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## Tracking the social dimensions of RFID systems in hospitals

Jill A. Fisher, Torin Monahan\*

Justice & Social Inquiry, Arizona State University, PO Box 870403, Tempe, AZ 85287-0403, United States

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### ABSTRACT

**Background:** Radio frequency identification (RFID) is an emerging technology that is rapidly becoming the standard for hospitals to track inventory, identify patients, and manage personnel.

**Methods:** Research involved qualitative methods including participant observation and interviews with hospital staff members and industry consultants in the United States.

**Results:** Hospital staff, especially nurses, expressed concern about the surveillance potential of these tracking technologies. Additionally, nursing staff frequently experience an intensification of labor as a result of the implementation of RFID systems because the task of keeping the systems operational often falls upon them.

**Conclusions:** The social and organizational factors that contribute to the success or failure of RFID systems in hospitals must be further analyzed. The implications of RFID systems, such as privacy concerns and work intensification for nursing and other hospital staff, should be taken into account from the outset, especially during the design and implementation of the technology.

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New technologies for the management of patients, personnel, and inventory promise to streamline the efficiency and effectiveness of hospital functions. The integration of these technologies into hospital practices often results in dramatic changes in management, division of labor, and accountability. Specifically, new technologies of monitoring, tracking, and identification aim to increase efficiency in hospitals but also tend to intensify the surveillance to which nurses and other hospital staff are subjected. In existing literatures on information technologies in hospitals, neither the social nor surveillance dimensions of new systems are adequately addressed. This article looks at one popular type of technological system for the management of hospital resources and personnel – radio frequency identification (RFID) systems – and provides a conceptual framework for analyzing the relationship of these systems to working experiences and power dynamics in U.S. hospitals.

RFID systems allow for the electronic tagging of assets, inventory, personnel, and patients. These systems draw upon their successful uses in factory and retail settings [1] to offer the potential for more efficient management of resources in organizations, and they draw upon their military and security applications [2,3] to offer the potential for heightened identification functions. Essentially, the RFID systems work by placing unique electronic identifiers on items (in the form of stickers embedded with RFID chips) or on people (in the form of bracelets or badges embedded with RFID chips). Once “tagged,” items and people can be identified, tracked, and managed through a centralized database. There are two main types of RFIDs: active and passive. Active RFIDs contain a miniature battery and actively emit radio frequencies to the system; passive RFIDs contain no battery source but instead draw the necessary power to emit a frequency through secondary “reader” devices such as hand-held

\* Corresponding author. Tel.: +1 480 965 4522.

E-mail addresses: [jill.a.fisher@asu.edu](mailto:jill.a.fisher@asu.edu) (J.A. Fisher), [torin.monahan@asu.edu](mailto:torin.monahan@asu.edu) (T. Monahan).  
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wands, which are called “interrogators” by industry vendors [4].

Many hospitals have begun to adopt active RFID systems with the goal of locating pieces of equipment when medical staff need them. This traceability serves two purposes. First, medical staff, especially nurses, can spend less time “hunting and gathering” equipment that they need and spend more time providing direct patient care [5]. Second, hospitals can more efficiently utilize the equipment they have and lower expenses on equipment rental and purchasing [6]. Such RFID systems have been called “indoor positioning systems” [7]. Other hospitals have begun to adopt active RFIDs for patient and personnel identification and location purposes [8]. For example, RFIDs have been embedded in patient bracelets so that medical staff can electronically identify patients before surgery and before administering medications and blood transfusions. Additionally, these systems have been implemented in order to locate where patients are and to passively collect data on patients’ movements through hospital services. Similarly, medical staff have also been given active RFID tags on badges in order to collect data on workflow to find inefficiencies in current hospital operations. These latter types of systems have primarily been implemented in emergency departments and surgical centers: places where there are large volumes of patients and heightened risks of medical error.

RFIDs in hospitals shape organizational relations in interesting and sometimes troubling ways, but they also introduce an important area of inquiry for social scientists. Information technologies must be studied both for their presence in particular contexts and for their linkages to larger shifts in the political economy. Sassen [9] reminds us that “understanding the place of these new [information] technologies from a sociological perspective requires avoiding a purely technological interpretation and recognizing the embeddedness and the variable outcomes of these technologies for different social orders” (p. 365). She continues to say that one can examine embeddedness by “focusing on three analytic issues for sociology: the complex interactions between the digital and the material world, the mediating cultures that organize the relation between these technologies and users, and the destabilizing of existing hierarchies of scale” (p. 365). In what follows, we adopt this orientation first to provide background into the development of RFID technologies; second to ground the study of RFIDs within a conceptual framework of post-industrialization, technology studies, and surveillance studies; third, to present findings from research on the use of RFID in hospitals; and fourth, to suggest criteria for the effective implementation of such technologies.

## 1. Methods

This article draws upon research conducted from May 2005 to August 2006 on hospital uses of RFID technologies. The primary methods were unstructured participant observation and interviews, conducted through a series of site visits. These included (1) site visits and interviews at three hospitals and technology companies in the Southwestern United States, (2)

participation and interviews at a national industry conference in Las Vegas, and (3) phone interviews with personnel at four flagship RFID hospitals across the country.

At a major medical clinic in the Southwestern U.S., interview data were collected from hospital administrators, technical staff, and physicians on the site’s plans to implement RFIDs in the near future. At two private technology and consulting companies also in the Southwest, site visits and interviews were conducted with consultants to evaluate the range of RFID systems available to hospitals, including the pros and cons of their functionality and cost. At the industry conference “Leveraging RFID for Hospitals,” held in Las Vegas in May 2005, participant observation research was conducted and interview data were collected on hospitals already using RFIDs successfully, hospitals in the process of transitioning to large-scale RFID systems, hospitals considering implementing RFIDs, and technology companies offering various packages and training for hospitals. At this conference, informal interviews were conducted with nurses, technology vendors and consultants, hospital administrators, and technical staff. Hospital personnel were present at this event either because they had RFID systems in place at their respective sites or because they were sent by their organizations to learn more about the systems. Finally, phone interviews were conducted with personnel at hospitals that are spearheading RFID systems; the goal of these interviews was to ascertain – based on current experience of individuals involved with RFID systems – the social, technical, and organizational obstacles to effective use of RFID in hospitals.

Informal interviews were conducted with 12 hospital administrators, 8 physicians, 8 nurses, 17 technical hospital staff members, and 15 technology industry vendors and consultants across the country. Data were collected on experiences of individuals at hospitals that are already using RFIDs successfully, hospitals in the process of transitioning to large-scale RFID systems, hospitals considering implementing RFIDs and evaluating the technologies, and technology companies offering various packages and training for hospitals. Particular attention was given to the organizational relations engendered by RFID systems and the workplace concerns of nurses and other staff as existing hospital practices are altered to accommodate such systems.

Guiding interview questions were used as prompts for further elaboration by interviewees and follow up questions by the researchers. Some of these prompts included: (1) Tell me about your involvement in the implementation of the RFID system in this hospital; (2) How is the system currently used to track individuals and evaluate workflow?; (3) How has your workload changed as a result of the implementation of the RFID system?; (4) What advice would you give other hospitals about what works and doesn’t work when implementing RFID systems?; (5) What kind of policies are in place regarding the RFID system?; and (6) What do you think are the advantages and disadvantages of RFID systems in hospitals?

The strength of qualitative research methods such as participant observation and interviews is that they are much better suited to identifying and describing everyday practices than are quantitative methods [49]. Qualitative methods can uncover rich data – especially in new areas of research where there is little to no available empirical data – because they

allow the data collection to remain open-ended [50]. The use of qualitative methods allowed room for the emergence of new and unexpected variables [51], such as staff concerns about “surveillance,” which may be crucial to understanding the phenomenon under study. The interviews aimed to document individual perceptions and values through narratives. The unstructured design of the interviews afforded the elicitation of tacit information of which interviewees may have been unaware they possessed and provided a forum for interviewees to speculate on their roles within the hospital system in ways that they may not have done previously.

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## 2. Background

In April 2004, President Bush issued an executive order calling for the incorporation of Health Information Technology (HIT) into all medical practices nationwide and the creation of a National Health Information Technology Coordinator to oversee the process [10]. In May 2005, the U.S. Department of Health and Human Services issued a complementary report calling for government partnerships with private technology companies in order to accelerate the HIT development process [11]. These policy positions are representative of a larger, ongoing shift toward information technology systems in public, private, and non-profit sectors [12]. For instance, the Health Insurance Portability and Accountability Act (HIPAA) of 1996 similarly legislates the adoption of electronic systems for information transfer between healthcare providers and insurance companies [13]. In this context, it is important to understand the organizational, financial, and technical constraints placed upon healthcare providers as they work to incorporate HITs. Likewise, it is important to document innovative uses of information technologies, such as radio-frequency identification (RFID) systems, which strive to meet hospitals’ technical and organizational obligations in novel ways [8].

Thus, RFID systems offer great promise for increased efficiency and cost savings in hospital settings, but little empirical evidence exists on how to implement the systems effectively. Existing literature on hospital uses of RFIDs touts the potential for heightened patient safety [14,15], better tracking of drug supplies [16], and real-time management of hospital assets [17,18]. Other studies of medical RFIDs highlight the complexity of integrating multiple technical systems when so few of them possess interoperable capabilities [19]—this is in part due to the proprietary nature of most information technologies. A larger constraint placed upon hospitals is the lack of financial resources and technical staff necessary to implement even basic systems to meet the requirements of HIPAA, let alone more specialized RFID systems [13].

In the transition from military and manufacturing to healthcare uses, the implementation of RFID systems may be fostering a disconnection between the “solution” that RFIDs offer and the clinical problems that many hospitals are facing. This leads some in healthcare to wonder if RFIDs are solutions looking for a problem (hospital representative, personal communication, 17/5/05). On one hand, these systems do not adapt easily to hospital settings because the infrastructure of hospitals – in terms of space, equipment, personnel, and patients –

is much more complicated than factory or warehouse settings [20]. On the other hand, these systems promise to decrease the operating expenses of already cash-strapped hospitals by increasing workflow and asset management [21]. What these issues mean for hospitals is that if implemented well, RFIDs have the potential to provide a robust return-on-investment. What is much less clear given the current state of knowledge about RFIDs and their implementation, however, is how well these technologies can improve healthcare delivery, particularly without creating new burdens on overworked clinical staff. Hence, it is imperative to understand the “soft” side of technology implementation so that the *social infrastructure* is as robust as the technological infrastructure in supporting RFID systems.

Because there is scant independent research on uses of RFIDs in medical settings, research on HITs provides deeper background for the issues presented by RFID systems. By and large, studies of HITs concentrate on the technical side of the systems with almost no attention to the social context of their use. Most of these technical studies draw upon computer science concepts and contribute to the field known as “medical informatics.” For instance, some studies argue for more standardized “problem lists” for hospital staff to accurately code patient conditions into computer systems [22]. Other studies conclude that the data-generation potential of such systems should be harnessed to produce a “prevention index” for more accurate assessment of patient needs [23]. Finally, other studies in medical informatics assert that HITs can lead to improved interactions between patients and physicians [24]. The conclusions of these studies tend toward recommendations for more technical interventions or developments that are strangely divorced from social and material contexts of use.

The few existing studies of HITs that do take the social context seriously find some benefits from the systems, such as improved communication between nurses and physicians, but also a host of constraints and unanticipated consequences, such as increased errors in the reading of patient charts, increased confusion in the interactions between physicians and patients, increased complexity from multiple systems, and insufficient time to train staff on the systems [25,26]. The concept of “peopleware” accounts for this social component which is necessary for the successful integration of new hardware systems and software applications in medical settings [27,28]. Unfortunately, while this concept is well known in medical informatics circles, it has yet to be embraced by medical facilities that are integrating new technologies or by researchers who are studying such technologies. Indeed, almost no formal evaluative studies have been done of HIT systems in practice [25], so this orientation toward the social side of technology use remains mostly unexplored.

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## 3. Conceptual framework

The move to rationalize and computerize the functions of institutions like healthcare should be seen in the context of post-industrialization. Profound changes have occurred in both the structure and logic of markets since the mid-1970s [29]. Most notably, Western countries have outsourced

manufacturing – and increasingly service-related – jobs to other countries, predominately in the global south. Equally important, however, “flexible accumulation” strategies have been adopted by most industries for just-in-time production, computerized automation, decentralization, and temporary employment practices [30,31]. Under the rubric of “reinventing government” [32], state institutions have also embraced flexible production models, predicated upon the privatization of public resources and services [33].

Just as flexibility is now valuable for industry practices and state/industry relations, it also represents a new form of social control over bodies in the post-industrialist era [34]. Organizations adopt new methods of data collection, leading to what some have called “audit cultures” in workplaces [35], where workplace tasks are valued according to their ability to be documented, subsequently devaluing and slowly eliminating less-documentable functions, such as patient care. In medicine, capital extends into the lifeworld of the body, converting biological functions into codes and tables that can be tapped as markets for new products or vast resources of intellectual property [36,37]. Within public organizations, such as hospitals, the employment of rationalized automated systems, such as RFIDs, may be reconfiguring social relations to demand greater flexibility of workers through heightened surveillance practices, which are consistent with broad post-industrial trends.

Technological infrastructures and classification systems can also be seen as contributing to certain social orders within institutions, whereby social relations are normalized and systems are invisible to those for whom they are sufficiently working [33,38]. As social creations, technological systems and devices require considerable organizational and material investments in order for them to become part of standard practice [38–40]. For instance, beyond the financial costs associated with RFID systems in hospitals, staff must be trained on their use; formal and informal policies must be crafted to direct daily activities; adequate space must be allotted for the equipment; divisions of labor must be spelled out and responsibilities assigned; work overload or labor intensification must be identified and corrected; coordination with existing check-in protocols, diagnostic tools, and records management must be achieved; and so on. The success of RFID systems, therefore, depends on a host of social and organizational factors. It is therefore important to study these systems in a context-sensitive way that attends to the dynamics of interpersonal relations and constraints. This includes the need for investigators to remain open to any unanticipated outcomes or ethical concerns that arise.

One key ethical concern may be with the surveillance modalities of new technological systems. Vast systems of monitoring, identification, tracking and control proliferate throughout contemporary societies, and RFID systems may contribute to the increasing surveillance of people through automated systems and databases. Surveillance may exert a subtle yet powerful effect upon social practices [41–43], perhaps diminishing the social and civic opportunities afforded by public arenas [44]. While any singular piece of information gathered about an individual may prove inconsequential in and of itself, when all the driving, education, medical, credit card transaction, phone call, and other data about individuals

can be stored and systematically searched, the effect is a loss of privacy that reduces the control people have over their own identities.

Most information and communication systems possess surveillance modalities, meaning that the data collected by them can be used for surveillance purposes. These systems introduce individuation and social ambiguity [45]. For instance, when people cannot adjust their behavior to the reactions they perceive in others (i.e., physically removed observers), the social context becomes an ambiguous one where everyone is presumed to be individually deviant until proven otherwise. The result is one that scholars call a “panoptic” effect on social behavior [46], meaning that people tend to police themselves and refrain from any actions that might verify their presumed status as deviants in the eyes of unseen others. Nonetheless, surveillance technologies can extend beyond self-policing functions to enforce the unequal social sorting of individuals through profiling based on race, class, gender, and/or sexual orientation [47,48]. RFID systems in hospitals may possess valences for social sorting and social control; the extent to which these possibilities become realities is dependent upon contexts, policies, and practices. Thus, to understand organizational change with RFID technologies and their implications for surveillance one must attend to specific social contexts.

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#### 4. Review of findings

Findings show a number of constraints placed upon hospitals beyond the financial allocations necessary for purchasing RFID systems. These constraints can be grouped into two categories: (1) the maladaptation of the technological system itself to the hospital setting and (2) the organizational challenges for hospitals to utilize the system. As has already been noted, RFID has been an effective technology in manufacturing, yet the benefits of it in healthcare have still to be produced. While this might indicate that the technology itself simply is not suited to the operation of hospitals, this initial conclusion is based on the ways in which technology companies have offered RFID systems to hospitals.

What is interesting to note about current RFID systems is that they have not been designed in response to the particular needs of hospitals. Technology vendors have created standardized and inflexible RFID packages that are designed to be plug-and-play regardless of the setting. Hospitals, like many other complex organizations, are often thought to be standardized in their built space and their processes and procedures, yet there is incredible variation among hospitals depending on the location, age, size, etc. As a result, the RFID system itself becomes a constraint for hospitals to adapt to rather than having the system adapt to each hospital's needs.

In interviews, hospital administrators, physicians, and nurses expressed a need for customizable RFID systems to fit the particular functions of their hospital sites. In order to achieve this type of flexibility, some university hospitals have developed or are in the process of developing their own systems “in house” rather than purchasing “off the shelf” equipment from vendors. By teaming up with other academic units affiliated with their universities, like engineering, com-

puter science, and informatics, these universities are able to build their own unique RFID systems and networks. This step means that these academic hospitals do not have to negotiate with technology vendors, but it also means that the process of implementing functional RFID systems is much more time and labor intensive. Instead of taking a few weeks to install, custom-made systems could take years to develop in full. Community hospitals, by contrast, do not have the same technical and institutional resources of university medical centers, so they have little choice but to purchase standardized packages or wait for customizable ones to be developed.

One of the key issues regarding the customizability of RFID systems that currently makes RFID maladapted to hospitals is interoperability. Most RFID systems are not interoperable with existing hospital computer systems. Existing systems include medical records, electronic "white boards" detailing the status of all patients, and administrative systems like patient billing, equipment rental, etc. Because there are many information systems already in place in hospitals and because many of the existing systems are proprietary with competing software companies, RFID vendors have simply decided (like most of these other IT vendors) to ignore the other systems in place when designing their own. What this means for those working in hospitals, however, is that not only do they have to learn multiple technology systems, but also that they often have multiple computer terminals dedicated to each system. This adds significant cost to hospitals, but more importantly for a sociological approach to technology, the presence of non-interoperable information systems creates increased labor and frustration for hospital staff, particularly nurses.

Another significant problem with current RFID systems from the perspective of hospital administrators is that the technology vendors have made no attempt to ensure that the systems are compliant with current medical regulations. This is fairly uncommon in the healthcare industry. The norm in the development of medical devices, technological systems, and organizational innovations is to make all new products responsive to federal codes and standards. Part of the issue regarding RFID systems is that there are few industry standards for RFID technologies more generally within the industry. This has two implications for hospitals wanting to deploy RFID within their facilities. First, hospital administrators worry about investing in RFID systems until they are certain that future technologies and standards will be compatible with existing ones. The second and more profound concern is that hospitals must undertake the burden for determining federal "compliance" on their own. This is particularly cause for concern as hospitals are grappling with making all their systems compliant with current federal privacy protections as mandated under HIPAA. Because RFID systems are creating and storing data about individuals – whether patients or employees – who are being tracked, hospital administrators report experiencing incredible stress as they make decisions about how to make the RFID systems compliant with HIPAA and other federal regulations. In fact, some hospital administrators have postponed the adoption of RFID systems specifically until these issues are resolved.

Even if the constraints of RFID systems can be adequately resolved for effective implementation in hospitals, there remain organizational challenges for their use by hos-

pital staff. One of the overwhelming themes in interviews and conversations with staff at hospitals that have installed RFID systems is that they were unprepared for the labor that resulted from the system's implementation. Rather than saving labor time for hospitals across the board as the technology vendors promise, most hospitals using RFID systems have needed to delegate new data management tasks to nurses and staff or to create new technology positions altogether. Thus, frustration is known to arise among hospital staff over new systems because of the labor intensification and increased monitoring they afford.

Nurses, in particular, express concern that they are overly scrutinized by these tracking technologies. They also indicate that the systems are based upon rational management models that do not accurately match the messy realities of hospitals. In addition to being watched by administrators, some nurses experience an intensification of labor, because the task of keeping RFID and similar systems operational often falls upon them and their already overburdened schedules. For example, nurses report that they would rather spend their time looking for equipment and locating patients than spending it logging in and navigating the RFID system software, replacing RFID tags, and/or calling technology support when the system is not working properly. In cases in which the staff are being tracked by the RFID systems, nurses describe feeling like "big brother" is watching as they spend time with patients, take unofficial rest breaks between patients, and take official breaks during their shifts. Several hospitals with strong nurses' unions have even blocked the implementation of RFID systems because of current evidence that the burden of these systems falls disproportionately on nurses.

While these problems are not ones that have technological solutions or that the technology vendors must resolve as part of the sale of RFID systems, most hospitals are unprepared for organizational challenges that emerge. Rather than having an organizational plan in place to complement the technological implementation, hospitals tend to respond to these challenges in an ad hoc way. From interviews with hospital staff, concerns regarding labor intensification and monitoring persist until hospitals craft clear policy protocols to address them. Sometimes these policies are informal in nature, such as permitting nurses to selectively deactivate the RFID devices that track their location and movement within hospital facilities. In most cases, transparent, formal policies about the use and storage of data generated by the RFID systems is critical for hospital staff to be supportive of systems that otherwise might feel imposed by administrators. It is in answer to these surveillance and labor intensification concerns, primarily, that the next section develops a set of recommendations for attending to the social dimensions of RFID implementation in hospitals.

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## 5. Recommendations

The review of findings suggest a range of sociotechnical needs for implementing or evaluating RFID systems within the complex organizations of hospitals: (1) the need for customized systems when most of the industry systems available are standardized "one size fits all" packages, (2) the need to establish clear policies and organizational relations when RFID systems



and their maintenance are outsourced to external technology companies, and (3) the need to address labor concerns of nurses and other hospital staff who may actually encounter labor intensification and/or greater undesired surveillance of their activities.

We offer a set of categories for effectively taking into account the social dimensions of RFID technologies (and their implementation) in hospitals. First, hospital administrators should craft clear management goals. This includes defining, in advance, the intended goals and functions of RFID systems, the ways in which RFID fit in to the broader management plans of hospitals, and rationales for tracking or not tracking the movement and functions of hospital staff.

Second, the organization of labor should be mapped out and negotiated in collaboration with staff members prior to RFID implementation and should be revisited periodically during and after implementation. This means determining the division of tasks surrounding the operation and maintenance of the RFID systems. It should be decided whether the number of staff assigned to RFID-related tasks is sufficient and whether the division of tasks is reasonable and clearly articulated. Related to this is the need to identify who has decision-making authority in relation to the RFID systems, who is given responsibility for the continued functionality of the RFID systems, and how labor will be managed and evaluated. In all cases, anticipating likely increases in labor and staff surveillance and explicitly negotiating policies with staff will likely engender greater staff support and more successful incorporation of the systems.

Third, the distribution of material resources should be evaluated and planned for well in advance. Administrators and staff should assess the types of spatial resources required by the RFID systems and the potential physical constraints such systems might impose upon the storage capacity for inventory or the mobility of staff or patients. It is also critically important that the design of such systems and interfaces are technically functional, intuitive, easy to use, and as complementary as possible to established practices and processes of delivering care at the hospital. Additionally, hospitals should expect that these systems will require ongoing investment in staff positions and technical supplies (e.g., replacement RFID tags and scanners) to keep them technically operational. The history of hospital technologies illustrates that they do require physical space and continual upkeep, and one should expect the same of the latest inventory and personnel tracking systems too.

Fourth, formal and informal policies regarding surveillance of individuals or groups should be established. Whenever possible, policies should be clear and arrived at with full participation of hospital staff. Data retention and use policies are especially important in this domain. Staff should have a clear idea of when they will and will not be monitored, who will have access to data about them, and how long the data will be kept before being destroyed. Just because data can be gathered in systematic ways and kept indefinitely does not mean that it is productive to do so in hospital settings. Because practices of ubiquitous surveillance may create a working environment perceived of as hostile and inflexible, it may be counterproductive to collect, store, analyze, or act upon data on personnel.

Finally, the attitudes of the staff should be ascertained and should inform the range of functions for RFID systems in each

hospital setting. It is important to ask how *each* group of hospital staff perceives the workload associated with the RFID systems, the surveillance potentials afforded by the RFID systems, and the utility of the RFID systems for patient care. If one can better understand the reasons for concern about the surveillance functions of RFID systems, for instance, then one could eliminate or alter the functions that are viewed as the most concerning, thereby increasing the likelihood of staff support for the systems.

Meeting criteria of this sort, whether in advance and/or after RFID implementation, will help hospital staff take advantage of the functions of these systems, especially for reducing medical errors and increasing efficiency, without necessarily increasing the surveillance and control of nursing staff. In addition to technical concerns, it is crucial to understand the ways in which the privacy of employees and others may be compromised by these systems or their workloads intensified. Both surveillance and labor intensification can lead to additional stress and to the decline of morale in hospitals. When these organizations are perceived as sociotechnical wholes, then technologies can never be viewed in isolation of the social contexts that sustain them and infuse them with meaning. A sociological understanding of RFIDs in hospitals focuses directly upon the social relations catalyzed or foreclosed by new technologies; it attends to the co-construction of organizational relations by social contexts and technological systems.

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## 6. Conclusion

RFID is an emerging technology that is rapidly becoming the standard for hospitals to track inventory, identify patients, and manage personnel. RFID systems are seen as valuable because of their ability to collect data in real-time. As a result, these systems may have a valence toward surveillance, such that the location of individuals is tracked and analyzed under the rubric of management paradigms like “workflow management.” Our findings indicate that hospital nurses feel overly scrutinized by these tracking technologies. Nurses also indicate that the systems are based upon rational management models that do not accurately match the messy realities of hospitals. In addition to being watched by administrators, some nurses experience an intensification of labor because the task of keeping RFID and similar systems operational often falls upon them and their already overburdened schedules.

This article has offered a conceptual overview for a sociologically rich investigation into technologies in hospital settings. Attention should be given to the political and economic shifts of which hospital management regimes are a part—namely post-industrialization and audit cultures. Next, technologies must be understood within their social contexts and not as external forces applied discretely to social problems. Finally, by means of their data collection propensities, all information and communication technologies have the potential to be employed for surveillance purposes. Any time people are monitored, tracked, or identified for control purposes, this constitutes “surveillance” and should be recognized as such [7].

The concern of this paper has not been to argue that healthcare can be improved through better implementation of RFID technologies—although this is likely the case. Rather, we advocate for a more complete understanding of the organizational and social effects of RFIDs in healthcare settings. To do so, healthcare-based social science research should answer two questions: (1) What effects do technological systems have upon organizational roles and relations? and (2) What are the surveillance potentials of technological systems? These questions are important because the emergence of new technologies alters the conditions within organizations as different groups adapt to and define their roles in relation to the innovations. The outcomes may be more invasive and less efficient than intended unless technologies are fully comprehended as social entities in their own right.

### Summary points

What is known about the subject:

- Information technologies, such as RFID-based systems, are being routinely integrated into hospital infrastructure in order to increase the efficiency and effectiveness of health care delivery.
- RFID systems can be used in hospitals to locate equipment, verify the identity of patients during medical procedures, and collect data on staff workflow to find inefficiencies in current hospital operations, but little empirical evidence exists on how to implement the systems effectively.
- RFID systems do not adapt easily to hospital settings because the infrastructure of hospitals – in terms of space, equipment, personnel, and patients – is much more complicated than factory or warehouse settings.
- Most of the literature focuses on the technical efficacy of RFID systems, not the social and organizational effects of such systems.

What this paper adds:

- A conceptual framework is developed for analyzing the host of social and organizational factors that contribute to the success or failure of RFID systems in hospitals.
- Hospitals implementing RFID systems tend to experience two types of constraint: (1) the maladaptation of the technological system to the hospital setting and (2) the organizational challenges for hospitals to utilize the system.
- RFID systems introduce a key ethical concern regarding privacy because of the surveillance potential of the technology. The extent to which surveillance becomes a reality is dependent upon the policies and practices developed in each hospital setting.
- Specific recommendations are detailed to mitigate negative organizational effects of RFID implementation in hospitals.

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