White Paper ∎

Toward an Informatics Research Agenda:

Key People and Organizational Issues

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A b s t r a c t   As we have advanced in medical informatics and created many impressive innovations, we also have learned that technologic developments are not sufficient to bring the value of computer and information technologies to health care systems. This paper proposes a model for improving how we develop and deploy information technology. The authors focus on trends in people, organizational, and social issues (POI/OSI), which are becoming more complex as both health care institutions and information technologies are changing rapidly. They outline key issues and suggest high-priority research areas. One dimension of the model concerns different organizational levels at which informatics applications are used. The other dimension draws on social science disciplines for their approaches to studying implications of POI/OSI in informatics. By drawing on a wide variety of research approaches and asking questions based in social science disciplines, the authors propose a research agenda for high-priority issues, so that the challenges they see ahead for informatics may be met better.

∎ **J Am Med Inform Assoc.** 2001;8:235–241.

Impressive innovations have been developed over the past 50 years in medical informatics. Meanwhile, it also has become apparent that, to realize benefits of medical informatics applications, attention to such people, organizational, and social issues as organizational readiness, diffusion of innovations, work flow, change management, professional values and status, and human factors is required. These concerns are more challenging now because technologic and institutional changes in health care are making complex organizational, social, and personal arrangements even more complex.

With rapid changes in both the technologies and the institutions of health care, informatics is becoming more central to health services. In this paper, we suggest how, in the new health care environment, key people, organizational, and social issues (POI/OSI)* are raised for informatics. These issues stem from changes that include:

∎ Wider availability of health information

∎ More fluid institutional boundaries

∎ Changing work practices and standards

∎ Increasing politicization of health care

∎ Changes in roles of health care consumers and providers

∎ The ability to create more integrated information systems that link clinical, personal, and organizational performance data

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* This acronym is used to reflect the current names of the AMIA People and Organizational Issues (POI) Working Group and IMIA Working Group 13: Organizational and Social Issues (OSI).

Table 1 ∎

Research Agenda Model: Key People and Organizational Issues—Sample Questions at Different Levels

Participants and Organizational Level (Low Granularity to High Granularity)	Social Science Discipline Level (Low Aggregation to High Aggregation)			
	Individual/Cognitive Psychology	Workgroup/Social Psychology	Organization/Sociology	Culture/Cultural Anthropological
Individual	▪ What affects information-seeking behavior and how information is used? ▪ How do different information sources influence health care decisions and outcomes? ▪ What information and information designs are effective for different individuals?	▪ How do rapid communication and changing roles of health care providers affect professional relationships? ▪ How does widespread availability of health information affect the patient role and patient decision making?	▪ How does widespread availability of health information affect relationships and roles between providers and patients or consumers? ▪ How do shifting patient loyalties and better-informed patients affect organizational structure in health care organizations?	▪ How should information be tailored to suit individuals from different cultural groups? ▪ How does one's culture affect one's use of IT? ▪ What meaning does "health" have for individuals of different cultural backgrounds?
Institutional	▪ What personal characteristics are needed in IT leadership?	▪ How are work routines affected by clinical practice guidelines, alerts, and reminders? ▪ How does a clinical information system change work routines and professional status? ▪ How do work routines affect the use of IT?	▪ How are professional identities changed by new communication patterns? ▪ How do different professional identities inter-relate to adoption of different informatics applications?	▪ How do professional cultures within an institution influence adoption of IT? ▪ To what extent is organizational culture uniform throughout an institution? ▪ How does IT change organizational norms and goals?
Trans-organizational	▪ How can multiple sources and formats of individual data be integrated or aggregated?	▪ How do auditing and monitoring of care affect professional identity and cohesion? ▪ How does the potential for distributed information and workflow affect how processes are organized and carried out?	▪ What would constitute an acceptable lifetime health record for each individual? Acceptable to whom? ▪ How do linkages through IT affect organizational identity and integrity?	▪ How can data be integrated and aggregated across organizations to obtain indicators and guidelines for improving care? ▪ How will clinicians and patients at an institution react to global indicators and guidelines?
Transnational	▪ How are individuals' perceptions of their health care needs influenced by trends elsewhere? ▪ How may information technologies be tailored for use by a wide variety of individuals in a wide variety of places?	▪ What pressures does internationalization of health care services create for local health care providers? ▪ What effects does health care information pitched to an affluent health care environment have on populations with more basic needs and services?	▪ How do disparities in health care maintain or disrupt social order? ▪ How does provision of health care services and health care information by foreign institutions affect local institutions? ▪ What information needs are most pressing in different settings, and who decides on priorities?	▪ How should disparities in health care be addressed at the national or cultural level? ▪ How well do different concepts of disease and health translate across cultures? ▪ What is needed for products and services to be successful and useful in a variety of locations? ▪ How can expenditures for IT be justified in light of pressing health care needs and high mortality rates? ▪ How is health care delivery in different places affected by transnational trends?

- The development of computer-based lifelong patient records

- The globalization of health care organization and delivery

- Growing international interoperability of the health enterprise

In turn, the medical informatics community is:

- Creating more integrated information systems that link clinical, personal, and organizational performance data

- Developing computer-based lifelong patient records

- Establishing Web-based information resources for use by patients, professionals, managers, and policy makers

- Constructing information management and decision support tools to support distributed health care practices

The medical informatics community has a long history of concern with POI/OSI, incorporating insights both from within the community[1,2] and from other disciplines.[3] We go beyond past models in the literature[4] by proposing a model for identifying and analyzing medical informatics challenges and for suggesting high-priority research questions, in the hopes of improving how we develop and deploy information technology to enhance health care.

Our model has a two-dimensional matrix structure. One dimension characterizes organizational levels of medical informatics use. The other dimension involves some of the social science disciplines that aid in understanding these organizational levels. Our discussion of the model draws on these social science disciplines as well as being grounded in our experience as informaticians, social scientists, administrators, academicians, clinicians, and worldwide consultants.

Table 1 depicts the matrix. We describe the two dimensions in the following sections, starting with the social science dimension. Then, as we describe the organizational level dimension, we turn to trends that are changing health care. The cells in the model include sample questions that could be addressed, using approaches of the indicated social science at the organizational level where they are listed. In this way, we identify both a set of research issues and also a set of theoretic and methodological analytic tools to formulate an informatics research agenda for POI/OSI.

Social Science Discipline Dimension

The social science dimension of the model starts with the individual and moves through work group, organizational, and cultural levels. We draw, in turn, on the disciplines of cognitive psychology, social psychology, sociology, and cultural anthropology—which have been considered "core disciplines"[3,†] and have provided distinguished contributions to the medical informatics literature over many years[‡]—to further suggest how social science is useful in informatics research.

Social sciences differ in the theories and methodologies they employ to study related, and sometimes similar or overlapping, questions. Here we distinguish among these disciplines by the level of aggregation involved. We consider how the social sciences contribute to our understanding at each level of aggregation, from individual to cultural group. We recognize that some practitioners in each discipline may not consider their primary focus to be as we describe. Nevertheless, we find it useful here, for our discussion, to both divide these disciplines starkly and to extend them across the cells in the table.

As shown in the table, we start with the lowest level of aggregation, the individual, shown in column 1 of Table 1. Cognitive psychology primarily concerns perception, cognition, imagining, learning, reasoning, judging, and abstract thinking. Individual cognitive psychology address questions such as how individuals manipulate symbols and images, what individuals know, how they know it, how this knowledge is organized, how individuals use this knowledge, and how individuals reason.[9] Because these influence acceptance and use of technology, individual decisions to use information technology, individual interpretations of cultural considerations and professional norms, and similar issues are taken into account in column 1.

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† We recognize that, in addition, valuable contributions can be made by incorporating theories, methods, and insights from other social science disciplines, such as economics, history, and political science. We urge, for example, increased attention to political issues in informatics, an expansion of economics approaches beyond cost–benefit analysis and technology assessment, and in-depth historical analyses.

‡ Contributors to Anderson and Jay[1] include persons with doctorates in anthropology, history, psychology, and sociology. In addition, paper and panel presentations by these and other social scientists became a tradition at the Symposium of Computer Applications in Medical Care (now the AMIA Annual Symposium). Among the panel presentations with social science orientations, cited here because information about panels is harder to locate, were those of Kaplan and colleagues.[5–8]

Next we suggest questions at the work group or social-psychological level. Social psychology addresses peoples' social nature—how people experience and act in social contexts, including, among other concerns, group dynamics, conformity, cooperation, negotiation, competition, persuasion, bargaining, group decision making, leadership, group performance, consensus, attitude change, and social interaction.[10,11] Questions in column 2 of Table 1 reflect the fact that health care work is done in groups. Research questions and strategies offered by social psychology involve understanding group membership, adoption of innovation, interpersonal communication, workplace interaction, and cooperative work groups. As the nature and make-up of work groups change, technology use will also change. The questions in column 2 focus on how the dynamics within those groups influence acceptance and use of technology.

The organizational sociological level is shown in column 3 of Table 1. Sociology explores institutional and organizational aspects of social aggregates and groups, the manner in which individuals form and function as collectives. It examines social systems and subsystems, social institutions, social structures, and how social settings provide enabling resources for behavior.[12,13] Sociology draws attention to health care as a nexus of interlocking institutions, including networks, functions, and structures of health care delivery systems, professions, and public government as well as organizational and professional structures, institutions, and roles. Questions in column 3 address how alternative ways of organizing health care institutions and the subunits within them influence communication of innovation and acceptance and use of information technology. As institutions merge and form alliances, difficulties arise when information systems must be integrated or architectures changed in accord with new organizational arrangements. Organizational analysis and sociological studies can shed light on the re-formation of organizational units, routines, professional roles, and norms in different groups and similar important influences that intersect with information technologies.

Finally, in column 4 of the table, we consider these kinds of questions at a macro level by focusing on cultures. Cultural anthropology is the branch of anthropology that studies culture by examining similarities and differences among different cultures.§ It offers theories and methods to explain the full range of human diversity by focusing on culture, i.e., characteristic attitudinal and behavioral dimensions of ethnic or social groups, including patterns and norms, systems of meanings and ideologies, and social practices and relations. It includes the study of economic and technologic behavior and artifacts as constituents of culture.[14–17] Cultural anthropological questions address how values and norms and, more generally, cultural systems influence the acceptance and use of information technology. Cultural differences affect technology transfer from one country to another. Culture affects inter- and intra-organizational transfers as well. Just as professional cultures within a medical center need to be considered,[18,19] attention also needs to be paid to values, beliefs, and other cultural considerations at the individual level as we design for people from different cultural groups.[20]

Participants and Organizational Levels Dimension

We now turn to fuller discussion of the dimension representing the organizational level where informatics applications are used. Here we characterize health care delivery from the perspective of participants, examining trends at different levels of granularity of organizational analysis, from individuals to trans-national organizations. Informatics innovations serve different purposes and have different effects at each level of granularity.

We start with the individual. In line with contemporary philosophies of patient-centered care, we incorporate both clinicians and patients.[21] The next level addresses concerns germane to clinical services and to information technology leadership at the institutional level.[18] At the next level, institutional boundaries are spanned. As boundaries expand, POI/OSI becomes more complex. Organizations are being linked in ways that cross institutional, geographic, and even national borders. Finally, the focus turns to global issues, as we discuss macro-ergonomic systems and major trends that are converging to change how health care services are forming trans-nationally.[22] At each level, we address changes and trends that are occurring in health care and their informatics implications.

Individual Person Trends

In Table 1, questions in row 1 concern individuals' roles in health care and how to design informatics applications for them. The changing roles of both providers and patients point to a need for patient-cen-

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§ Outside the United States, the term "ethnology" may be used to distinguish what, in the United States, is considered cultural and social (or sociocultural) anthropology from physical anthropology.[14]

tered systems.[21] New sources of health care information are burgeoning and becoming more accessible to both clinical and lay people. In addition, integrated delivery systems and managed care organizations are forming and reforming their delivery components in response to changing demand and contracts. These pressures make the individual—and the information about the individual—even more central as an essential thread through the various health care entities with which individuals must deal.

Consequently, the designs of medical records and personal health records need rethinking. Furthermore, individuals need to be enabled as intelligent "trading partners" with others who deliver their health care. This will involve re-engineering systems to be useful for all potential users, whether professional or lay, and across geographic, economic, and cultural boundaries—for example, by providing both common and clinical terminology or by providing interfaces that are meaningful to diverse populations. Among the informatics challenges are to pay attention to the form, content, and accessibility of health records; to ensure security, authentication, identification, and privacy in communicating health information; to examine patient outcomes on the individual level as well as for overall populations; and to build tools to enable individuals to become involved in their care no matter where they are. Such tools may include programs for monitoring one's own health and health behaviors, tools for accessing quality information, and tools for communicating with others in like circumstances or with health professionals.[23]

Individual Institution Trends

Information technology leadership challenges within a single health care institution are among the considerations reflected in row 2 of Table 1. Information technology leaders need multiple talents. They must keep up with frequent changes in both technology and service demands. They also must be adept at bringing together different professional cultures within an institution and building consensus among them, thereby providing an environment where new information technology can be deployed and managed effectively.[18] New forms of information technology leadership, including a team approach, are being developed. These developments suggest the need to study the effectiveness of information technology leadership.

Also at issue are changing work routines, work group organization, and professional identities and norms, because individual practitioners may no longer work in relative isolation in an organization. Professional identities and cultures may be changing along with the roles of providers and patients. Professional cultures affect, and are affected by, information technology use. Row 2 includes some research questions relating to practice routines and professional issues. Similar considerations also are reflected in changing forms of health care organization, as discussed in the next section.

Trans-organizational Trends

Radically different work practices are developing. These developments are being influenced by cost containment, concurrent and retrospective audit, normative practice standards, and the need to provide publicly available evidence of professional competence, efficacy, and cost effectiveness of treatment. Moreover, organizations no longer are bound by the walls of an institution but extend across institutions and even across nations. All this has occurred in the context of increasing politicization of health care. The result: A significant change in the complexity of the organizational environment for information technology. Questions concerning this change are posed in row 3 of the table. They address both information systems design and organizational design.

As organizational structures and individuals' roles are crossing boundaries, so is health care information. These fluid boundaries make for concurrent changes in information needs and information flow. Detailed information about populations, their prospective health needs, and their demands is being made available through implementation of lifelong, multi-disciplinary health records, linked across care episodes and institutions. Similar efforts also are under way concerning information on organizational and clinical efficacy.

What we are seeing, then, is that in health care delivery, the organization is evolving to encompass an entire health care system. To anticipate and address these new concerns will involve informatics personnel in discussions with representatives of society, not just of health care organizations. A broad perspective on how these changes affect, and are affected by, information technology is needed, as suggested by the questions that appear in Row 3. Such a perspective also needs to take into account an understanding of "the organization" as being an entire country, or even a trans-national entity, as indicated in the following section.

Macro Trans-national Trends

Two major macro-level trends are converging to change how health care services are forming trans-nationally. These trends are contributing to a shift toward larger organizational scope in providing health care services.[22] Some of the many concerns connected with these changes are reflected in row 4 of Table 1. The first of these major trends is the split between "haves" and "have nots," not only within a country but between countries as well. This leads to the second trend—the growing demand for health care and related services that match Western standards.

This demand is based on two factors. The first is the worldwide increase in peoples' expectations for rapid advances in health and genetic interventions. The other is demographic shifts such as aging and the concomitant demand for services. Consequently, governments experience political pressures as they move to provide funding for, or, alternatively, encourage private provision of, health care and the means to support it. Thus, an internationally inter-operative health enterprise is growing, as private care and a variety of insurance products are being developed for customers worldwide. This is leading toward virtual, geography-independent health enterprises in which the United States now has, but could lose, its competitive edge. Influences and pressures related to these changes need to be investigated, as suggested in row 4.

These trends also are leading informatics, as an information-intensive industry, to become a major pillar of health care. However, different countries have different needs. Although we can ship technology internationally, technology transfer is not successful unless we take into account differences in process and people in different places. Row 4 suggests questions pertaining to doing this.

We also are experiencing the growth of symbiotic relationships among products and services across national boundaries. Because the person is the only element in common across institutional, organizational, and national boundaries, we come full circle, to the need to re-design systems around the person—that is, to patient-centered informatics.

Discussion

The model we propose is useful for addressing different levels of organization, from individual to trans-national trends, and different levels of aggregation, from individual to cultural. However, the neat cells in the table should be considered to have permeable walls. Although it is tremendously useful to focus on one cell for analytic purposes, we should not lose sight of how the information represented in any one cell may contribute to what appears in another.

Furthermore, although many of the sample questions in Table 1 concern how information and information technology may affect what goes on, those effects, in turn, influence what happens with the information technology. The changes that occur, or are thought likely to occur, can influence how individuals, institutions, and governments react to information technology and also how they adopt, deploy, and use it. We are discussing multi-directional influences, considerations, and causality, even though we divided our discussion into separate individual cells for analytic and presentation purposes.

Conclusion

As we consider trends that are changing health care delivery and services worldwide, several observations seem self-evident. First, there may be no truly universally accepted ways of deploying information technology. Nevertheless, information technology facilitates the transmission of health care information without regard to location; it contributes to the trend toward boundary-less delivery of both health information and health care.

The one universal is that individuals—consumers, providers, and policy makers—will ultimately determine how information technology is used in any particular setting. Both health care consumers and health care providers are experiencing changes. They will be using information technology more and more, and facing decisions about information technology use. We need, therefore, to keep in mind all individuals, in their many different roles, as we design systems to support them. These systems should be designed around individuals and their different situations. To provide for the multiplicity of institutions, settings, and individuals worldwide, attention to people, organizational, and social issues is necessary in informatics.

We propose a model in which we outline some key trends and suggest some questions to form a basis for a research agenda in this area. We further suggest that, by drawing on a wide array of research theories, methods, approaches, and questions derived from social science disciplines, we may better meet the challenges these important changes portend for informatics.

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