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# Challenges in Medical Informatics

# *Challenges for Medical Informatics as an Academic Discipline: Workshop Report*

## Origins of the Workshop

In March 2001, twenty members of the informatics community gathered in Madrid, Spain, to discuss the state of our field as an academic discipline and the challenges that university-based workers in health informatics face. This meeting received considerable support from Erasmus University Rotterdam and the Spanish Society for Health Informatics (SEIS), and was designated as an IMIA Satellite Working Conference. The two-and-a-half day meeting took place in conjunction with the SEIS national conference and the meeting of the IMIA board of directors.

The workshop was motivated by observations that members of our community have made in recent years. Although the validity of some of these observations is debatable - and certainly was debated at the workshop - there has been concern that:

- Membership in professional societies for medical informatics, for the most part, remains flat.
- Recognition of medical informatics as a coherent academic discipline - especially by workers outside of medical informatics - has not been abundantly forthcoming.
- Many investigators within the medical informatics community are perceived to have difficulty articulating the underlying theories and principles that guide their work.
- Many prominent leaders in medical informatics recently have left academia completely in favor of work in the commercial sector.
- It remains difficult to fill available academic positions with well-qualified candidates.
- Many academicians are abandoning work in clinical informatics in favor of work in bioinformatics, which seems to have considerably more cachet.

These observations seem paradoxical at a time when governments and health-care organizations are loudly articulating the need for information technology to improve patient safety, to guide clinical decision making, and to eliminate inequities in the distribution of medical services. They seem worrisome at a time when the vendor community should be relying on the results of university-based research to help frame the next round of industrial innovation. It thus seemed appropriate to take stock as a community of where our field is heading and of how we can address the underlying structural problems that may be impeding our progress.

Participants of the workshop submitted position papers that were distributed among the group in advance of the meeting. Some of these position papers have been expanded, and appear in the January 2002 issue of *Methods of Information in Medicine*. Some of the participants at the workshop also summarized their positions at a special session at Medinfo 2001 in London. There is a hope that the open discussion at Medinfo and the journal publication of the position papers will initiate a broad dialog among members of the health informatics community regarding the issues discussed in Madrid.

## The State of Medical Informatics

The format for the workshop allowed the participants to present their positions briefly, followed by considerable discussion among the group. We will not attempt to abstract the positions of each contributor in this report, since most of the corresponding papers are now available in published form and the statements of each participant are best read in context. We believe it is more useful to summarize the key observations made by the group and to enumerate the points of debate.

Much of the discussion focused on the nature of medical informatics itself. One fundamental question centered on whether informatics is some sort of a science or whether it is an engineering discipline. To many, it seemed almost pejorative to describe informatics as engineering, and yet the workshop participants agreed that the scientific underpinnings of the field are not well articulated in our textbooks or by our professional societies. If informatics is a science, then surely it is not a natural science concerned with the elucidation of truths about the natural universe. If it is a "science of the artificial," to use the expression coined by Newell and Simon, then there are open questions about what are the hypotheses that workers in medical informatics are attempting to test, what are the theories that unify our approach, and what are the generic methods that allow us to validate our work empirically. In the absence of a clear expression of an agreed-upon underlying theory, it was difficult for many of the participants to feel comfortable with the description of informatics as a scientific discipline. At the same time, there was a nearly universal sentiment that academic work in informatics is indeed reflective of some sort of science. In the setting of this uncertainty, perhaps the most significant challenge to emerge from the workshop was a desire for our community as a whole to be more active in enunciating the theory that we believe drives our work and to be more precise about stating the hypotheses that we are attempting to test. If all of our theory is to be borrowed from traditional computer science, from information science, or from biostatistics, for example, we are left with the open question of what might remain at the academic core of informatics that we can claim to be our own.

Despite the problems of defining a core theory for our discipline, the workshop participants rejected the suggestion that academic medical informatics was simply the application of information technology in health care. Although terms such as "computers in medicine" provide an easy-to-understand slogan, the participants believed that such descriptions only confuse the outside world (as well as our own community) about the essence of medical informatics. They pointed out that the word *informatics* increasingly is being used to connote nearly anything that has to do with computers, and that the emphasis on hardware and software obscures the centrality of *information* as a first-class object of study.

Although medical informatics may not be the same thing as "medical computer science,"it is clear that workers in medical informatics frequently serve as "brokers" who can mediate among biomedical professionals, computer scientists, and end users. Conference participants noted that communication skills are very important in our line of work, and that an important contribution of our community is the ability to develop solutions to problems posed in a variety of professional frameworks. Nevertheless, there was a strong belief that research in informatics involves much more than the provision of translation services among the various stakeholders and the application of known computational principles to a particular domain. The challenge for our field, of course, is to be able to articulate better what that unique contribution is.

Attempts to define the "correct" relationship between academic informatics and institutional service led to considerable discussion at the meeting. It is obvious that workers in informatics may fill critical service roles within their organizations - both in the clinical and basic-science arenas. As a consequence, they may manage an information environment that offers them opportunities both for the integration and evaluation of new technologies and for the collection of significant data sets with which to test their computational methods. There was consensus among the conference participants that academic work in informatics involves goals and methods that are inherently different from those of applied work to manage an institution's information infrastructure. There was not agreement, however, whether scholarly activities and service activities are best performed by the same people. The group leaned toward the conclusions that service and scholarship require different training and different aptitudes. Nonetheless, there are clear synergies when a single organization can include individuals who can take on these respective roles.

## Attention to Emerging Fields

Much discussion centered on the surfacing of new fields that build on the basic techniques studied by workers in medical informatics. The new, heightened importance of bioinformatics and computational biology was mentioned by many of the participants. Although the generalizability of our work may be obvious to *us*, our field's traditional grounding in the health-care domain often makes it difficult for outsiders to appreciate that many of our basic techniques can translate into support for work in basic science. Again, the conversation focused on the need to clarify basic principles of *informatics* (without an adjective such as "medical" or "bio") that can lead to applications in both health care and basic biology. There was agreement that the boundaries between clinical informatics and bioinformatics are not terribly distinct - particularly as health-care practices increasingly will incorporate knowledge of patients' genetic condition and work in basic biology requires phenotypic information available in electronic patient record systems.

Although they are not receiving nearly as much attention - or funding - as is bioinformatics, other health-related disciplines are trying to carve out special pieces of the informatics pie. In particular, consumer health represents a burgeoning area of interest where information technology can play a key role. While recognizing the importance of such application areas, the group believed strongly that academic research in informatics needs to be able to transcend application areas. Thus, although consumer health and other disciplines can be extremely important driving forces for work in clinical informatics, our fundamental methodologies should not necessarily careen as new application areas are perceived to have greater or lesser importance to the health-care community.

## The Role of Education and Training

A major challenge for the informatics community lies in the training of the next generation of researchers and practitioners. There is enormous variability in the curricular goals implemented by different training programs. There are few textbooks in our field and each one has its own definition of medical informatics. Once again, the lack of well articulated principles for the discipline make it difficult to know what core competencies our trainees need for success in their careers.

The group identified a need for better professional leadership to help set standards for training in informatics and to define the appropriate scope of formal curricula. Although IMIA and other societies have advocated guidelines for medical informatics education, there does not exist a perception - either from within the informatics community or from the outside - that there is an agreed-upon, circumscribed set of learning objectives in force within all training programs in informatics. The group stopped short of advocating accreditation of informatics training programs or certification or credentialing of informatics professionals. The participants noted, however, that accreditation and certification are important objectives for professional societies in other fields, clarifying the core concepts of the discipline and making the statement that certified individuals have unique knowledge and skills. The group believed that organizations such as IMIA can play a key role in supporting the education of trainees and in advertising the qualifications of people with formal training in informatics to the outside world. Such activities, however, would require a new level of leadership in our professional societies. Attaining these objectives also would require our community to reach consensus concerning the boundaries of our discipline.

## Where to Draw the Line

A central issue that kept reemerging in the discussion concerned the scope of medical informatics itself. Ours has always been an inclusive discipline, and we have gained strength from the interactions that occur when we bring together people who have a variety of viewpoints. We always have involved both basic scientists and practitioners in our discussions, and our journals and conferences can take advantage of contributions from many different perspectives. We have never worried about what is - and what is not - medical informatics, believing that our field benefits from diversity. As the participants of the workshop struggled to define underlying principles for medical informatics and a core curriculum for our students, however, it became increasingly unclear how inclusive our field ought to be. It is impossible to define learning objectives or desirable skill sets without drawing boundaries that determine what is "in" and what is "out"; it is impossible to begin to discuss the credentialing of practitioners of medical informatics without some notion of what the core competencies are. Many of the challenges facing academic informatics seemed to stem from a lack of crispness in defining what the field really is. Past monikers such as "computers in biomedicine" have done little to clarify the situation. The vagueness also has made it particularly difficult for our community to argue that workers in medical informatics have special skills, since the boundaries of those skill sets are not defined.

The result is a dilemma: We can clarify the core dimensions of medical informatics - its theory, its principles, its applicability - and have a foundation for designing curricula, for credentialing practitioners, and for defining the place of informatics as an academic discipline. To clarify these dimensions, however, inherently will disenfranchise important members of our community. To paraphrase Kuhn, all paradigm shifts in science redefine the relationship of each academic to the discipline, forcing some investigators to the center and others to the periphery. In medical informatics, we have not done a particularly good job of defining a prevailing paradigm in the first place. This vagueness has served us well, allowing many of us to move between quite theoretical research and pragmatic applications, between laboratory experiments and large-scale deployment of information systems. The problem is that, although we and our particular health-care environments may have benefited individually from this lack of clarity, our discipline overall has not acquired any more coherence.

The workshop participants acknowledged that applications of informatics often address very broad user needs and

must embrace a wide range of perspectives. Inclusivity is essential if informatics is to succeed as an engineering discipline. At the same time, there needs to be a sharpening of our focus if medical informatics is to be considered a science. We need to define our paradigm, and to demonstrate how our research collectively builds on a common theory. Of course, articulating that theory remains a major academic challenge for all of us.

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