or researchers[8], highlighting an important direction for future research.

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