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Review

People, Organizational, and Social Issues: Evaluation as an exemplar

Introduction

Many promising applications of information and communication technologies have been applied in health care over the past 50 years. During this time, it also has become apparent that attention to people, organizational, and social issues is required in order to realize the potential benefits of informatics applications [1]. Clinically, the most pressing questions surrounding information and communication technologies are: (1) Are information and communication technologies clinically effective? and, (2) Do information and communication technologies deliver positive outcomes for patients?

A system must be used in order to be effective clinically. It has been estimated that nearly 50% of technically sound systems have foundered on staff revolt, boycott, sabotage, or dissatisfaction [2]. With reports of "surprisingly frequent failures" [3], it is not surprising that informatics experts rank organizational change issues and barriers to use among the most important research priorities in health informatics [4]. Effectiveness depends as much on these concerns as on technical excellence. Organizational culture, professional values, work practices, change management, and effective leadership are crucial.

Barriers to using information and communication technology in health care have been discussed since the 1950s (e.g., [5, 6]). In 1987, Kaplan classified barriers previously identified in the literature into four categories [6]:

1. barriers of insufficiency (i.e., not enough funding, knowledge, or sufficiently advanced technology),
2. barriers inherent in the medical environment (i.e., the fragmentation of health care institutions into separate departments and organizations, and difficulty in organizing and standardizing medical knowledge),
3. barriers pertaining to project management (i.e., difficulties of coordinating teams of clinicians, computer scientists, and professionals from other disciplines); and
4. user resistance (especially what is perceived as resistance by physicians to medical informatics applications).

These barriers concern people, organizational, and social issues. For example, concern over user resistance and adoption of clinical applications has been long-standing [6]. In 1980, Dowling studied user sabotage, providing case examples, a classification scheme for types of sabotage, and management recommendations [2]. "Resistance" may be understood as a response to people, organizational, or social issues that need addressing [3, 7, 8, 9].

Much attention has been paid to physician resistance. However, physicians readily adopt some information technologies and applications, but not others. Historically, physicians were faulted for overenthusiam, rather than resistance, in adopting CT scanning [6]. Now, the same physicians who use electronic mail, the Internet, and personal productivity software are disenchanted with their electronic medical record system [10]. Physicians use technologies they see as being worth the time it takes to use them, ones that facilitate their work flow while not interfering with patient rapport, quality of care, and privacy. They are more favorable to informatics applications that enhance their sense of what it means to be a physician: autonomous architect of patient care, artful and compassionate practitioner of scientific medicine, provider of quality individualized care, and cultivator of good patient rapport [10, 11]. Some researchers further explain differential adoption as related to cultural considerations such as these physician values as compared with the values of others within a health care institution [11, 12, 13]. For example, Kaplan argued that how physicians view a system, and conflicts between developers' goals and physicians' values, affect physicians' adoption and

use of informatics applications [11, 14, 15, 16]. Regulatory and economic incentives, as well as strong leadership, also clearly are important, and help explain why nearly all general practitioners in the UK use computers, while fewer than 10% of UK hospital physicians do [17].

More recently, concern about physician resistance to informatics applications has been underlying efforts towards gaining physician adoption of clinical practice guidelines and practices deriving from evidence-based medicine, as embodied in clinical decision support systems [18, 19]. Also, physician order entry, rather than physician resistance *per se*, has been addressed. Few hospitals - 20% in Japan, 32% in the US - have physician order entry, and few physicians use it [3, 20, 21, 22]. As found in early studies of record systems such as COSTAR [23], these rates may be due, at least in part, to physicians' seeing more benefits of such systems to others than to themselves [3, 24, 25, 26, 27]. In a series of studies, Ash *et al*. identified a variety of other issues surrounding house staff concerns pertaining to physician order entry: educational issues, benefits, problems, feelings, implementation strategies, and future of physician order entry [28]; technical and implementation issues, organizational issues, clinical/professional issues, organization of information and knowledge issues, and personal issues of the system [21, 29]; and communication within the institution and management style [30]. They developed a taxonomy of ten high level themes from their study: (1) language and misunderstandings; (2) the importance of context; (3) benefits and tradeoffs; (4) contrasts, conflicts, and contradictions; (5) collaboration and trust; (6) special people; (7) customization and the organization of information; (8) defining the boundaries of physician order entry; (9) the ongoing nature of implementation; and (10) time [30]. Their analysis indicates some of the problems that occur with physician order entry even in institutions where it is used, and suggests recommendations for more successful implementation [27].

As these studies of resistance and of physician order entry indicate, people, organizational, and social issues are important aspects of informatics. Such issues have been addressed directly within the field of medical informatics [1, 31, 32], and also by incorporating insights and research from other disciplines, such as the social sciences [1] and organizational theory [33]. Within the past few years, the International Medical Informatics Association (IMIA), American Medical Informatics Association (AMIA), and European Federation for Medical Informatics (EFMI) established working groups concerning these aspects:

- IMIA Working Group 13: Organizational and Social Issues http://www.imia.org
- AMIA People and Organizational Issues Working Group http://www.amia.org
- EFMI Working Group 9: Human and Organizational Issues of Medical Informatics http://www.efmi.org

These working groups have been building on years of activities and research by organizing conference sessions and publications. One such session resulted in a White Paper in *The Journal of the American Medical Informatics Association* proposing a research agenda for key people and organizational issues. The authors indicate that these concerns are more challenging now because technological and institutional changes in health care contribute to making complex organizational, social, and personal arrangements even more complex [1].

In this paper, we review some streams of activity relating to people, organizational, and social issues. Because of its long history in medical informatics, we take evaluation (sometimes called "assessment") as our primary focus and draw on it for examples.

Evaluation

Evaluation serves multiple purposes [34, 35, 36]. Such studies are done not only for research, but also to provide information, inform action, and enhance decision making by using the knowledge generated in order to solve problems. Because change is required when introducing information and communication technologies, evaluation has been thought imperative for identifying where such change may need fine tuning or major adjustment, preventing harm, and minimizing disruption, as well as for providing evidence for decision-making and extending knowledge [37]. Thus, evaluation and change management are closely related in that they address similar concerns and involve related theories [3, 8, 34, 38], and because evaluation can inform change and generate management recommendations.

Foundation studies

Evaluation addressing people, social, and organizational issues has accompanied informatics projects in health care at least since the 1960s, resulting in a stream of publications during the 1970s and 1980s. Representative work from this period is collected in [31]. These early papers, many by researchers who have stayed active in the field, report insights that remain relevant.

In the United States, for example, an evaluation of the PROMIS system was published in 1981 [39, 40]. This multi-method study by external evaluators is exemplary both methodologically and for the people, organiza-

tional, and social issues insights it produced, including how this new records and clinical guidance system was related to issues concerning professional roles and status; change management; user involvement; and relationships between the medical record, philosophy of health care delivery, and clinical work. Other early evaluations focusing on these kinds of issues include a series of studies at what was then called the Rockland Research Institute in New York [e.g., 41, 42], and another series at Methodist Hospital in Indiana [e.g., 43, 44]. The new hospital information system at El Camino Hospital in California also was extensively evaluated by independent researchers during the 1970s [45]. Originally developed by Lockheed Missiles and Space, it became the popular Technicon, then TDS, and, later, the Eclypsis system.

During the 1970s, analyses began to appear of lessons learned and prescriptions for success [46]. Management issues, user acceptance, and diffusion and adoption of information systems have been discussed in the medical informatics literature at least since the early 1980s [47]. From early on, authors linked diffusion studies, evaluation research, and change management [e.g., 16, 48, 49, 50, 51, 52]. Studies of diffusion of a hospital information system, for example, showed that physicians' professional networks influenced adoption [43, 44], so that these professional networks could be used to encourage system use. Others analyzed medical informatics applications according to innovation characteristics known to affect adoption [51, 53].

Current studies

Evaluation [34, 35, 36] and change management [54, 55] by now have come into their own. The UK's National Health Service, for example, advises that evaluations should include business, user (i.e., organizational), and technical impact [56]. In a discussion of problems, challenges, and perspectives on the transition from hospital to health information systems, Kuhn and Giuse [3] include a variety of human-computer interaction, socio-technical, and organizational issues, including: the importance of user perspectives on benefits and stresses; adaptation to users' work practices, work flow, and terminology; and "common ground" [57] between physicians' thought processes and knowledge structures embodied in software. They emphasize that organizational and social issues are crucial for successful implementation.

In another recent literature review, Kaplan summarizes evaluation findings in terms of people, organizational, and social issues and the fit of information and communication technologies with various aspects related to these concerns [19]. These include how information and communication technologies fit other contextual issues surrounding their development, implementation, and use. Researchers have addressed work flow [27, 58, 59, 60, 61], clinicians' level of expertise [59], values and professional norms [11, 62], institutional setting [63, 61], communication patterns [64], organizational culture and status relationships [27, 40, 65], cognitive processes [66], congruence with existing organizational business models and strategic partners [67], and compatibility with clinical-patient encounter and consultation patterns [61, 68]. Authors also have addressed (in various combinations) the fit between information technology and how individuals define their work, user characteristics and preferences (e.g., information needs), the clinical operating model under which the system is used, and the organization into which it is introduced [69, 70, 71, 72, 73, 74]. Others have discussed interrelationships among key components of an organization, such as organizational structure, strategy, management, people's skills, and technology [75]; and compatibility of goals, professional values, and cultures of different groups within an organization, including developers, clinicians, administrators, and patients [11, 12, 13, 29, 75, 76, 77, 78, 79, 80]. Some have discussed difficulties of transferring to another country a system designed for use under a different country's health care system [61]. In addition, there has been work on ways in which informatics applications incorporate values, norms, representations of work and work routines; assumptions about usability and about links between medical knowledge and clinical practice; and how these assumptions influence design [79, 81, 82, 83, 84,85, 61]. The concept of "fit" thus links evaluation and design [86, 87, 88, 89, 90].

Newer applications of information and communication technologies, such as for telehealthcare, have given rise to a body of research literature reporting results from small-scale demonstration projects and feasibility studies. This literature also discusses a range of problems that relate to evaluation [91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104]. Among these issues are how technology incorporates new rules and resources that embody new structures for health care [105]. As with previous medical technologies and information systems, as well as newer consumer informatics applications, telehealth technologies may be used in ways that redefine how health care is delivered, or change the relationship and personal distance between practitioner and patient [68, 106, 107, 108, 109]. Imaging technologies, among others, have provoked discussion of how the meaning of clinical findings is negotiated among clinicians, and of the effects of making visible clinical work and procedures that previously had been seen only by those involved [109, 110, 111]. Another new use of technology, telephone keypads which patients/consumers use

for input into a voice-response intelligent consultation system [112], like some older applications [29, 61, 70, 113, 114], raises issues of the different meanings information and communication technologies have for different users, even among those who appear to be of the same group. Additionally, telehealth involves ethical questions not traditionally considered in evaluation - such as empowerment, effect on home-care and home-care givers, equity and equality of services, how health care roles change, medicalization of social phenomena, and individuals' relationships both with practitioners and technologies - suggesting that such concerns should be reflected in evaluations of other areas of information technology in health care as well [105, 112]. Lastly, evaluation studies themselves may need to change from a focus on individual technologies, individual institutions, and individual users, to the changing context of patient-centered care and integrated delivery systems, and networked technologies that support them [67].

Current Concerns

As these many studies indicate, system success depends not only on system functionality, but also on organizational and behavioral issues, such as organizational readiness, diffusion of innovation, work flow, change management, and human factors, as well as on clinical context, cognitive factors, and methods of development and dissemination [1, 19, 73, 115, 116 , 117]. Numerous studies support the observations that: "Sociologic, cultural, and financial issues have as much to do with the success or failure of a system as do technological aspects" [118] because "information technologies are "embedded within a complex social and organizational contex" [119]. Thus evaluation needs to address not only how well a system works, but also how well it works with particular users in a particular setting. This focus is needed in order to help answer such key questions as:

- Why are the outcomes that are studied as they are?
- What might be done to affect outcomes?
- What influences whether information and communication technologies will have the desired effects?
- Why do individuals use or not use an informatics application?
- What from one study might be generalizable to other sites or applications?

To help do this, five areas need additional development:

1. Many evaluations focus on practitioners, primarily physicians [19]. While some studies include nurses, administrators, patients, or personal caregivers, more evaluations are needed to address concerns of the many individuals involved in or affected by informatics applications.
2. Attention is needed not only to successes, but also to failures, partial successes, and changes in project definition or outcome. Although, over the years, some researchers have examined failures, removals, or sabotage of systems [e.g., 2, 75, 120, 121, 122, 123, 124, 125, 126, 127], and some high-profile failures have been reported for UK National Health Service projects [128] - the failure of the London Ambulance Service's dispatch system, for example, has been studied extensively [e.g., 129, 130, 131] - or how failures became successes or were otherwise redefined [e.g., 30, 75, 80], publication bias in medical informatics provides little opportunity to learn from studies in which technology interventions resulted in null, negative, or disappointing results [132].
3. Comparative studies, while exceedingly difficult [133], are important for illuminating contextual issues. Such studies might compare similar groups using the same technology at different sites, different groups using the same technology at one site, or various other combinations. The value of such research is illustrated by comparative studies of an electronic medical record [134], physician order entry [29], pediatric office systems [113], CT scanning [135], and physicians' use of images [111]. Extending such considerations not only across sites, but cross-culturally, remains a challenge [136].
4. Reporting and dissemination mechanisms are needed for work that is not published in traditional research outlets. Insights gained through evaluations of governmental projects world-wide, and experiences in non-western countries need to be disseminated.
5. More work is needed to develop both evaluation methods and theory, and to bring together understanding developed through studies undertaken in different areas of health care as well as studies undertaken by researchers in other disciplines (e.g. information systems, social studies of science, organizational behavior, computer science, and information studies), as discussed in the remainder of this paper.

Evaluation methods and project life cyle

There has been considerable debate about the appropriateness of methods evaluation researchers use. Because what happens when a new technology is introduced is affected by organizational and implementation processes, as well as affecting them, evaluation is inherently political. Some, therefore, resist evaluation for fear of potential disruptiveness of the investigation or its findings [37]. Others may view evaluation results as site specific.

Consequently, some discount either conducting evaluation studies or accepting their results [137]. Efforts have been undertaken to address these concerns while providing a structure for evaluations. For example, The National Health Service in the UK has issued an evaluation framework with the intent to improve the quality of evaluations [56]. In the European Union, the first phase of ATIM, the Accompanying Measure on Assessment of Information Technologies In Medicine, was undertaken as an Accompanying Measure in the Programme for Telematics Systems in Areas of General Interest (DG XIII) in the area of AIM (Advanced Informatics in Medicine). Its goal was to develop consensus on both methods and criteria for assessment [137]. In addition, IMIA WG15: Technology Assessment and Quality Development in Health Informatics, is directly concerned with these issues [37], as are the three sister working groups listed above.

Jones classified evaluation approaches into four models: randomized controlled trials, scientific/quantitative/objectivist, project management, and qualitative/interpretive/subjectivist [128]. Randomized controlled trials and experimental designs dominate [19] and are advocated as the best evaluation approaches [138, 139]. However, they have come under increasing criticism [19, 119, 133, 140, 141, 142, 143, 144, 145]. Other approaches, when used under controlled conditions, also have been criticized for excluding a variety of human, contextual, and cultural factors that affect system acceptance in actual use [19]. Some have called for making it a priority "to develop richer understanding of the effects of[system] benefits in health care and to develop new evaluation methods that help us to understand the process of implementing it" [119].

A school of thought has developed suggesting that neither randomized controlled trials, experimental designs, nor economic impacts are suitable in and of themselves for evaluating informatics applications. Such designs may pinpoint *what* changed, but they make it hard to assess *why* changes occurred. Additionally, these traditional designs prove difficult for following changes as they are developing, or in determining system design and implementation strategies that are well suited to particular institutional setting and societal considerations. Longer-term field studies and more interpretive approaches are better for investigating processes, multiple dimensions of causality, and relationships among system constituents and actors [8, 38, 127, 146].

Evaluation methods and questions depend upon both system development phase and purpose of the evaluation [3, 34, 56, 137, 147, 148]. Evaluation, therefore, should be an on-going process throughout the life of a project, and include a variety of approaches, selected from, for example, randomized controlled trials, experimental designs, simulation, usability testing, cognitive studies, record and playback techniques, network analysis, ethnography, economic and organizational impacts, content analysis, data mining, actor-network theory based approaches, balanced score cards, soft systems and participatory design methodologies, surveys, qualitative methods of data collection and interpretive analyses of it, technology assessment, benchmarking, SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis, and social interactionism [3, 34, 35, 36, 56, 142, 143, 144, 145].

The need for evaluation to influence system design, development, and implementation also has become apparent. While results of post-hoc or summative assessments are useful for future development, evaluation (or, some argue, technology assessment) that precedes or is concurrent with the processes of systems design, development, and implementation can be a helpful way to incorporate people, social, organizational, ethical, legal, and economic considerations into all phases of a project [8, 38, 137, 149, 150, 151]. Because evaluation is both theoretically based and practically oriented, some authors draw on their research to make project management or system design recommendations [e.g., 2, 27, 55, 65, 75, 79, 152, 153, 154]. Thus, evaluation and other project phases may converge.

Evaluation theory

Most evaluations are based on positivist, rationalist, or rational choice theoretical perspectives [19]. However, many alternatives have been developed, and these efforts continue. Evaluations informed by a variety of theoretical work in both organizational theory and the social and behavioral sciences have been undertaken for some time [1, 19]. Lorenzi [54] gives an overview of organizational theory influences. Earlier examples of work based in the social sciences are in [31, 39, 40, 47] and cited in [1, 46]. More recently, in order to address people, organizational, social, and other contextual issues, Forsythe advanced ethnography [141]; Lau and Hayward discussed the value of action research [153]; Weaver [155] and Ash *et al.* [27] use diffusion of innovation theory, while Schubart and Einbinder also based their study on it and provided a brief review of others who have [156]; and Anderson, Aydin, and Kaplan have been advocating social interactionism based on diffusion of innovation theory in their various publications [e.g., 7, 19, 157]. Among other recent examples are a variety of studies drawing on a constructivist tradition emphasizing organizational, political, social, and cultural concerns: Aarts employs actor-network theory [158], while Whitley and Pouloudi apply concepts connected with it [80]; Berg and colleagues have been advancing a sociological approach that employs sociocultural analyses and

sociotechnical design as well as drawing on actor-network theory and situated action/design[159, 160, 161, 162], and others have drawn on this work [163]; Bygholm uses activity theory [164]; Sicotte *et al.* and Kristensen both take a social constructionist approach [60, 122, 165]; while Klecun-Dabrowska and Cornford combine construtionist theories and structuration theory [105]. These efforts are reflected in working group activities. The AMIA People and Organizational Issues Working Group established the Diana Forsythe Award in 2000 to recognize new publications at the intersection of medical informatics and social science; EFMI WG 9 on Human and Organizational Issues held a conference in 2001 that drew on the disciplines of medical informatics, information systems, and social studies of science [166]; and IMIA WG 13 on Organizational and Social Issues, together with these sister working groups, co-sponsored sessions on evaluation alternatives to randomized controlled trials at the AMIA Fall 2000 Symposium and at Medinfo 2001 [142, 143, 144, 145]; and the AMIA People and Organizational Issues Working Group organized panels at the AMIA 2001 Fall Symposium, one on "Situational Implementation: Human Factors in the Diffusion Process," and the other on "Organizational Issues for Design of Medical Informatics Systems" and, together with the AMIA Consumer Health Informatics Working Group, one on "Decreasing Disparities in Access to Health Care for Vulnerable Populations." These efforts are bringing together researchers from different traditions and creating opportunities for findings from evaluation studies of different applications areas to enrich each other. This developing tendency should help counteract the insulation such studies (and researchers) have had from each other, resulting in an impoverished analysis of evaluations and consequent understanding of people, organizational, and social issues that could result from them [19].

Social science influences also are apparent in efforts towards informing design. Using evaluation to influence system design enables building into the system an understanding of users' goals, roles, tasks, and how they think about their work. To do this, situated action and participatory design approaches - often based on Suchman's influential work on situated action [167, 168, 169] - have been undertaken in efforts to link work design and software design, including attempts to model work according to users' views [19]. The underlying principle is that "knowledge can never be decontextualized" because knowledge "is situated in particular social and physical systems" and "emerges in the context of interactions with other people and with the environment" [170]. These themes are apparent in a special issue of *Artificial Intelligence in Medicine* [171]. The authors draw on Scandinavian participatory design approaches [172] and on the writings of Winograd and Flores [173], as well as on Suchman. A stream of work undertaken by Timpka and colleagues promotes action design, a combination of action research, participatory design, and situated action [e.g., 84, 85, 174, 175].

Kaplan argues that each of these theoretical threads is a form of social interactionist theory [19]. She sees in social interactionism an explanation for the concept of "fit" summarized above, and also a theoretical base from which to derive evaluation frameworks, principles, and guidelines [8, 19, 38].

A recent trend in evaluation takes a more post-modern stance and turns reflexively to examine evaluation itself [176]. Instead of seeing evaluation as a neutral technical process of applying specific methods, evaluation results and reports are recognized to be affected by decisions such as: what evaluation is, how it is to be done, which questions are addressed, what methods are selected, and how it relates to other aspects of care delivery (service).

Moreover, the focus of evaluation itself changes throughout a study as various actors adapt, modify and transform themselves, the technology, and the evaluation. Political, professional, and commercial interests play into such processes. In this view, evaluation is seen as a component of extended social and technical networks that grow throughout the life of an intervention. Within these networks, the individuals involved define and negotiate ideas about the appropriateness of particular technologies and models of practice as they deal with contingent and structural factors (e.g., service take-up - the rate at which a new method/delivery route of providing care is accepted by users, and costs); interpersonal relations (e.g., inter- and intra-professional networks, professional-patient interaction); and technical considerations (e.g., how the technology itself functions and is used). In the process, they develop definitions of efficacy and utility that meet their situational demands.

These contingent processes present major challenges for evaluators who are dealing with a technology that is applied and deployed in the real world of health care provision, rather than the laboratory of system developers [177]. A conceptual model that places information and communication technologies and their evaluation in context as products of networks of professional and organizational activities, and of their internal and external processes of negotiation, may help illuminate some of the complex dynamics of evaluation. Producing evidence of efficacy and utility comprises relatively fluid processes, even where the design of evaluation or research projects apparently is structured in a

rigid and "objective" way [68, 127, 178]. However, because much existing research in this vein has focused on historical examples like ultrasonography [179], new studies are needed to develop this kind of understanding for contemporary systems [180]. Both organizational and technological complexity are increasing as telecommunications integrated delivery networks support healthcare integration, new organizational forms, and new modes of health care delivery [67]. More work is needed to improve approaches to people, social, and organizational issues in this changing environment.

Evaluation frameworks

A number of authors have suggested frameworks for conducting evaluation studies that draw on different theories, combine methods, and address a variety of concerns. Kaplan's 4Cs framework - focusing on communication, control, care, and context - and her set of evaluation guidelines call for flexible multi-method longitudinal designs of formative and summative evaluations that incorporate a variety of concerns are examples [8, 19, 38]. Shaw identifies six aspects in her CHEATS framework: clinical, human and organizational, educational, administrative, technical, and social [148]. Lauer, Joshi, and Browdy illustrate how an equity implementation model can apply to evaluating user satisfaction [9]. Aarts and Peel discuss stages of implementation and change [181, 182]. Others elaborate or extend Donabedian's well-known structure-process-outcome evaluation model [183, 184] for use in evaluating information systems in health care [e.g., 56, 185, 186]. IMIA WG15 is attempting to create a framework for assessing the validity of a study [187], and Jones is concerned with how to evaluate evaluations [128].

Conclusion

The underlying basis for attention to people, organizational, and social issues is that human and organizational concerns should be taken into account during system design, implementation, and use. International perspectives are converging to a broad and encompassing multi-method approach to evaluation throughout the life of a project, with studies conducted in actual clinical settings so as to allow for complex contextual issues to be addressed through a variety of theoretical lenses [19, 148]. Considerable work has been undertaken concerning appropriate evaluation paradigms. Newer evaluations build on the work of early evaluation researchers to focus on roles of different actors and the connections between them; on contextual, organizational, and social concerns; on meanings attributed to the experiences by the persons involved; and on the processes and interactions among these different aspects of system design, implementation, and use.

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