

## Comparative Analysis of Undergraduate and Master's Medical Informatics Education in China and the United States: Current Status and Implications (Postprint)

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### Abstract

[Purpose/Significance] This study conducts a comparative analysis of undergraduate and master's education in medical informatics at universities in China and the United States, aiming to provide references and insights for the future development of medical informatics education in China. [Methods/Process] Using program establishment time and institutional tier as screening criteria, 10 representative universities were selected from each country among those offering medical informatics education in China and the United States as research subjects. Through online investigation, a comprehensive analysis was conducted on the undergraduate and master's education in medical informatics in both countries from the perspectives of basic requirements, curriculum design, faculty strength, teaching methods, and employment prospects. [Results/Conclusions] Although China's undergraduate and master's education in medical informatics has undergone decades of exploration and practice, achieving certain accomplishments, compared with the United States, China still exhibits several deficiencies. In terms of basic admission requirements, there is an emphasis on undergraduate education while the high-level talent cultivation system remains incomplete. Regarding curriculum design, course content is monotonous, the proportion of non-medical foundational courses is excessively high, and interdisciplinary integration is not evident. Concerning faculty strength, teachers have singular academic backgrounds and the distribution of professional titles is unbalanced. In teaching methods, instructional approaches are simplistic and students have limited practical opportunities. Regarding employment prospects, students' knowledge systems are unsystematic and employment opportunities are restricted. In the future, China should adapt to the development requirements of the big data scientific research paradigm, accelerate the cultivation of high-level medical informatics talent, improve curriculum systems and content

design to broaden the disciplinary knowledge base, optimize faculty allocation to attract multi-disciplinary talent, and enrich training methods with greater emphasis on integrating theory and practice.

## Full Text

## Preamble

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### **Comparative Research and Enlightenment on the Current Status of Undergraduate and Master's Education in Medical Informatics Between China and the United States**

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## Abstract

**[Purpose/Significance]** This study compares and analyzes the general situation of undergraduate and master's education in medical informatics at Chinese and American universities, providing references for future medical informatics education in China. **[Method/Process]** Using program establishment time and institutional ranking as selection criteria, ten representative universities were selected from each country offering medical informatics education. Through online investigation, this paper comprehensively analyzes the basic requirements, curriculum design, faculty strength, teaching methods, and employment prospects of undergraduate and master's education in medical informatics in both China and the United States. **[Result/Conclusion]** Although China's medical informatics education has undergone decades of exploration and practice with certain achievements, compared with the United States, several shortcomings remain: in terms of admission requirements, China emphasizes undergraduate education while its high-level talent training system is imperfect; in curriculum design, course content is monotonous, the proportion of non-medical basic courses is too high, and interdisciplinary integration is not evident; in faculty strength, teachers have single disciplinary backgrounds and unbalanced title structures; in teaching methods, instruction is simplistic with limited practical opportunities for students; in employment prospects, students lack systematic knowledge structures, limiting their career prospects. In the future, China should adapt to the development requirements of the big data scientific research paradigm, accelerate the cultivation of high-level medical informatics talents; improve curriculum systems and content settings to broaden

disciplinary knowledge scope; optimize faculty allocation to attract multidisciplinary talents; and enrich training methods while emphasizing the combination of theory and practice.

**Classification Number:** G250

**Keywords:** medical informatics; undergraduate education; master's education; comparative study

## 1. Introduction

Discipline informatics, as an important branch of the dual development of disciplines in the era of big data scientific paradigms, has increasingly become an indispensable component of disciplinary development. Medical informatics, as the fastest-growing specialized field within discipline informatics, emerged and developed alongside the application of computer technology in the biomedical field. In the early 1970s, the term “medical informatics” first appeared at the International Federation for Information Processing (IFIP) conference. By the late 1970s, the discipline name was standardized at the third International Conference on Medical and Health Informatics (MedInfo), and in 1978, the International Medical Informatics Association (IMIA) was established as the internationally recognized leading organization in the field. Over the years, scholars have summarized definitions of medical informatics from different perspectives. American scholar D.B. Shires proposed in 1974 that medical informatics is the science studying the nature and laws of information and its role in disease diagnosis, treatment, rehabilitation, and prevention. Chinese scholar Wang Wei defined it in his 2006 book *Medical Informatics* as an interdisciplinary field studying medical information phenomena and patterns for medical decision-making and management. In essence, medical informatics applies informatics theories, methods, and technologies to the medical field to promote orderly medical information and efficient healthcare delivery.

With the rapid development of medical informatization, countries worldwide have embraced it as a powerful platform and tool for solving healthcare system challenges, with “talent” being both fundamental and essential in healthcare system reform and informatization construction. Between 1999-2000, IMIA released its first international recommendations on education in biomedical and health informatics, establishing curriculum objectives and pathways to promote medical informatics education development globally. In China, the April 2009 “Opinions of the Central Committee of the Communist Party of China and the State Council on Deepening the Reform of the Medical and Health System” (referred to as the “New Healthcare Reform”) marked a new stage for China’s healthcare development. The reform proposed establishing a sustainable medical and health technology innovation mechanism and talent guarantee system, making medical informatics education particularly important for adapting to new era medical information work requirements.

Currently, countries are actively exploring suitable medical informatics educa-

tion models. Germany emphasizes informatics, requiring medical informatics courses as compulsory for medical majors. The UK employs a core module plus elective module system. Some American universities (such as Columbia University and Stanford University) have developed systematic medical informatics degree programs. American medical informatics education is relatively mature and internationally representative, dating back to the 1950s when Vanderbilt University physicians R.S. Ledley and L.B. Lusted proposed using computers for medical diagnosis and treatment. Institutions began research and education in the 1970s-80s, with rapid development in the 1990s. In contrast, China's medical informatics education started later. At the end of 2002, with Ministry of Education approval, Central South University renamed its "Information Management and Information Systems (Medical Direction)" major to "Medical Informatics," formally launching the discipline in China.

Domestic scholars have researched medical informatics education regarding discipline construction, development, teaching reform, and talent cultivation. Some studies focus on foreign countries, such as Cao Gaofang et al.'s comparison of domestic and international medical informatics education from perspectives of discipline definition and curriculum. Zhang Yuanpeng et al. compared European and Chinese medical informatics education in curriculum, faculty, and research directions. Others specifically examine the United States, such as Hu Zhaoqin et al.'s analysis of American medical informatics education, and Zhang Zhimei et al.'s comparative study of Chinese and American medical informatics education models and curricula, offering development suggestions. Lü Ting's in-depth analysis focused on educational level and program design differences. American medical informatics education leads internationally, having formed a mature teaching model after years of exploration, which provides positive references for China. However, existing literature mostly selects only some American universities without Chinese counterparts for comparison, and fails to clearly define and compare undergraduate versus master's education differences due to different educational emphases between the two countries. Therefore, based on investigation of universities and institutions offering medical informatics education in both countries, this study takes the current status of undergraduate and master's education (hereinafter referred to as "undergraduate and master's education") as research objects, using comparative analysis to learn from American experiences and promote innovation and reform in China's medical informatics education.

## 2. Research Objects and Data Sources

Using program establishment time and institutional ranking as selection criteria, the authors conducted online surveys of over 50 Chinese universities offering medical informatics education, 94 institutions and universities listed on the American Medical Informatics Association website offering degree programs or training courses, and universities certified by the American Health Information Management Association for graduate and undergraduate programs. Ten

historically established, comprehensive, high-ranking universities were selected from each country as research objects (see Table 1 and Table 2 ). Since China emphasizes undergraduate medical informatics education while most American universities focus on master's and doctoral education, very few institutions offer complete and mature undergraduate and master's programs simultaneously. Therefore, some of the 20 selected universities only offer undergraduate or only master's education.

Based on investigation results and collected datasets, this paper analyzes the basic situation of undergraduate and master's medical informatics education in both countries from perspectives of basic requirements, curriculum design, faculty strength, teaching methods, and employment prospects. All data and materials were obtained from official websites of relevant departments, with missing Chinese data collected through contact with university teaching secretaries.

### 3. Overview of Chinese and American Medical Informatics Undergraduate and Master's Education

Medical informatics talent education and training in China and the United States primarily relies on two approaches: first, formal institutional degree education (undergraduate, master's, doctoral); second, continuing education for health information personnel, medical staff, and non-health IT professionals interested in biomedical informatics. Since few Chinese institutions offer doctoral education and continuing education remains unsystematic and immature, this paper analyzes and elaborates on undergraduate and master's education.

#### 3.1 Chinese Medical Informatics Undergraduate and Master's Education

**(1) Basic Requirements.** Students face no strict admission restrictions. Undergraduates only need to meet university score requirements, and master's programs generally have no undergraduate major requirements, allowing interdisciplinary students opportunities to obtain medical informatics degrees. Programs include required, elective, limited-choice, and practicum courses, with students needing to complete corresponding credits to obtain degrees. Additionally, students must pass final thesis review and defense. Full-time undergraduate programs typically last 4 years (5 years at some institutions like Jilin University), while full-time master's programs generally last 3 years (2 years for professional master's degrees).

**(2) Curriculum Design.** The former Bethune Medical University (now Jilin University), China Medical University, the former Tongji Medical University (now Huazhong University of Science and Technology), and the former Hunan Medical University (now Central South University Xiangya Medical College) are recognized as the "four pioneers" of Chinese medical informatics education, with large and stable enrollment and relatively reasonable curriculum design that

other institutions reference. Table 3 shows core curriculum for undergraduate and master's programs at these four institutions.

Table 3 reveals that all undergraduate programs offer Management Information Systems, Hospital Information Systems, Information Organization, Information Retrieval, Data Structures, Database Technology, and Advanced Programming Languages, indicating preliminary standardization of core undergraduate courses. However, master's programs lack clear, unified course categories—some institutions emphasize computer courses (e.g., China Medical University) while others focus more on management courses (e.g., Huazhong University of Science and Technology). Additionally, except for Central South University, which has balanced undergraduate and master's core courses, other institutions offer fewer master's courses than undergraduate courses. The investigation found many master's programs only offer half-year courses with limited class hours.

The authors categorized all courses from the ten institutions into four areas: computer science, management, medicine, and information science. Statistical analysis of 342 undergraduate courses and 80 master's courses across the ten Chinese universities shows computer science courses account for the highest proportion (Figure 1 [Figure 1: see original paper]), reflecting the data-driven model demands of the big data era. Medical informatics development trends aim to provide personalized, intelligent, and knowledge-based health information services. Medical courses exceed management and information science courses because Chinese medical informatics education mostly begins at the undergraduate level without prior medical foundation, and programs are typically affiliated with medical schools emphasizing pharmaceutical basic courses. In master's programs, medical courses constitute only a small portion, while management, information science, and computer science courses dominate, related to students' prior medical knowledge accumulation and the shift in disciplinary direction to meet social demands as big data deepens in medicine. For example, Jilin University and its First Hospital jointly established a “Medical Big Data Research Center,” and Central South University renamed its program “Information Security and Big Data Research Institute.” However, advanced computer courses remain limited, and big data analytics courses with medical backgrounds still have limited coverage.

Comparison shows Chinese undergraduate education emphasizes basic knowledge, requiring students to understand medical, management, information science, and computer science theories before engaging in simple system design, maintenance, and management, with relatively low practical ability requirements. Master's education shifts focus to practical operation training, cultivating management and technical talents with solid computer knowledge for advanced data analysis and management in healthcare, such as interdisciplinary professionals capable of information management, analysis, and information system development in medical fields.

**(3) Faculty Strength.** Because Chinese medical informatics education includes many medical and public basic courses taught by faculty from other

departments, few full-time faculty exist in the major itself. Except for Central South University (24 faculty), Liaoning University of Traditional Chinese Medicine (23 faculty), and Shanxi Medical University (20 faculty), other institutions have only about ten faculty members. Figure 2 [Figure 2: see original paper] shows degree distribution among 135 faculty members across ten institutions, with master's degrees accounting for the highest proportion and bachelor's degrees the lowest, reflecting increasing educational requirements for faculty in interdisciplinary contexts. Investigation revealed bachelor's degree holders are mostly senior scholars, while younger scholars hold doctoral degrees or overseas study experience, demonstrating China's emphasis on faculty credentials. However, most faculty have single disciplinary backgrounds, predominantly in pure medicine, public health, or library and information science.

Title structure reflects the overall academic level and working capacity of the talent pool. Figure 3 [Figure 3: see original paper] shows title distribution among 139 faculty members, with senior titles (professors and associate professors) accounting for 49%, intermediate titles (lecturers) 45%, and junior titles (teaching assistants) 6%. While faculty quality is relatively high, ensuring student and research quality, the low proportion of junior faculty occurs because many universities directly appoint new doctoral graduates as lecturers who quickly advance to associate professor based on research achievements, potentially reducing mid-career faculty's research enthusiasm after promotion.

**(4) Teaching Methods.** Chinese undergraduate medical informatics education primarily relies on classroom learning, with experimental classes for clinical courses and computer lab sessions for some information courses (e.g., information retrieval), but these focus on basic knowledge without connecting to practical needs. Undergraduate students rarely participate in medical informatics projects, limited to annual entrepreneurship competitions that may be unrelated to medical informatics. Although hospital internships are arranged, they are brief and fail to provide deep understanding of information system operations. Moreover, graduation internships conflict with postgraduate entrance exams and job hunting, making practical teaching largely formalistic. Master's teaching methods are slightly more diverse, including conference attendance and participation in advisor projects to understand frontiers, but opportunities remain limited. Overall, practical teaching components are still insufficient. As Yang Fengli noted, informatization inevitably leads to educational transformation. Under the current environment where medical institutions have "talent shortage but not manpower shortage," practical teaching time is universally short and "theory-over-practice" phenomena are serious, making graduates' practical skills unable to meet employer needs.

**(5) Employment Prospects.** Both undergraduate and master's graduates can work in hospital information departments, medical record rooms, disease prevention and control centers, and health statistics information centers for data analysis, management, and information system construction, or in medical journals as editors and pharmaceutical companies as academic specialists

or system maintenance staff. Undergraduates need higher degrees to continue medical informatics research in universities or research institutions, and require further training for hospital information system maintenance. Because hospital information and medical record departments hire few staff with relatively light workloads, while pharmaceutical companies and medical big data development engineers prefer computer science backgrounds, many students choose to pursue graduate studies in library and information science or other information consulting services, gradually deviating from medical backgrounds.

### 3.2 American Medical Informatics Undergraduate and Master's Education

**(1) Basic Requirements.** American undergraduates must typically complete prerequisite courses in their first two years before qualifying for medical informatics programs. Graduate admission requirements, beyond conventional criteria, encourage backgrounds in biology, medicine, public health, computer science, and mathematical statistics. For example, Columbia University requires remedial computer science courses for students without prior relevant training. Degree requirements include credit completion, generally 30-60 credits for master's degrees and 50-100 for doctoral degrees, including coursework, research (thesis), teaching, and comprehensive examinations. Full-time undergraduate programs last 4 years, master's programs 2-3 years, and part-time master's programs 4-5 years.

**(2) Curriculum Design.** According to the American Medical Informatics Association (AMIA), curricula should include information science, computer science, library science, cognitive science, business management, statistics and biometrics, mathematics, artificial intelligence, operations research, economics, and basic, clinical, and health sciences. The authors analyzed institutions offering both undergraduate and master's programs (Indiana University, University of Central Florida, University of Washington, University of Kansas), with results shown in Table 4 .

Table 4 shows American medical informatics education focuses on computer science and management literacy improvement, particularly numerous computer courses with extensive selection space. Courses extend beyond basic theory to advanced offerings like Genomic Data Analysis and Precision Medicine, ICD Coding, and Healthcare Information Abstraction and Modeling, closely integrating biomedical informatics with big data contexts for effective clinical application.

Categorizing all 169 undergraduate and 271 master's courses from ten American institutions into computer science, management, medicine, and information science shows balanced proportions of management and information science courses, with computer science dominating and medicine accounting for the lowest proportion (Figure 4 [Figure 4: see original paper]). This reflects that American medical informatics was born from increasing computer applications

in healthcare. The U.S. Department of Health's Federal Health IT Strategic Plan (2011-2015) identified three major goals related to health IT: meaningful use for application and information exchange, improving healthcare and population health while reducing costs, and strengthening technological innovation. The low proportion of medical courses occurs because American undergraduate programs accept transfer students, some clinical medical students switch to medical informatics, and many schools offer medical informatics as a second major for students with medical backgrounds. Additionally, some master's programs require biomedical domain backgrounds, allowing non-medical students to take medical courses in later undergraduate years.

Comparison shows American medical informatics education emphasizes theory-practice integration, developing stronger practical abilities for scientific research using unique medical informatics methods. Management, information, and computer courses mostly relate to medicine, aiming to cultivate advanced professionals who understand both medicine and computer information processing. Master's courses are more advanced with more computer science offerings, adapting to new challenges in medical and health development under big data environments.

**(3) Faculty Strength.** Investigation revealed faculty are distributed across different departments and institutions. Harvard University and MIT have formed a biomedical informatics research and education consortium in the Boston area with Boston University, Tufts New England Medical Center, Massachusetts General Hospital, Children's Hospital, and Brigham and Women's Hospital. Figure 5 [Figure 5: see original paper] shows degree distribution among 463 faculty members across ten American universities. Except for some bachelor's degree holders at Indiana University, all faculty hold master's or doctoral degrees, with far more doctorates than master's degrees. Many faculty hold dual or multiple degrees, indicating robust faculty strength matching medical informatics' interdisciplinary nature.

American professors have three ranks: assistant professor, associate professor, and full professor. Figure 6 [Figure 6: see original paper] shows title distribution among 463 faculty members, with assistant professors accounting for 48%, full professors 27%, and associate professors 25%. America's "up-or-out" tenure system requires assistant professors to undergo rigorous review for promotion to associate professor after about five years, then to full professor after another five years. Associate and full professors have tenure, creating intense competition that motivates researchers to produce academic achievements.

**(4) Teaching Methods.** American medical informatics education employs flexible models, mostly combining online and offline instruction (e.g., Indiana University, University of Kansas), with master's students emphasizing offline learning more than undergraduates. Beyond required credits, universities invite industry professionals for lecture series. For example, the University of Washington ensures students understand latest industry issues and trends through frequent guest lectures and group discussions. Universities provide

numerous project participation opportunities, such as Columbia University's projects in clinical informatics, public health informatics, clinical research informatics, translational bioinformatics, and computational biology. Many universities have specialized laboratories, such as Columbia University's four labs (Biomedical Language Lab, Decision and Cognition Lab, Biomedical Knowledge Technology Lab, Computational Biology and Bioinformatics Center) and University of Utah's six labs (Biomedical Language Understanding Lab, Biology Ontology Lab, Bioinformatics Methods Lab, Genomic Algorithms Research Lab, Text Data Analytics Lab), providing excellent research environments.

**(5) Employment Prospects.** Systematically educated and experienced medical informatics professionals are in short supply in the U.S., creating excellent employment opportunities including Chief Information Officer (CIO), Chief Medical Information Officer, Chief Information Security Officer, Systems Analyst, and IT Entrepreneur. Graduates can also work in medical software companies, consulting firms, home health agencies, hospital information departments, or as assistant professors. Compared with China, employment prospects are broader and clearer because the U.S. healthcare industry accounts for 18% of GDP with mature health informatization, and diverse, specialized curricula cultivate high-level professionals who effectively match job requirements.

#### 4. Comparative Conclusions on Chinese and American Medical Informatics Education

China's medical informatics started late and developed slowly, showing gaps with the United States in undergraduate and master's education:

##### 4.1 Emphasis on Undergraduate Education with Imperfect High-Level Talent Training Systems

China's medical informatics education focuses on undergraduates without strict admission restrictions, while the U.S. primarily targets master's and doctoral students requiring backgrounds in medicine, computer science, and statistics, with some courses only open to students with relevant knowledge. As an interdisciplinary field facing big data paradigm impacts, medical informatics requires multidisciplinary knowledge. China's focus on undergraduate training leaves large gaps with practice, while few Chinese institutions offer mature master's and doctoral programs, causing many students to choose library and information science graduate programs, wasting their medical backgrounds and causing talent loss. In contrast, America's higher training levels produce graduates with complete knowledge structures meeting social demands.

##### 4.2 Monotonous Curriculum with Excessive Non-Medical Basic Courses and Weak Interdisciplinary Integration

Comparison shows that while Chinese undergraduate computer science courses account for the highest proportion, they are limited to basic theoretical courses like database technology and computer systems introduction, insufficient for

medical big data mining and analysis. American institutions offer basic, intermediate, and advanced computer technology courses, some requiring pre-requisites. Chinese undergraduate curricula have excessive medical courses that are broad but not specialized, including non-basic courses like pathophysiology and immunology. Chinese medical informatics education tends toward library and information science, spending substantial time on affiliated discipline knowledge with limited medical intersection, offering only traditional courses like medical statistics and hospital information systems. Information retrieval and organization courses belong to library and information science with almost no connection to medical basic courses. Compared with the U.S., Chinese master's courses are fewer and lack clear, consistent core courses.

### **4.3 Single Faculty Disciplinary Backgrounds and Unbalanced Title Structures**

M.H. Anne proposed that faculty backgrounds should be diversified, preferably selecting those with library and information knowledge, specialized discipline knowledge, and strong computer skills. American faculty mostly hold dual degrees (medicine and management), while Chinese faculty are relatively single-disciplinary, lacking interdisciplinary backgrounds—some have management backgrounds, some medical, and even fewer have computer science backgrounds, creating situations where computer experts don't understand medicine and medical experts aren't proficient in computers, limiting faculty perspectives. Additionally, Chinese faculty titles show a top-heavy structure, with professors and associate professors exceeding lecturers and teaching assistants, potentially reducing research enthusiasm after promotion. Although American faculty mostly hold doctoral degrees, creating a gap with China, China is gradually increasing its doctoral faculty and optimizing its teaching force.

### **4.4 Simplistic Teaching Methods with Limited Student Practice Opportunities**

Chinese undergraduate medical informatics education primarily focuses on theoretical knowledge with single teaching methods, and clinical practice courses mostly follow formalistic procedures. In contrast, besides classroom instruction, America offers frequent guest lectures, training workshops, and group discussions, hiring professionals from different backgrounds—especially computer engineers and experts—to enrich teaching content. Collaborations with medical software companies or affiliated hospitals, such as Columbia University Medical Center and NYU Medical Center, enable deep practical understanding. Chinese master's students have few and single-type opportunities to participate in faculty projects, while American institutions offer numerous projects for different research directions, such as Columbia University's genomics, proteomics, and telemedicine projects, and Kansas University's specialized Alzheimer's and cancer informatics projects. Although Chinese institutions have different teaching and research offices, they don't function effectively, while American laboratories are well-equipped with abundant resources and strong faculty, providing superior research environments.

#### **4.5 Unsystematic Student Knowledge Systems and Limited Employment Prospects**

Compared with the U.S., China's medical informatics talent employment channels are not lacking, but the real problem is the shortage of high-quality interdisciplinary professionals under the big data scientific paradigm. Medical informatics is an intersection of medicine, information science, and computer science, but Chinese curricula lack connections between medical basic courses taught in first and second years and later information management courses, failing to maintain systematic curriculum structures and hindering students' knowledge system formation. This makes students unable to 胜任 positions in pharmaceutical software companies, hospital information system maintenance, and medical big data mining and analysis, causing these positions to flow to computer science professionals.

### **5. Implications for Chinese Medical Informatics Education**

Based on the above comparative analysis and China's current medical informatics education status, Figure 7 [Figure 7: see original paper] summarizes prospects for future medical informatics talent cultivation in China under big data environments.

#### **5.1 Adapt to Big Data Scientific Research Paradigm Requirements and Accelerate High-Level Medical Informatics Talent Cultivation**

Data-driven big data paradigms demand increasingly high-level talent. China should accelerate establishing and improving high-level talent training mechanisms, standardizing master's education systems to provide more advanced study opportunities for medical informatics undergraduates and attract interdisciplinary talents from medicine, computer science, biology, and library and information science to expand China's medical informatics talent pool.

#### **5.2 Adjust Curriculum Systems and Content Settings to Broaden Disciplinary Knowledge Scope**

Curriculum design should reflect medical informatics' multidisciplinary integration, constructing course systems based on multiple dependencies among medicine, computer science, and information science. China should appropriately reduce non-medical basic courses and increase advanced computer courses to highlight disciplinary characteristics under big data backgrounds. Master's curricula should first establish consistent core courses, then develop specialized features and advantages based on institutional backgrounds. Additionally, practical and applied courses should be reasonably arranged, such as increasing information course lab sessions, deepening statistical analysis software operation, introducing latest hospital information systems, and promoting research on medical informatics big data analysis theories, methods, and specialized analytical tools and platforms.

#### **5.3 Optimize Faculty Allocation and Attract Multidisciplinary Background Talents**

China should attract more medical informatics interdisciplinary talents to join faculty ranks while hiring practicing professionals based on course needs to enrich teaching forms. Title grade differentiation should be increased with appropriate promotion difficulty to maintain faculty research interest and enthusiasm. To promote interdisciplinary development, China should learn from American experiences allowing talents to hold concurrent positions across different institutions.

#### 5.4 Enrich Training Methods and Emphasize Theory-Practice Integration

Training processes should diversify methods, such as introducing Problem-Based Learning (PBL), appropriately increasing lab session time and difficulty, inviting hospital and enterprise experts for lectures, providing project participation opportunities, popularizing mentorship systems (one-on-one advisors for undergraduates), and standardizing hospital trainee systems to create more practice-oriented opportunities for students.

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## Author Contributions

Zhang Xue: Collected, organized, and analyzed research materials and data; drafted and revised the manuscript.

Zhang Zhiqiang: Proposed research ideas; participated in manuscript revision.

Chen Xiujuan: Assisted in framework development; participated in manuscript revision.

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## Comparative Research and Enlightenment on the Current Status of Chinese and American Medical Informatics Undergraduate and Master's Education

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**Abstract:** [Purpose/significance] This paper compares and analyzes undergraduate and master's education in medical informatics at Chinese and American universities to provide references for future medical informatics education in China. [Method/process] Using program establishment time and institutional level as selection criteria, ten representative universities from each country offering medical informatics education were selected as research objects. Through online

investigation, this paper comprehensively analyzes the general situation of medical informatics undergraduate and master's education in China and the United States from aspects of basic requirements, curriculum, faculty strength, teaching methods, and employment prospects. [Result/conclusion] Although China has made some achievements in medical informatics education after decades of exploration and practice, compared with the United States, China still has shortcomings. In terms of admission basic requirements, China focuses on undergraduate education while its high-level talent training system is imperfect. In curriculum, course content is monotonous, the proportion of non-medical basic courses is too high, and interdisciplinary integration is not obvious. In faculty strength, teachers have single disciplinary backgrounds and unbalanced title distribution. In teaching methods, instruction is simple with fewer practical opportunities for students. In employment prospects, students' knowledge systems are not systematic and employment prospects are limited. In the future, China should conform to the development requirements of the big data scientific research paradigm, accelerate the cultivation of high-level medical informatics talents; improve curriculum systems and content settings to broaden the scope of disciplinary knowledge; optimize faculty allocation to attract multidisciplinary talents; and enrich training methods while emphasizing the combination of theory and practice.

**Keywords:** medical informatics; undergraduate education; master's education; comparative study

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

*Source: ChinaXiv — Machine translation. Verify with original.*