



## Review article

# The evolution of medical informatics in China: A retrospective study and lessons learned



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## ABSTRACT

**Background:** In contrast to China's giant health information technology (HIT) market and tremendous investments in hospital information systems the contributions of Chinese scholars in medical informatics to the global community are very limited. China would like to have a more important position in the global medical informatics community.

**Objective:** A better understanding of the differences between medical informatics research and education in China and the discipline that emerged abroad will better inform Chinese scholars to develop right strategies to advance the field in China and help identify an appropriate means to collaborate more closely with medical informatics scholars globally.

**Method:** For the first time, this paper divides the evolution of medical informatics in China into four stages based on changes in the core content of research, the educational orientation and other developmental characteristics. The four stages are infancy, incubation, primary establishment and formal establishment. This paper summarizes and reviews major supporting journals and publications, as well as major organizations. Finally, we analyze the main problems that exist in the current disciplinary development in China related to medical informatics research and education and offer suggestions for future improvement.

**Conclusions:** The evolution of medical informatics shows a strong and traditional concentration on medical library/bibliographic information rather than medical (hospital information or patient information) information. Misdirected-concentration, a lack of formal medical informatics trained teaching staff and mistakenly positioning medical informatics as an undergraduate discipline are some of the problems inhibiting the development of medical informatics in China. These lessons should be shared and learned for the global community.

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## 1. Introduction

Medical informatics is defined [1] by experts of the American Medical Informatics Association as ‘the interdisciplinary field that studies and pursues the effective uses of biomedical data, information, and knowledge for scientific inquiry, problem solving and decision making, motivated by efforts to improve human health’. Medical informatics has a long history and established a comprehensive disciplinary infrastructure system. The discipline systems that have been gradually recognized include bioinformatics, image informatics, clinical informatics, public health informatics, nursing informatics, consumer health informatics and other branches. However, the evolution of medical informatics in China originated from the traditional medical information science or library science, which is very different in discipline systems, theory and research content compared to formal medical informatics. Recently, there has been rapid development of the application of health information technologies such as hospital information systems in China, although the development of medical informatics as a discipline has relatively lagged. The establishment and development of a discipline are inseparable from the establishment of a discipline system, major supporting journals and publications, and relevant organizations and associations. Medical informatics, which is an emerging, fast-developing and multidisciplinary discipline, faces many challenges and difficulties in China due to the formal informatics faculty deficit and other historical factors. To promote its development, this paper provides a systematic and comprehensive overview of the historical development stages of medical informatics, major publication and research content, and relevant organizations in China, elaborates the differences and connections between medical informatics and traditional medical information and library disciplines (which were considered ‘medical informatics’ for a long time in China), and also analyzes the existing problems and proposes suggestions for the field’s future development.

## 2. Four stages of the evolution of medical informatics

### 2.1. Infancy period (1979–1997)

This stage cannot be called a period of medical informatics. Instead, it was a period that oversaw the gradual formation of medical informatics, or to be precise medical information science. In 1979, China’s first medical informatics magazine the *Journal of Medical Information* (renamed *Journal of Medical Informatics* in 2006) was started [2], marking the germination of medical informatics-based research. However, during this period China’s medical informatics research focused on medical information (more frequently called intelligence), medical libraries and medical journals [3]. Such concentrations of medical bibliographical information research included reviews and summaries, the presentation of situations and reforms, development planning, and suggestions for medical bibliographical information rather than hospital information. The focus of medical library science is the generation of the medical library and the development direction of library management and its influencing factors, including training of librarians, collection development, management systems and the introduction of foreign libraries. From 1985 to 1987, in

order to train professional talent on medical library information, the Ministry of Education and the Ministry of Health approved the establishment of an undergraduate education program formally named medical library information in four institutes [the so-called ‘old four’ among related scholars: Tongji Medical University (now Tongji Medical College, Huazhong University of Science and Technology), Hunan Medical University (now Xiangya School of Medicine, Central South University), Norman Bethune Medical University (now Norman Bethune College of Medicine, Jilin University) and China Medical University] [4]. This program did make certain contributions to the development of the medical informatics discipline, although very limited genuine medical informatics professional talent was cultivated by this program. Indeed, the development of talent was restricted by the nature of this program because the teaching philosophy and the direction were based on medical library and bibliographical information rather than hospital information or patient information.

### 2.2. Incubation period (1998–2002)

This period marks the gradual incubation and transformation of medical informatics in China. In 1998 [4], the above mentioned four universities put the discipline ‘Medical Library Information’ into the category ‘Information Management and Information System’, which was a discipline established by the Ministry of Education. Other institutions began a similar discipline of medical information engineering or set disciplines such as hospital information management, health information management and information systems under another established major called ‘public health management’ within the School of Public Health. During this period, the research focus gradually shifted from medical (library/bibliographical) information to medical literature retrieval and new science and technology reviews, which was a service provided by librarians to offer researchers a systematic review on certain topics [3]. However, the traditional research focused on medical library and medical journal studies still dominated in this field because hospital information was not the focus of the government who paid for the technologies and there was a shortage of teachers in this field; this period was simply a transforming period in which the concept, teaching and research on medical informatics were discussed, but very few studies on medical informatics were truly performed.

### 2.3. Primary establishment period (2003–2009)

This period encompassed the early days of the genuine discipline of medical informatics. In 2003, medical informatics was separately listed in the professional catalogue of higher education by the Ministry of Education, and the name ‘Medical Informatics’ was formally established [4]. The traditional medical library information gradually faded out of sight; even traditional medical library research shifted its attention to the construction of digitalized libraries, medical library information services and library knowledge management. Emerging technologies based on the digitalization, network and individualization were on the rise. Importantly digital public health and hospital information systems made significant progress during this period due to the sharp rise

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