Medical Errors and Information Quality: A Review and Research Agenda

Research-in-Progress

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ABSTRACT

The Information Systems (IS) discipline is active in researching the many aspects of the role of information systems in healthcare and the application of Information Technology (IT) to healthcare delivery. The contributory role of poor quality information to medical errors is one area that has received little direct attention by IS researchers. In this paper, we present a brief review of the literature on medical errors and examine a number of definitions that have been offered. We further look at the relationship of complex systems and errors. We then briefly outline some research avenues in which the IS/IT community could become more active. Lastly, we present the specific, but limited area, on which we are focusing our research. We present an outline of our research strategy and short term objectives.

Keywords

Medical errors, human error, complex systems, information quality, Information Systems, Information Technology

INTRODUCTION

The issue of medical errors receives a good deal of attention in the popular press as well as in the medical literature. (Bogdanich and Rebelo, 2010; Landro, 2010; Landro, 2010). Many are familiar with the Institute of Health's estimate of between 44,000 and 98,000 deaths a year in US hospitals due to medical errors (Kohn,Corrigan,Donaldson,and Molla, 2000). Putting aside the way this number was obtained and promulgated, the issue of medical errors is of great importance to the medical field in general and to the individual patient in particular.

In this paper we approach the topic of medical errors with an information quality and data quality perspective (Lee, Pipino, Funk and Wang, 2006) We posit that a number of these errors can be directly or indirectly associated with poor quality information and data. For example, in the article in the New York Times on stereotactic radiosurgery (SRS) (Bogdanich and Rebelo, 2010), there are allusions to possible causes of problems that we would classify as poor quality information or lack of transmission of correct or complete information. We do not suggest that the majority of medical errors are attributable to poor data/information quality. We do suggest, however, that a sufficient number can be associated with data/information problems such that the role of poor information in adverse medical events and errors is a legitimate concern and one that should be researched by the Information Systems (IS), Information Technology (IT), and medical informatics community.

The topic of medical errors, however, has not received much direct attention by the mainstream IS healthcare researchers. They have concentrated on such areas as: the adoption of IT software and hardware and the underlying reasons for non-adoption (Jayasuri, 1998; Raitoharju and Laine, 2006), description of specific hardware or software for application to a particular medical problem (Gagnon, Lamothe, Fortin, Cloutier, Godin, Gagne and Reinharz, 2005) or environment (Lewis, Balaji and Rai, 2010), automation of procedures or delivery systems (Balaji and Rai, 2010; Bashur, Reardon and Shannon, 2001), use of the internet and the practice of e-Medicine and telemedicine [Bashur et al., 2001; Gogan, 2010), Electronic Patient Records, Physician Order Entry and other such systems (Ash, Berg and Coiera, 2004; Campbell, Sittig, Ash, Guappone and Dykstra, 2006). The lack of attention to research investigating the association of poor information and medical errors is also reflected in the topics list in the many CFPs associated with conferences directed at IS applications in healthcare. Even in the medical literature, the focus is on the physical processes and/or systemic problems, but there is little research that examines the impact of poor information in the epidemiology of errors. Granted, there have been strong calls for

the use of IT to help reduce errors and improve the quality of care. Little has been reported, nevertheless, addressing the impact of poor information quality on the occurrence of medical errors. This is in no manner intended as a criticism of past and current research on the application of IS and IT to healthcare. Rather, it is a call to expand and broaden the area of IS and IT research in healthcare.

RESEARCH OBJECTIVES

Our long range research objective is to research the role of poor information quality in medical adverse events and medical errors and in so doing to understand the epidemiology of these errors. Further, we wish to use this understanding in conjunction with the knowledge base of the information systems and information quality disciplines to eliminate many of these errors or, at the least, detect the errors before they evolve and develop a momentum of their own and then become difficult to correct. The objective of this paper is to begin the process by reviewing how the medical field views errors and proposing a set of research areas, a research agenda, for the IS field in this area of healthcare. This paper should contribute to the understanding of what people mean by medical error, to the development of a long-term research agenda investigating the role of information quality in medical errors, and in the more limited area of the information "handoff" problem that arises often in a medical context.

We anticipate that data/information quality errors will become of greater concern as the use of information, encoded electronically and not in hardcopy, becomes more widely embedded in medical systems and as newer information technologies are introduced in the process of care and treatment. As these new software and hardware technologies are introduced, they will introduce their own idiosyncratic challenges and unintended consequences as well as new ways of committing errors. See, for example, the articles by Ash et al. (Ash et al. 2004) and Campbell et al. (Campbell et al., 2006) on the unintended consequences of information technology in healthcare.

It is important to begin by examining how error, in general, and medical error, in particular, has been viewed, debated, and defined. These definitions reveal why and how medical practice, insurance practice, legal proceedings, governmental assessments and policy, and the like view errors and illuminate the fundamental foundations on which legal and medical practice base their policies and proscriptions to avoid error. Obtaining a precise standard definition of medical error is not the intent of this paper or our research agenda. That is better left to the medical, legal, and government professionals. We do offer the opinion, however, that achieving a standard, all-inclusive and logically consistent definition of medical error is not readily achievable. The systems are too complex. Perhaps a taxonomy of error types is much more useful. The question that has been and continues to be debated of "What is a medical error?" is not where we should fix our focus. The objectives in eliminating as much error as possible is to provide the best care possible to the patient, minimize any harm done to the patient by the provider(s) of care, develop systems, procedures, practices, and attitudes that contribute to these objectives and, in addition, focus more on preventing error rather than assigning blame.

In keeping with our stated goals above, in this paper we present a brief review that addresses the definition of medical error, the definition of error, in general, and the relationship between the two. We will extend the review to some views of the role that the complexity of systems plays in the generation of error. With this backdrop we will suggest areas and avenues of research that IS/IT can and should explore in relation to medical error research, and we will briefly present our research agenda within the broader context that we have laid out.

UNDERSTANDING MEDICAL ERRORS

What does the medical field consider an "error"? How does the medical field define the term "error"? Is there a standard, accepted definition? How are these views and definitions related to the general view of error? We will address these questions briefly in this section.

It is appropriate to begin our discussion by referencing the now famous 2000 report by the Institute of Medicine (IOS) (Kohn et al., 2000). This report received widespread attention in the U.S. media, particularly, its estimate of between 44,000 and 98,000 deaths in US hospitals. The manner in which this figure was obtained was questioned in that it was an extrapolation of some estimates developed earlier in the Harvard Medical Practice Study (Brennan, Leape and Nan, 1991; Harvard Medical Practice Study Report, 1990; Leape, Brennan and Nan, 1991) and other studies in Utah and Colorado (Thomas, Studdert and Burstin, 2000). The Harvard study's intent was not to study medical errors per se. The study was undertaken to study malpractice and tort issues and associated policies. In so doing it had to estimate "the incidence of injuries resulting from medical interventions, which we called 'adverse events,' and a determination of the percentage of such events that resulted from fault or negligence of the physician or other provider." To do so they undertook a review of hospital medical records, examining a sample of over 30,000 hospital records from New York hospitals. The Institute of Medicine extrapolated the results of the Harvard and Utah/Colorado studies and obtained the 44,000 to 98,000 figures. Regardless, of

the validity of these numbers, the report clearly highlighted the problem of medical errors and was instrumental in propelling what some refer to as the medical error movement.

The IOS report defines error and adverse events:

> "An error is defined as the failure of a planned action to be completed as intended (i.e., error of execution) or the use of a wrong plan to achieve an aim (i.e., error of planning)." (Kohn et al., 2000, p. 28)
> "An adverse event is an injury caused by medical management rather than the underlying condition of the patient. An adverse event attributable to error is a 'preventable adverse event.' Negligent adverse events represent a subset of preventable adverse events that satisfy legal criteria used in determining negligence (i.e., whether the care provided failed to meet the standard of care reasonably expected of an average physician qualified to take care of the patient in question)." (Kohn et al., 2000, p. 28)

In 1994, Leape had defined a medical error as follows: "Error may be defined as an unintended act (either of omission or commission) or one that does not achieve its intended outcome." (Leape, 1994. p. 1851) The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) suggested, essentially the same definition: "Error: An unintended act, either of omission or commission, or an act that does not achieve its intended outcome." (Joint Commission, 20002, p. 339) Another example of error definition is that given by the Dana Farber Cancer Institute as cited in Banja (2005, p.4): "Error is an event or act of commission or omission with the unintended potentially negative consequences for the patient." (Dana Farber Cancer Institute)

As with the definitions above, many of the definitions of medical error in the literature, have been influenced by the classic work of Reason (1990) on human error. Since, Reason's classic work is referenced so frequently in the medical literature and has been used so widely as a basis for other definitions, it is appropriate to briefly summarize some of Reasons' basic definitions and constructs. Reason asserts that the major elements in the production of an error are the nature of the task and its environmental circumstances, the mechanisms governing performance, and the nature of the individual. The decomposition of error that Reason introduces is the concepts of slip, lapse, and mistake. We quote Reason directly:

> "Error will be taken as a generic term to encompass all those occasions in which a planned sequence of mental or physical activities fails to achieve its intended outcome, and when these failures cannot be attributed to the intervention of some chance agency." (Reason, 1990, p.9)
> "Slips and lapses are errors which result from some failure in the execution and/or storage stage of an action sequence, regardless of whether or not the plan which guided them was adequate to achieve its objective." (Reason, 1990, p.9) "*slips* are potentially observable as externalised actions-not-as-planned (slips of tongue,.....), the term *lapse* is generally reserved for more covert error forms,
> largely involving failures of memory that do not actual manifest themselves in actual behavior and may only be apparent to the person who experiences them." (Reason, 1990, p.9).
> "Mistakes may be defined as deficiencies or failures in the judgmental and/or inferential processes involved in the selection of an objective or in the specification of the means to achieve it, irrespective of whether or not the actions directed by this decision-scheme run according to plan." (Reason, 1990, p.9)

Banja (2005) draws an interesting and important comparison among Reason's definition and the others quoted above. Although Banja's primary objective "...is to investigate the phenomenon of medical error concealment despite an acknowledged moral obligation to disclose harm-causing errors," (Banja, 2005, p.1) he reviews some definitions of medical errors, points out some deficiencies in the previously given definitions, and offers his own definition. Referring to the definitions of IOS, Leape, JCAHO, and Dana Farber. He points out the following:

> "The problem these definitions share is that they disregard the occurrence of factors *that are beyond the actor's reasonable control* but that can nevertheless render his or her action unintentional or that can negatively affect the action's consequence(s)." (Banja, 2005, p. 4)

He further points out that Reason's definition recognized that there are circumstances or situations in which external factors or "chance agencies" affect the action but are not within the control of the actor. Banja goes on to define an error as follows: "An Error is an unwarranted failure of action or judgment to accommodate the standard of care." (Banja, 2005, p. 7)

Shortly after the IOM report, Hofer, Kerr and Hayward (2000) gave their own description of how a medical error should be defined in a paper that responded to the IOM definition and approach, reviewed how medical errors had been defined in the past, and posed some important questions regarding exactly what is a medical error. In that paper they criticize the IOM definition of error in that it focuses on process and does not include consideration of outcome. They argue that error must be defined taking into consideration both process and outcome. To quote Hofer et al.:

> "A failure of a structure or process is an indication of error only to the extent that it prevents maximizing the outcomes of interest to the patient. As such, we do not directly measure error. We measure specific attributes of structures, processes, or outcomes, and we infer error through an argument that rests critically on the strength of the link between structure, process, and outcome." (Hofer et al., p. 267)]

Grober and Bohnen (2005) argue that "a definition of medical error should capture process or system failures that cause errors, irrespective of outcome (a *process-dependent* approach). Ideally, process-dependent definitions of medical error should capture the full spectrum of medical errors, namely, errors that result in adverse patient outcomes as well as those that expose patients to risk but do not result in injury or harm." (Grober and Bohnen, 2005, p. 41) These authors propose the following definition of medical error: "*Medical error*: an act of omission or commission in planning or execution that contributes or could contribute to an unintended result." (Grober and Bohnen, 2005, p. 42)

Reason (2001) suggests that medical errors are deviations from the process of care, which may or may not cause harm to the patient. Bagley as cited in Jenicek (2011, p.7) may have given the most down to earth definition of medical error when he stated that "...a medical error is anything that happened in my office that shouldn't have happened and that I absolutely do not want to happen again." (California Academy of Family Physicians) In his recent book, Jenicek's (2011) major focus is on the cognitive and critical thinking aspects of the medical error problem.

The need for a formal, standard definition of error is understandable. With the degree of statistical data collected by governmental agencies at all levels, with the constant litigation involving the medical field, with the instant media exposure of catastrophic adverse events and associated pressure to assign blame, it is understandable that attempts are made to define error, preferably in a standard way. For these purposes, the quest for an agreed upon formal definition may be important. For our research purposes, we suggest that this is not the debate we should have. Rather, we need a relevant and operational definition that helps bound and direct our research, specifically towards the role of information and poor information quality in contributing to generation of medical error. The objectives in eliminating as much error as possible is to provide the best care possible to the patient, minimize any harm done to the patient by the provider(s) of care, develop systems, procedures, practices, and attitudes that contribute to these objectives and, in addition, focus more on preventing error rather than assigning blame. An additional obstacle to these goals is the complexity of healthcare delivery systems. We turn briefly to the topic of complexity of systems and error.

THE COMPLEXITY OF THE HEALTHCARE ENVIRONMENT AND MEDICAL SYSTEMS

The topic of system complexity and its relation to errors and accidents merits a brief review. Cook (1998) as cited in Banja (2005, p. 10) has stated that due to the complexity of some systems errors are inevitable. To quote directly: "The potential for catastrophic outcome is a hallmark of complex systems. It is impossible to eliminate the potential for such catastrophic failure; the potential for such failure is always present by the system's own nature. "(Cook, 1998, p.2) Cook goes on to state:

> "There is no isolated "cause" of an accident. There are multiple contributions to accidents. Each of these is insufficient in itself to create an accident. Only jointly are these causes sufficient to create and accident. Indeed, it is the linking of these causes together that creates the circumstances required for the accident. Thus, no isolation of the 'root cause' of an accident is possible." (Cook, 1998, p.2)

In a similar vein, Reason (2000) presents a discussion of the mechanisms placed into a system to act as defenses and safeguards to protect against accidents. These barriers can be both human and mechanical. He offers his "Swiss cheese" simile:

> "In an ideal world each defensive layer would be intact. In reality, however, they are more like slices of Swiss cheese, having many holes – though unlike in the cheese, these holes are continually opening, shutting, and shifting their locations. The presence of holes in any one 'slice' does not normally cause a bad outcome. Usually, this can happen only when the holes in many layers momentarily line up to permit a trajectory of accident opportunity – bringing hazards into damaging contact with victims."
> (Reason, 2000, p.2)

"The Wrong Patient" case (Chassin and Becher, 2002) is an excellent example of what Cook and Reason have suggested. We briefly summarize it here to illustrate the point. The case involves two individuals, Jane Morrison who on the day in question *was scheduled* for a cardiac electrophysiology study (EPS), an invasive procedure, to correct a heart problem and Joan Morris who the day before *had undergone* a procedure to correct a brain aneurysm and was *awaiting to be*

discharged. The essence of the case is that because of a series of minor but cumulative "errors" Joan Morris, who was scheduled to be discharged, was subjected to the EPS procedure a day after having undergone the procedure to correct the brain aneurysm. It was only after the doctors undertook the heart procedure (EPS), could find nothing wrong with the heart and additional information on the patient was checked did it become apparent that the wrong patient had been worked on.

Chassin and Becher identified 17 "errors" that occurred. They were: ***(1)*** An unidentified person on the telemetry floor misdirected RN_1 by saying "patient Morrison" was not on the floor (when she was) and by saying that she had been transferred to oncology (6:15 AM). ***(2)*** An unidentified person on the oncology floor misdirected RN_1 by saying the patient she sought (Ms. Morrison) was on the floor when she was not (6:20 AM). ***(3)*** An unidentified person on the oncology floor told RN_2 to bring her patient (Ms. Morris), the wrong patient) to the electrophysiology laboratory (6:30 AM). ***(4)*** RN_2 took her patient to the electrophysiology laboratory despite (a) the patient's objections, (b) the lack of a consent form and order in the chart, (c) lack of knowledge on her own part or that of her charge nurse that the procedure was planned (6:45 AM). ***(5)*** RN_1 failed to verify the patient's identity against the electrophysiology laboratory schedule when the patient arrived in the electrophysiology laboratory (6:45 AM). ***(6)*** RN_1 failed to recognize the significance of Ms. Morris's objections to undergoing the procedure (6:45 AM). ***(7)*** The electrophysiology attending physician failed to verify Ms. Morris's identity when he spoke with her by telephone, and he failed to understand the basis of her objections to the procedure (6:45 AM). ***(8)*** RN_1 failed to appreciate the significance of the lack of an executed consent form in the chart, especially given that the electrophysiology schedule stated that the correct patient (Ms. Morrison) had signed the form (6:45 to 7:00 AM). ***(9)*** The electrophysiology fellow failed to verify the patient's identity, failed to recognize the significance of the lack of pertinent clinical information in her chart, and failed to obtain consent that was informed (7:00 to 7:15 AM). ***(10)*** The electrophysiology charge nurse failed to verify the patient's identity (7:10 AM). ***(11)*** RN_3 failed to verify the patient's identity (7:15 to 7:30 AM). ***(12)*** The neurosurgery resident did not persist in obtaining a satisfactory answer to his question as to why his patient was undergoing a procedure about which he had not been informed (7:30 AM). ***(13)*** RN_4 failed to verify the patient's identity (8:00 AM). ***(14)*** The electrophysiology attending physicians failed a second time to verify the patient's identity when he did not introduce himself to Ms Morris at the beginning of the procedure (8:00 AM). ***(15)*** The electrophysiology fellow disregarded the fresh groin wound from Ms. Morris's cerebral angiogram the day before and started the electrophysiology procedure on the opposite side (8:00 AM). ***(16)*** A telemetry nurse (RN_5) and two electrophysiology nurses (RN_3 and RN_4) failed to verify the identities of the patients they discussed on the telephone (8:30 to 8:45 AM). ***(17)*** The electrophysiology charge nurse failed to persist in obtaining a satisfactory answer to her question of why no patient with the name Joan Morris appeared on the electrophysiology schedule (8:30 to 8:45 AM).

We refer the reader to the case for more specifics. It is, however, a good example of the situation where a number of minor errors, if they occur as they often do in isolation, ordinarily would not be a problem. In this case, however, a whole series of minor errors lined up to create a situation resulting in a major error. A series of holes in the slices of Swiss cheese lined up.

We offer an observation; call it a corollary, to Reason's Swiss cheese simile. Note that Reason does not require that all the holes in the defenses have to line up. He uses the phrase "...when the holes in many layers momentarily line up..." In some cases, it does not necessarily require the holes in many of the defense layers to line up. It may be sufficient to have the holes in a few adjacent layers line up, generating strong momentum; together they overpower the subsequent defenses and may even cause the holes in subsequent layers to shift and line up such that a momentum of inevitability develops and all subsequent layers are overpowered. The Wrong Patient Case illustrates this. By the time Ms. Morris reached the operating room on the second day, the pressure and momentum to perform the procedure had built up to a point that even when the EPS charge nurse (error 17) brought up the possibility of having the wrong patient, she was immediately thwarted and did not persist. (See write up of the case.)

A brief review of some of the errors in the Wrong Patient Case would appear attributable to poor information: information that was not accessible, information that was misinterpreted because of the similarity of names, information that was communicated poorly and, as such, corrupted, and poor quality information that was the basis of unsound assumptions. A surgeon leaving sponges in the abdominal cavity of a surgery patient is not an adverse event we suggest IS/IT address. But, what and how poor quality information was transmitted to a surgeon who removes the wrong leg, for example, would definitely have an IS/IT component and would raise interesting IS/IT research questions.

Perrow strikes a similar theme to Cook and Reason. In his book *Natural Accidents* (Perrow, 1999) he concentrates on large, complex, and "risky" systems. Perrow asserts that certain systems have special characteristics, "that make accidents in them inevitable, even 'normal'." (Perrow, 1999, p. 4) These are systems with much interactive complexity and tight

coupling. He provides a simple but illuminating example in daily life that we might label the Murphy's law example. It traces a series of events, some tightly coupled and others loosely coupled, along with some random, unexpected failures of backup systems at the wrong time, that lead to an individual missing an important job interview. The litany begins with a broken coffee pot, then the locking of car and apartment keys inside the home, realizing too late that the hidden spare keys were lent to a friend, the neighbor's car which ordinarily you could borrow but today is not operative, the bus drivers being on strike that day and, thus, no taxis being readily available. The result is that an important interview is missed. We quote from Perrow to impart the flavor of his example:

> " The cause of the accident is to be found in the complexity of the system. That is, each of the failures – design, equipment, operators, procedures, or environment- was trivial by itself. Such failures are expected to occur since nothing is perfect, and we normally take little notice of them. The bus strike would not affect you if you had your car key or the neighbor's car. The neighbor's generator failure would be of little consequence if taxis were available. If it were not an important appointment, the absence of cars, buses, and taxis would not matter. On any other morning the broken coffeepot would have been an annoyance (an *incident*, we will call it), but would not have added to your anxiety and caused you to dash out without your keys. (Perrow, 1999, p. 7)
>
> "Though the failures were trivial in themselves, and each one had a backup system, or redundant path to tread if the main one were blocked, the failures became serious when they interacted. It is the interaction of the multiple failures that explains the accident. We expect bus strikes occasionally, we expect to forget our keys with that kind of apartment lock (why else hide a redundant key?), we occasionally loan the extra key to someone rather than disclose its hiding place. What we don't expect is for all of these events to come together at once." (Perrow, 1999), p. 7)

Note the similarity to the Wrong Patient Case and Reason's Swiss cheese simile. Perrow's work has influenced and been cited by a number of medical error researchers, for example Leape et al. (1991) and Hofer et al. (2000).

MEDICAL ERRORS: AN INFORMATION QUALITY PERSPECTIVE

General Observations

As we pointed out in an earlier section, a review of what is meant by error and, in particular, what is meant by error in the medical community is important. Further, it is not our intent to join the debate surrounding a standard definition of medical error. We do, however, need a working definition of *error attributable to poor information* to inform our research and that of the IS/IT community in regard to the information aspects that contribute to medical errors. To initiate the debate and propel the discussion we offer the following preliminary definition:

Information error: The state of the information such that its measurement, collection, storage, maintenance, retrieval (or lack thereof), its transmittal (or lack thereof), its visualization, or its use, create an environment that enables actions that, in turn, contribute directly or indirectly to intermediate or final adverse outcomes.

This places our focus on how poor information affects outcomes and not so much on an all-encompassing definition of error. It limits the scope of our inquiries and directs our attention to specific areas in medical and healthcare systems. Returning to the Wrong Patient Case, unquestionably, information of poor quality - inadequate, faulty, or unavailable - contributed to the error. Indeed, it was the momentum of a succession of information miscues (the Swiss cheese holes lining up) that built up such a momentum that it was difficult to stop near the end of the process.

Although work is ongoing in applying simulation to medical systems this would be a fruitful area for the IS/IT community to investigate more widely. We have the situation in which a sequence of minor errors cascade, contributing to an adverse outcome. One question, among many, might be: At what point does a series of minor occurrences of poor information become major? This would be fertile ground for simulations in different medical contexts, such as, removing the wrong limb or administering wrong dosages of medications and the like. Making use of simulations or other techniques, an interesting question is also where and how does information become corrupted, what points in the sequence are tipping points, at what level does it become toxic (lethal, catastrophic) or irreversible.

Somewhat related to the above is the application of the medical concept of triage to study the sources and consequences of poor quality information. In a manner similar to the triage practiced in an emergency room setting, where

patients are categorized into classes based on severity of the condition, developing a taxonomy of adverse events, information contributors, and severity classes might yield further insights into the role of poor information and uncover additional areas of research.

Those IS/IT researchers who have examined the adoption of technology in the medical arena and those working in e-Medicine and telemedicine could easily establish a new branch for their inquiries on the affect of poor quality information on adverse outcomes, performance, and avoidance of error. Much of their work on the behavioral aspects should be applicable or could form a basis for new lines of research. Extending the research in such areas as the unintended consequences of adopting new, electronic systems and the unintended consequences, particularly of errors in the handling of information, would be beneficial.

Implicit in many of the definitions of medical error is the idea of assigning cause and more insidiously assigning "blame." For the IS/IT researcher intriguing questions are: How much does trying to assess blame or creating an environment where blame assessment is paramount exacerbate/justify the poor quality information? or How does trying to avoid blame affect the design of the healthcare info system which in turn may make it more difficult to detect potential errors? Such questions must be made operational, but certainly merit additional investigation from the IS perspective.

Specific Research Agenda

Within the broader research areas enumerated above, our research is directed initially at a more limited and circumscribed area. Referring to our preliminary definition in the previous paragraph, we have concentrated our initial efforts on the transmittal of poor quality information. A big problem related to medical errors, one that is continually raised, is the "handoff" problem – the passing of information from one individual to another. Our view of a handoff is broader than that usually described. A handoff of information, in a medical context, could be the passing of information from one nurse to another or a nurse to a physician. It can also be the passing of information from an individual to a machine, such as, a person entering information into electronic medical records or an encoder entering medical codes into the automated system.

We are examining and analyzing specific cases, such as, the Wrong Patient Case, to identify specific handoff errors and associated information error states in an attempt to isolate and study the error states. We plan to develop a reasonable database of these cases and associated analyses to inform additional research. The additional research would take the form of developing a classification scheme (analogous to a triage protocol) along such variables as the level of severity of the outcome, level of severity of the error, and the specific action of the agents or actors. It is the intent to use this scheme to further examine and classify medical errors related to handoffs and related problem areas. This, in turn, should lead to a better understanding of handoff errors and to recommendations for improvement in the information quality in the systems and to the improvement to processes within these systems.

We expect to have a substantive number of case analyses completed by the time of the AMCIS 2011, but, at a minimum, we will have a small set of relevant, informative, and well-analyzed cases to append to this paper.

CONCLUSION

Our research aims to examine poor quality information's contributory role in medical adverse events and the causation of medical errors. This paper reflects the beginning of that journey. In this paper we have presented a brief review of the literature on medical errors and have examined a number of definitions that have been offered for medical error. We have further presented some of the disagreements revolving around these definitions. Further, we introduced the topic of system complexity and its role in error. Clearly, today's healthcare delivery systems fall into the category of complex systems. We then briefly outlined some research avenues in which the IS/IT community could and should become more active. Lastly, we presented the specific, limited area on which we are focusing and we presented an outline of our research strategy and short term objectives. These, along with new initiatives that examine the role of information in medical error by the IS/IT community, could lead to reduction in medical error occurrences. Even assuming that adverse events and medical errors attributable to poor quality information are a small percentage of all medical errors (an assumption that would have to be empirically validated), reduction in a small percentage will be well worth the research effort.

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