

*Viewpoint Paper* ■

# Who are the Informaticians? What We Know and Should Know

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**Abstract** The beginning of the 21st century has seen a surge in interest and enthusiasm for health care information technology based on its ability to demonstrate improvements in the quality, safety, and cost-efficiency of health care. One question, however, for which we have fewer answers is “who will be the individuals that develop, implement, and evaluate these systems?” In particular, while most attention has been paid to the exemplar leaders in health information technology, less has been focused on the issue of the workforce necessary to sustain the systems to achieve their vision. The discipline of medical informatics must pay sufficient attention to the professional workforce that will deploy systems outside the informatics research setting so their benefits may more widely accrue.

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There is an emerging consensus from both political and health care leaders that health care information technology (HIT) is an important component of efforts to improve the quality, safety, cost, and satisfaction of the health care system in the 21st century.<sup>1</sup> This consensus is driven by the recognition of the value that the electronic health record (EHR) and health information exchange (HIE) across traditional business boundaries can potentially provide.<sup>2</sup> Recent actions such as the organization of the National Health Information Infrastructure<sup>3</sup> and the National Institutes of Health Roadmap<sup>4</sup> represent milestones that cement the importance of this technology. A growing body of scientific evidence supports the use of this technology, particularly with regards to clinical decision support to improve health care safety and quality.<sup>5</sup>

A great deal has been written about the impediments to use of IT in health care.<sup>6</sup> Issues such as cost, interference with clinical workflow, and technical support are often mentioned. But one area receiving little attention revolves around who will be the leaders in hospitals, physicians' offices, and communities where these systems are deployed. Furthermore, since the participation of physicians, nurses, and other health care professionals is crucial for the successful implementation of these applications, how will such individuals be trained to provide them with the knowledge to work with IT professionals?

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The goals of this viewpoint are to review what we know about the HIT workforce, to propose some questions that should be asked and investigated, and to analyze the author's experience (as the director of an educational program) as it relates to the future. This paper derives from a talk presented at the Jochen Moehr Surprise Retirement Colloquium in Victoria, British Columbia, on June 3, 2005. Professor Moehr was deeply involved with educational issues in our field and led successful academic programs at the University of Victoria and the University of Heidelberg over four decades. This viewpoint acknowledges the paths he illuminated for us.

## What We Know

Although IT units are a substantial part of health-related organizations, we do not have comprehensive knowledge of the backgrounds, training, skills, and job activities of those who work with health IT units. There is a specific lack of information about those who have clinical backgrounds and work in HIT settings. The importance of this workforce, however, is increasingly acknowledged by leaders in HIT. Dr. David Brailer, Director of the Office of the National Coordinator for Healthcare IT (ONCHIT) has stated, “We have a huge manpower crisis coming down the road” in the implementation of HIT systems.<sup>7</sup> Drs. Charles Safran and Don Detmer, Chairman of the Board of Directors and President (respectively) of the American Medical Informatics Association (AMIA), have called for at least one physician and nurse each at all 6,000 hospitals in the United States to be trained in medical informatics to guide HIT implementation in their local settings.<sup>8</sup>

## The Health Care Information Technology Workforce

While no data provide an overall picture of those who work with HIT, some data exist about specific disciplines within the overall field, such as IT staff and health information management (HIM) professionals. But a comprehensive picture of all who work in HIT, should include:

- Clinicians: physicians, nurses, and other health professionals who are involved in HIT development, implementation, or management on a full- or part-time basis

- IT professionals: often with backgrounds in areas such as computer science and management information science, although sometimes with no formal IT background at all
- HIM professionals: who have historically managed medical records departments but now are evolving with the increasingly electronic record
- Health science librarians: who manage medical libraries as well as clinicians' interactions with knowledge resources

The Gartner Group has assessed HIT staffing in integrated delivery systems (IDSs). Their 2003 report assessed 85 IDSs of varying sizes.<sup>9</sup> They found that regardless of size, each IDS had about one IT staff per 56 non-IT employees. Typical IT job functions included programmer/analyst (51%), technical support/help desk (28%), telecommunications/network support (16%), and management (15%). IDSs spent a little under 3% of their overall budgets on IT.

Likewise, the American Health Information Management Association (AHIMA) has carried out workforce analyses of HIM professionals. The HIM profession has undergone significant changes during institutions' migration toward EHRs. The former skill set related to managing folders of paper decreased as the ability to manage electronic data increased. A recent initiative of AHIMA is e-HIM, which aims to guide the profession in the emerging electronic environment.<sup>10</sup> The Bureau of Labor Statistics estimated that 136,000 Americans were employed as HIM professionals (defined as "medical records and health information technicians") in 2000, with projected growth of need by 2010 of 49%.<sup>11</sup> AHIMA interprets this need as a major call for expansion of their profession,<sup>12</sup> particularly in the development of graduate-level programs.<sup>13</sup> A recent survey of AHIMA members found an increasing diversity of roles in HIT settings by its members.<sup>14,15</sup>

Health science librarians also play a prominent professional role in the HIT arena. In recent years, discussions have focused on the role of the "informationist," a new professional derived from the clinical librarianship tradition but with a broader skill set for the clinical environment. This discussion began with publication of an editorial advocating development of this new professional,<sup>16</sup> followed by the publication of a series of papers in *Journal of the Medical Library Association*<sup>17</sup> and a conference that was followed by additional papers.<sup>18</sup> This author has advocated that medical informatics education could provide a useful pathway to train some individuals to be informationists.<sup>19</sup>

There are fewer data about clinical informaticians. There has been no formal analysis of the informatics workforce. In 2003, the trade publication *Modern Physician* surveyed the 1,110 members of the Association of Medical Directors of Information Systems (AMDIS), of which 82 members replied.<sup>20</sup> Some important findings from this survey of a very limited number of individuals were that few had formal training in informatics (reflecting in part the fact that such training did not exist when they entered the field), that salaries tended to reflect the clinical specialties from which they came, and that the skills they valued most were more organizational and managerial than technical. The most important skills they valued for their work included problem-solving skills, quality improvement in patient care, assessing interests/informal politics, and innovation and change management.

Some data about informaticians come from surveys of desired skills of potential employers. Hoffmann and Ash<sup>21</sup> asked 148 potential employers of graduates from informatics graduate programs to rate the skills they believed were most important for graduates to have. The skills that were most frequently ranked in the top five included knowledge of the information used in clinical care, interpersonal skills, change management, relational databases, and project management. As with the AMDIS survey, technical skills were important but only one component of a larger set.

Knaup et al.<sup>22</sup> also published a survey of graduates from two large, long-standing Master's programs in Germany. A total of 446 graduates responded, with the most common places of employment being hardware/software companies (32.9%), other companies (19.4%), and hospitals or medical institutions (18.0%). The most valued subjects in their education were deemed to be software engineering, database and information systems, and informatics. Areas where they felt less well prepared included project management, object-oriented techniques, staff management, and economics.

Despite the paucity of data about the quantity of clinical informaticians, research has shown that they are a key component to successful IT implementations. Ash et al.<sup>23</sup> have found that successful implementation of computerized physician order entry is highly dependent on "special people," typically administrative leaders, clinical leaders, and bridge personnel who provide vision and guidance. One HIT recruiter has noted that leaders in clinical settings (e.g., chief medical information officers) must have a spectrum of skills that include not only those in technology but also in people and leadership areas.<sup>24</sup> Even among nonclinicians in HIT, there is a recognition that an understanding of the health care environment is essential. A recent poll asked nonclinician HIT leaders whether understanding of the health care system was important knowledge for successful HIT work, with over 90% responding affirmatively.<sup>25</sup>

### Framework of Informatics Practice

Lacking a quantitative handle on the medical informatics workforce, one can review the literature to define a framework of informatics practice. Covvey et al.<sup>26</sup> attempted to define job competencies for different types of informatics practice. Their categories included academic/research and applied/professional practitioners (along with competencies needed for clinical and biomedical research practitioners omitted from this discussion, which is focused on the HIT workforce). We believe there is an additional category of practice seen increasingly in clinical settings, which is the local expert or liaison who provides a bridge between the IT staff and clinical users, representing the user community. Expanding research literature documents the value of user engagement in the success of HIT projects.<sup>23,27</sup> Table 1 shows categories of informatics practice with a description of related work and example job titles.

The lines between these categories are admittedly fuzzy. The informatics leader at a large medical center may well need (or desire) the breadth of training of an academic informatician. Likewise, the local expert in a community hospital or large clinical practice may also want to have additional training at or near the level of an informatics professional. The amount of expertise among the levels, especially between expert and

**Table 1 ■ Categories of Informatics Practice (Adapted from Covvey et al.<sup>26</sup>)**

Level of Practice	Type of Work	Example Job Titles
Academic/ research	Individual who does research and/or teaching in an academic center	Professor, scientist
Applied/ professional	Individual who works in an operational informatics setting for a majority of his or her working time	Chief Information Officer, chief medical or nursing information officer, project manager, developer, trainer
Expert/liason	Individual who spends part of his or her working time as a local expert and interfaces with informatics or information technology professionals	Chief medical or nursing information officer, clinical information technology liaison

professional, may really be more of a continuum, with the expert advancing to the professional level as his or her career develops.

The report of Covvey et al. is not the only effort to define the educational goals and competencies of informatics training. The Working Group on Education of the International Medical Informatics Association has published guidelines for health informatics education.<sup>28</sup> The American College of Medical Informatics has also published a set of competencies, although these are aimed more at researchers, with considerable influence from the bioinformatics environment.<sup>29</sup> Another effort to define occupational standards for informatics professionals is being undertaken in the United Kingdom by the National Health Service (NHS) Information Authority.<sup>30</sup> The American Medical Informatics Association Education Committee also has a process under way to define competencies for the informatics field more broadly.

There have also been attempts to define competencies in informatics for clinical practitioners. Among the professional groups for whom these have been published are medical students,<sup>31</sup> nurses,<sup>32</sup> nurse practitioners,<sup>33</sup> and public health professionals.<sup>34</sup> The NHS has defined competencies for information professionals in the United Kingdom.<sup>35</sup>

### Informatics as a Profession

Another way to assess informatics is to look at how well it meets common definitions of a "profession." One classic model is that of Pavalko,<sup>36</sup> who determined that a profession is characterized by a strong knowledge base and intellectual technique, relevance to basic social values, specialized training, driven by "service ideal" ahead of self-interest, autonomy in practice, long-term commitment to profession, sense of community, and highly developed code of ethics. Joyub<sup>37,38</sup> analyzed the state of professionalization of the HIT workforce in the United Kingdom based on Pavalko's framework and determined that informatics was very early in its development as a profession.

The Software Engineering Body of Knowledge ([www.swebok.org](http://www.swebok.org)) has a similar but more prescriptive set of characteristics that define a profession:

- An initial professional education in a curriculum validated through accreditation
- Registration of fitness to practice via voluntary certification or mandatory licensing
- Specialized skill development and continuing professional education
- Communal support via a professional society
- A commitment to norms of conduct often prescribed in a code of ethics

By these definitions, informatics has some characteristics of a profession. While there is a continued growth in the self-identification of medical informaticians, the field still lacks a formally defined curriculum and set of agreed-on competencies. Some analyses have assessed the curricula of educational programs and how they match emerging definitions of professional competencies, finding a great diversity in curricula.<sup>39</sup> The International Medical Informatics Association has developed a code of ethics.<sup>40</sup>

Another step towards professionalization would be certification. While the medical profession in the United States has not (yet) recognized informatics as a specialty (or what will more likely happen, a subspecialization within specific specialties), the American Nurses Association has begun certifying nurse informaticians.<sup>41</sup> In the United Kingdom, the U.K. Council for Health Informatics Professionals (UKCHIP) has been formed to address certification and other issues of professionalization.<sup>42</sup>

### What We Should Know

The limited amount of data about the HIT workforce portends a number of questions about the relationship between HIT and medical informatics proper: What, if anything, distinguishes medical informatics from other areas of HIT? If there is a difference, where does HIT end and informatics begin? What jobs or roles within HIT require formal training in medical informatics? How much informatics training should non-HIT professionals have?

From the author's perspective as an academic and educator, there is great value for everyone involved in the field to see the discipline of medical informatics emerge as a profession. For those in operational or other applied settings, it will improve self-identification and commitment to the field by having a professional identity. For those in academic settings, it will give greater purpose to programs in research and education.

One of the challenges for the field is that medical informatics, like the rest of HIT, is a heterogeneous field. There will always be a diversity of backgrounds, skills, and knowledge, which is probably beneficial for the complex task of working at the intersection of health care and IT. However, if informatics is indeed evolving into a profession, then it also requires a professional underpinning that guides and unites those who work in the field. Just as the knowledge base of all medical specialties informs professional practice, so too must the knowledge base of informatics. As such, educational leaders must come together to define competencies and curricula for the broad categories of informaticians.

There is also a research agenda that must advance for us to better understand the roles of various individuals in HIT. This will not only allow them to better develop in their

careers, but also improve our implementation of HIT that will benefit health care more broadly. Some of the particular research questions that require answering include

- What is optimal organization of the workforce within organizations to best achieve the value of HIT?
- What is the best training for the various individuals who assume those roles in the workforce?
- How can professionalization of this workforce improve implementation of HIT?

## Perspective and Vision

While the first generation of leaders in Professor Moehr's generation laid the foundation of informatics science, fewer set the mold for widespread dissemination of that science. Although Professor Moehr was an exception in that he recognized the need for and led the development of an academic program that synergistically combined informatics research and professional practice. Other academic programs certainly need to incorporate this view if we want to see our work have an impact on improving health care and biomedical research.

There is no question that the HIT workforce is unique. Training in health care or computer science alone will not provide the basis for professional practice. As Hersher and Hodges<sup>43</sup> note, talking to the head of the internal medicine department is quite different from talking to the director of the hospital supply chain. Leaders in HIT must clearly understand both IT and how it is used in the health care setting.

The experience of our own educational program in medical informatics program at Oregon Health & Science University (OHSU) provides some additional perspective.<sup>44</sup> When our program was developed in the early 1990s, we followed the path of most graduate programs at the time: aiming to develop academically oriented graduates likely to pursue research. After the program began, however, a more diverse mix of students appeared. In particular, there was much greater interest in our students in working at jobs in Covvey et al.'s applied/professional category. This was particularly true for physicians, many of whom sought to attain roles such as chief medical information officer. We have also seen great popularity and continued interest in our distance learning program, which appeals to those who wish to enter the informatics field but not abandon their daytime jobs in the process.<sup>45</sup> This culminated in the development of the AMIA 10 × 10 program, initially codeveloped with OHSU, that aims to extend informatics training to an even broader segment of the health care environment.

This evolution has led to change in our program's overall curriculum, with increased emphasis on more practical content in informatics. But this does not mean we have abandoned our commitment to training those at the academic/research level. In fact, we believe those individuals actually have their research perspective enhanced by this more practical view of our very applied and integrative field.

The author, as the director of an informatics education program, is often asked what job opportunities are available to those who undertake education in the field. One clear observation is that informatics is a very heterogeneous field. Education is not "cookie cutter," i.e., producing a set of uniform skills as might be found, for example, in undergraduate

accounting majors. In an analogy to Bayesian statistics, what an individual does upon graduating from an informatics program is in part a function of what he or she did before entering. In other words, a physician or nurse is highly likely to draw on his or her clinical training in an informatics job, whereas someone with a background in computer science will likely gravitate toward technical positions that draw on his or her previous skills. Our educational program actually values and leverages this diversity of students, which is something we recommend for all programs.

Since professional growth is usually enhanced by organizations that represent professions, it is also imperative that organizations emerge that provide a "home" for those professionals. The best of these organizations provide a bridge for those in academics and applied to interact in mutually beneficial ways. In the United States, AMIA has always had an academic orientation but included members from applied settings. It is the ideal organization to take the lead in advancing the interests of all professionals in the field. Although the needs of academics and professionals can diverge in some regards, they do share many commonalities, and organizations like AMIA should leverage those for the benefit of itself and the field.

The growing role of HIT in improving the quality, safety, and cost of health care is undisputed. While continued attention must be paid to systems, interoperability, and financial issues, a well-educated and self-identified professional workforce is essential to achieve the best results. The academic informatics field must increasingly recognize the importance of the nonacademic aspects of the profession and be prepared to work in partnership for the benefit of the discipline as a whole.

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