



Communication Changes Everything..... Especially Within the Complex World of Care Delivery!

Quantifying the Economic Impact of Communication Inefficiencies in U.S. Hospitals

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WHAT IS THE ECONOMIC BURDEN OF POOR COMMUNICATIONS?

**"Effective Communications is
Critical to Quality & Safety"**

EXECUTIVE SUMMARY

Care delivery is a complex enterprise that involves multiple interactions among multiple stakeholders. Effective communication between these dispersed parties is critical to ensuring quality and safety and improves operational efficiencies. Time and motion studies in hospital settings provide strong evidence that care providers—doctors and nurses—spend a significant proportion of their time obtaining or providing information (i.e., communicating). Yet, surprisingly, no studies attempt to quantify the economic waste associated with communication inefficiencies in hospital settings at a national level.

**What is the Economic
Waste of Poor
Communications?**

Our research focuses on developing models for quantifying the economic burden on hospitals of poor communications. We developed a conceptual model of the effects of poor communications in hospitals that isolates four outcomes: (1) efficiency of resource utilization, (2) effectiveness of core operations, (3) quality of work life, and (4) service quality, identifying specific metrics for each outcome. We developed estimates of costs associated with wasted physician time, wasted nurse time, and increase in length of stay caused by communication inefficiencies across all U.S. hospitals, using primary data collected from interviews in seven hospitals and secondary data from a literature review, the Bureau of Labor Statistics (BLS), and the Agency for Healthcare Research and Quality (AHRQ). We find that **U.S. hospitals waste over \$12 billion annually as a result of communication inefficiency among care providers.** Increase in length of stay accounts for 53 percent of the annual economic burden. A 500-bed hospital loses over \$4 million annually as a result of communication inefficiencies. We note that our estimates are conservative as they do not include all dimensions of economic waste arising from poor communications. The economic burden of communication inefficiency in U.S. hospitals is substantial. **Information technologies and process redesign may help alleviate some of this burden.**

**"US Hospitals waste over
\$12B/Year in Inefficient
Communications"**

**"A 500 Bed Hospital Loses
\$4M/yr because of
Communication Inefficiencies."**

**"Information Technology and
Process Redesign Helps to
Alleviate Extra Costs."**

Time in motion studies indicate that caregivers spend a significant portion of their day obtaining or providing information (ie Communications)

"Technology facilitates timely dialogue for care providers"

INTRODUCTION

The U.S. healthcare system is frequently criticized for a number of shortcomings, including excessively high costs and poor quality of care (IOM 1999; 2001). Care delivery is a complex enterprise that involves multiple interactions among multiple stakeholders. Effective communication among these dispersed parties is critical to ensuring quality and safety in care delivery while improving operational efficiencies.

Time and motion studies provide strong evidence that care providers—doctors and nurses—spend a significant proportion of their time obtaining or providing information (i.e., communicating) (Hendrich et al. 2008; Soto et al. 2006). Yet, surprisingly, no studies are reported in the literature that attempt to quantify the economic waste associated with communication inefficiencies in hospital settings at a national level. One explanation may be that reliable estimates of the total amount of time expended by clinicians on communications are not available. However, an attempt at quantification, even if it is based on informed estimates and limited by simplifying assumptions, contributes to an understanding of the magnitude of the problem and helps construct an overall estimate of the economic burden confronting hospitals. Such understanding might allow us to design and implement interventions to address the problem.

The few available quantitative estimates of inefficiencies and other negative outcomes due to poor communications in the overall healthcare system are striking. Little (1992) suggested that the U.S. health system could save \$30 billion annually through

"Improved telecommunications is attributed to better management of patient information"

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Poor communications accounts for more than 65% of sentinel events!

improved telecommunications, with the savings being attributed to better management of patient information, claims processing, and inventory management. Although these estimates do not explicitly focus on hospitals or on interpersonal communication, they are nonetheless informative to the degree that telecommunications technology can facilitate timely dialogue between care providers. In reviewing prior work that has attempted to understand why medical errors occur, Safran, Miller, and Beckman (2006) note that "recent work and commentaries highlight the fact that medical errors are largely a result of failed communications among clinical teams." The Joint Commission's analysis of the root causes underlying sentinel events, defined as "an unexpected occurrence involving death or serious physical or psychological injury, or the risk thereof," reinforces this conclusion—poor communication has been implicated as the origin of more than 65 percent of sentinel event occurrences (Silvey 2009).

Our research focuses on developing models for quantifying the economic burden of poor communications in U.S. hospitals. Hospitals occupy a central role in the U.S. healthcare system. In 2007, hospitals accounted for 31 percent of overall healthcare expenditures and employed over 5 million full-time and part-time workers, and hospital jobs pay significantly more on average than jobs in other service industries. Further, hospitals generate significant social value by providing charity and other uncompensated care, and they have an indirect economic effect on a host of other sectors, including finance, insurance, and retail (AHA 2008).

"Medical Errors are largely the result of failed communications..."



There are multiple varieties of Communication inefficiencies that are prevalent in hospitals.

We conducted a multistage study to meet our overarching objective of developing a model for total national waste attributable to poor communications in hospitals. In Stage 1, we reviewed prior literature focused on communication within hospital settings. The literature review brought to the surface several outcomes of poor communications and a limited number of quantitative estimates of these outcomes. We followed this in Stage II with interviews conducted with key informants in seven hospitals, including senior administrators and clinical staff. This primary data provides additional insights related to the opinions of stakeholders about the challenge of poor communications. We combined the data collected in Stage I and Stage II to construct a conceptual model of the outcomes of poor communications. Finally, in Stage III, we developed a quantitative model for estimating inefficiency based on two sources of data: (1) estimates available in published sources constructed using time and motion studies in clinical settings and (2) the primary data gathered through the interviews.

PRIOR LITERATURE

We review prior literature on communication in hospitals to illustrate three key points. First, we establish that there are multiple varieties of communication inefficiencies in hospitals that are endemic. Second, we summarize literature that has provided estimates of how caregivers spend their time across different activities, of which communication is one. Finally, we present evidence from studies that have shown how various technology-based interventions can improve communication processes.

Evidence suggests that communication intervention can improve the patient care process.

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COMMUNICATION INEFFICIENCIES IN U

Care Delivery Entails high levels of:

- 1) Dynamism
- 2) Frequent Exceptions
- 3) Urgent Circumstances

A decade ago, Coiera and Torres (1998) noted the paucity of studies on communication systems within health-care and called for research that isolates the size and form of different communication flows in healthcare. Since that time, there is a small but growing research literature on the importance of effective communication and coordination in hospital processes in general (e.g., Williams et al. 2007) and the role of technology in facilitating such processes in particular (e.g., Kuruzovich et al. 2008). This literature underscores the complex and multifaceted nature of the tasks associated with care delivery and discharge planning in hospitals. Not only do these activities involve multiple stakeholders that include people (e.g., nurses, physicians, administrators) and departments (e.g., radiology, pharmacy, billing), they are also characterized by high levels of dynamism, frequent exceptions, and urgent circumstances such as a patient requiring immediate attention. They also entail extensive coordination among the various constituents. For example, in discharge planning, physicians, nurses, patients, the patient's family, community health workers, administrators, and others may be involved in process completion.

Gottschalk and Flocke (2005) divide primary care physician activities into four categories, providing an estimate for the proportion of time devoted to each in an average 8.6 hour day:

1. Face-to-face patient care, 55 percent
2. Work specific to visits outside the exam room, 14.5 percent
3. Work outside the exam room with patients not currently being seen, 22.9 percent

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"How do care providers spend their time?"

Face-to-Face = 55% Work outside exam room = 14.5% Work with patients not currently being seen = 22.9% Other = 7.5%



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Use wireless communication devices for specialized inpatient settings

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4. Other outside-exam-room work, including paperwork, academic and administrative work, 7.5 percent

Though the study is limited to only 11 physicians and 2 patient care days, the 611 outpatient visits observed revealed the intangible benefits of systems such as electronic medical records (EMR) and e-prescribing and phone call triage protocols in reducing time spent in information dissemination and management.

Chisholm and colleagues (2001) address the issue of interruptions to the planned activities of emergency physicians (EPs) and primary care providers (PCPs) and how these interruptions affect their daily time distributions. They show that every hour, EPs and PCPs spend 2.6 and 3.9 minutes, respectively, on the telephone, experiencing 1.4 and 0.6 phone interruptions. Hendrich and Lee (2005) provide a complementary study on the causes of wasted time on intrahospital patient transfers. Observation of 200 random patient transfers suggested that the most common causes of wasted time are (1) administrative requirements, (2) bed control, (3) unavailable resources, (4) disruptions, and (5) breakdowns in communications. The authors observed that an application of lean methodologies to obtain process efficiencies can yield a potential time savings of over four hours per transfer. Coiera and colleagues (2002) also investigated the importance of communication in hospital processes, specifically focusing on the frequency, nature, and effect of interruptions to the performance of physicians and nurses. Their research highlights and justifies

the importance of studies aimed at gauging the "errors and poor outcomes" associated with hospital settings.

A recent time and motion study by Hendrich and colleagues (2008) of medical-surgical nurses in hospitals presented detailed data on the breakdown of various activities in which the nurses engage. They found that approximately 6.6 percent of each nursing shift is "wasted" time. Nurses devoted the bulk of their time (77.7 percent per shift) to nursing practice, of which 86 minutes or 20.6 percent was consumed by care coordination that involves communication with team members or other departments. Finally, Friedman and Berger (2004) provide evidence restructuring teams and their communication processes reduces mean length of stay in a tertiary care hospital while maintaining a high level of patient satisfaction.

Several technology solutions have been developed to tackle the systemic healthcare delivery inefficiencies documented in the literature. Some studies specifically isolate and quantify the value associated with the use of communication technologies in specialized inpatient settings. Soto and colleagues (2006) investigated the use of mobile telephones in critical care environments. Their survey of 4,018 anesthesiologists revealed that mobile telephone use by anesthesiologists is associated with a 19 percent reduction in the risk of medical error or injury. Buckles and Herpin (2007) focused on an information technology (IT) application for a patient nurse-call system and used interviews and historical data to assess the value of this system. They found that among

Time in Motion Study found....6.6% of Nursing Shifts is "Wasted Time"

20.6% of a nurse's shift
Involves communication
With team members or other
departments

Integrated Nurse Call Communications Improves Overall Response to Patient Requests By 51%

other positive outcomes, the system resulted in an increase in compliance with Medicare congestive heart failure core measures from 68 percent in 2004 to 93 percent in 2005, an estimated reimbursement realized as a result of the documented compliance of \$430,000 annually, and a 23 percent decrease in administration delay.

Kuruzovich and colleagues (2008) provided quantitative evidence that use of an integrated communications system for the nurse-call process improved the overall mean time for responding to patient requests by 51 percent. Their study also presented preliminary evidence of creative and evolving system impacts that were not originally envisioned, such as use of the technology by nurses for organizing meetings and conducting conversations when face to face interactions were infeasible. Finally, O'Leary, Liebovitz, and Baker (2006) addressed the issue of hospital-wide time distribution by analyzing a 753-bed teaching hospital and shadowing 10 hospitalists for 74.5 hours. The analysis shows a significant amount of time spent on communication and highlights the effect that paging interruptions and multitasking have on the likelihood of medical errors. Specifically, they found that 24 percent of a hospitalist's total time is spent on communication. The study outlines the opportunities technology offers in solving such communication problems in this particular setting.

Summary

Overall, agreement is widespread that the practice and delivery of healthcare fundamentally and critically depends on

Locate important stakeholders and create timely access to information using communication tools!!

effective and efficient communication.

The complexity of inpatient care delivery and discharge planning in hospitals is undisputed: It demands rapid and timely access to information, the ability to locate important stakeholders at any point in time, and platforms for coordinating the work of care providers and other actors who may be temporally distributed.

All concerned parties need to be able to communicate information about the status of a patient either asynchronously or synchronously, as situation and availability demand. Clearly, communications technologies, coupled with process redesign, play a major role in enabling these capabilities, and researchers have increasingly begun to acknowledge this. However, the evidence to date on the specific value such systems create for a hospital and for the patients the hospital serves is sparse.

THE QUALITATIVE STUDY OF COMMUNICATION CHALLENGES IN HOSPITALS

We conducted a qualitative study of communication challenges in seven hospitals. Given the limited prior work in this area, such formative research is useful. Because the nature and severity of communication challenges is likely to be influenced by certain hospital characteristics, we selected hospitals that varied in size (ranging from 162 to 918 staffed beds and 47,000 to 279,000 patient days per year), revenue (with a range of \$770 million to \$1.45 billion) and location (urban and suburban). All seven hospitals were short-term acute care facilities. Data were collected through hour-long structured interviews with key informants conducted by two



Past studies have shown that communication technology offers the tools for solving problem of wasted time communicating.

Overwhelming Sentiment - Communication Lapses Occur Frequently, Which Could Result in Mistakes, Patients Not Being Served in a Timely Manner, Thereby Increasing Patient Risk and Length of Stay.

researchers. Interviews were recorded and transcribed for data analysis.

The interview protocol encompassed four broad domains: (1) identification of specific bottlenecks in current communication processes during care delivery and discharge planning, (2) an understanding of the negative outcomes that result from these bottlenecks, (3) respondents' subjective quantification of the extent to which the **negative outcomes could be mitigated by improving communications, and (4) respondents' opinions on specific communication capabilities that they might find useful, such as collaborative workspaces and mobile telephony.** Interviewees included chief nursing officers (CNOs), chief information officers (CIOs), chief medical officers (CMOs), physicians, nurses, and hospital chief executive officers (CEOs). The data were analyzed using content coding to identify major themes in the four domains. Both researchers who conducted the interviews independently extracted themes that were subsequently compared to validate and triangulate findings. Agreement in the themes extracted was 92 percent for all seven interviews.

When asked whether communications in the hospital were a challenge, every interviewee responded strongly in the affirmative. They each provided several examples of poor communications in their respective settings. The CNO at Hospital F said "I think there's a tremendous amount of wasted time and effort in tracking down people. It's huge!" She went on to observe that **one of the nurses took four years to find out how to discover which doctor is on call.** The CIO at Hospital G said, "In an

environment like ours, where there be many different physicians who are participating in a patient, it is difficult to always know who is in charge [...]. It sounds like it wouldn't be a big deal, **but it's amazingly complicated and very difficult to ensure that you always reach the right person at the right time.**" She also noted "most of the time when an error is made it's because somebody changed something and forgot to communicate that to the rest of the care team." In general, consistent with what prior research has shown, the overwhelming sentiment of the respondents was that communication lapses occurred frequently in the hospital, resulted in inefficiencies in the utilization of clinical staff, and increased the likelihood of mistakes. Further, the respondents pointed out that poor coordination could result in patients not being serviced in a timely manner, thereby increasing patient risk and possibly length of stay.

In response to questions related to quantifying the time wasted due to communication bottlenecks, the interviewees offered a range of estimates. Hospital E estimated that **nurses spend 3 hours per shift tracking down other people,** while the CIO of Hospital D believed that 20 percent of productive time was wasted due to communication bottlenecks. The CNO at Hospital F said it took nurses on average 5 to 6 calls to locate a physician and observed that **beeper dependency is "antiquated."** The CMO from Hospital A said that during care delivery, face-to-face communication was not so essential, as long as the caregiver was able to speak with the right person in real time. His

CIO Hospital G: "It sounds like it wouldn't be a big deal, but it's amazingly complicated and very difficult to ensure that you always reach the right person at the right time."

WOW FACTOR!

CIO Hospital F: "I think there's a tremendous amount of wasted time and effort in tracking down people. It's huge!"

- Nurses spend 3 hours a shift tracking down people, it takes 5 to 6 calls to locate a physician
- CIO Hospital F observed: that it took one nurse four years to find out how to discover which doctor is on call.



CONSERVATIVE ESTIMATE OF TIME WASTE DUE TO POOR COMMUNICATIONS IS 10%, ONE CIO ESTIMATES TIME WASTED AT AS MUCH AS 40%!

conservative estimate of time waste due to poor communications was 10 percent. At Hospital G, a state-of-the-art facility with a wide variety of advanced technologies in place, according to the CIO, nurses spent 50 percent of their time away from care delivery, and in her estimate, total waste in the system was about 25 to 30 percent, and could be as high as 40 percent.

The picture that emerged from these interviews, echoing findings in prior literature, is that the hospital environment is rife with communication delays and failures. In some ways this is not surprising, given the number of caregivers who have to closely coordinate their activities, the distributed location of resources, and the high-pressure and frequently resource-constrained hospital setting. Not only does this result in a suboptimal use of scarce resources, such as the expertise and skill of caregivers who may find themselves performing non-value adding activities or hospital beds that remain occupied because patients are not discharged on time due to poor coordination during the discharge process, it can also have serious ramifications for patient safety and quality of care. Although our respondents were reluctant to directly implicate poor communications in the compromise of patient safety, they all agreed that mistakes frequently occur because of poor communications.

A CONCEPTUAL MODEL OF COMMUNICATION OUTCOMES

As the literature suggests and our interviews confirm, poor communication among care providers can lead to a wide array of negative consequences. We

synthesized the data from prior research and primary data related to the first two domains in the interview protocol, the identification of communication bottlenecks and the associated negative outcomes, to construct a conceptualization of the various outcomes related with the quality of communication in a hospital (see Exhibit 1). We identified four primary dimensions along which communication quality can be assessed: (1) efficiency of resource utilization, (2) effectiveness of resource utilization, (3) quality of work life, and (4) service quality. We then associated specific outcome metrics for assessing each dimension.

Efficiency depends on the optimal use of key and often scarce resources in hospitals: the time of physicians and nurses. Appropriate diagnoses and rapid and safe patient treatment represent the effectiveness of the core operations of the hospital and are measured by length of stay and incidence of medical errors. Several studies have highlighted the importance of communications quality for improving the working conditions for hospital clinicians (e.g., O'Leary, Liebovitz, and Baker 2006). Therefore, we include quality of work life, measured by job-related stress and job satisfaction, as a third dimension. Finally, it is important to recognize that healthcare is fundamentally a service business, and hospitals are service organizations. The notion of service quality is a key component of quality improvement efforts that seek to meet or exceed customer expectations through process improvement (Weiner et al. 2006). Poor communications can affect service quality in multiple ways—for example,

Poor Communication Can Affect Service Quality



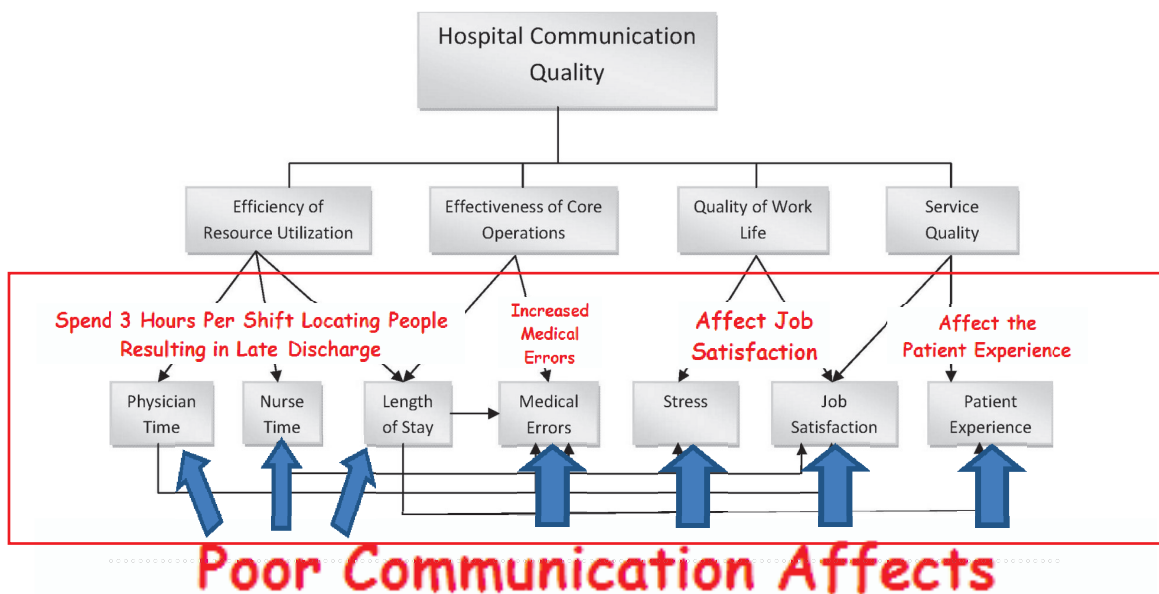
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The literature suggests and the interviews confirm, poor communication among care providers can lead to a wide array of negative consequences.

Communication Technology Can Improve Process; Providing an Increase in Patient, RN, Physician, and Staff Satisfaction

EXHIBIT 1

A Conceptual Model of the Outcomes of Communication in Hospitals



a patient not being informed about test results in a timely manner, delays in patient discharge, and a lack of information available to the patient's family. The AHRQ has launched the CAHPS initiative largely in response to concerns that service quality measures are not a part of the core Centers for Medicare & Medicaid Services metrics. Poor service quality affects caregivers and patients, as the metrics of job satisfaction and patient experience reflect.

Our conceptual model explicitly captures the interconnectedness among the various communication outcomes. Unproductive use of their professional expertise is likely to affect the job satisfaction of professional caregivers. Likewise, any increase in length of stay will negatively affect the patient experience in the hospital. Overall, the model demonstrates that the negative consequences

of communication inefficiencies are manifold and multidimensional. The fact that the consequences are tightly linked suggests that poor communications pose the risk of a vicious cycle for hospitals: Wasted nurse and physician time and increased length of stay reduce hospital margins and increase staff and patient dissatisfaction, further limiting the hospital's ability to generate economic resources for long-term sustainability.

Some of these dimensions, such as efficiency and effectiveness of resources utilization and their associated metrics, are tangible and can be directly translated into monetary terms. Others affect economic value through a complex causal chain. For example, poor service quality can lead to staff turnover, thereby increasing hospital costs of recruiting and training nurses. Poor

Consequences of Poor Communication Pose the Risk of a Vicious Cycle for Hospitals



Service Quality Affects the Patient Experience and Negative Experiences Can Result in Patients Selecting Alternate Hospitals

service quality also affects the patient experience, and negative experiences can result in patients selecting alternative hospitals or harming the hospital's reputation through word-of-mouth communications. Thus, hospital executives should monitor not only the easily measurable tangible outcomes, but also the difficult-to-quantify intangible outcomes that may have even more economic ramifications.

Efficiency of resource utilization represents the major source of cost for hospitals.

AN ECONOMIC MODEL FOR THE EFFICIENCY OF RESOURCE UTILIZATION

We limited the economic model to one dimension of the conceptual model: efficiency of resource utilization, which represents the major source of cost for hospitals. The economic model quantifies three categories of waste: physician time, nurse time, and patient length of stay. The overall model logic for doctors and nurses is predicated on estimating the proportion of time spent in hospitals on communication that is "wasted"; while for length of stay, we estimated the increase attributable to poor coordination during care and discharge coordination.

Waste in Physician Time

According to this computation, the economic impact of communication inefficiencies in the hospital setting for physicians is in excess of \$800 million annually (see Exhibit 2). Most physicians are not employed by hospitals. According to the BLS *Occupational Outlook Handbook*, 19 percent of salaried physicians and surgeons are employed by hospitals (BLS 2010). Our estimate accounts for this and is solely based on

the time spent by physicians in hospitals (i.e., that of salaried hospital physicians such as hospitalists and those acting as consultants). Thus, as will be discussed later, we believe this is a conservative estimate, and the actual waste is likely to be substantially higher.²

Waste in Nurse Time

Exhibit 3 summarizes the results of our analysis for nurses. Not surprisingly, given that nurses are the primary caregivers in hospitals (Hendrich et al. 2008) and serve as the focal point for coordinating patient care, communication inefficiencies generate over six times the amount of waste due to physician communication, estimated at about \$4.9 billion annually. The demand for nurses in the U.S. health-care system continues to outstrip supply, with the projected demand expected to increase 41 percent between the years 2000 and 2020 (IOM 2003) and the national shortage of 1 million full-time equivalent (FTE) RNs in 2020. Thus, in addition to the economic burden, unproductive use of nurse time creates a further artificial shortage of critical workers in an already resource-constrained and stressed healthcare system.

Nurses Represent 6X the amount of wasted time than do physicians totaling \$4.9B Dollars

Increase in Length of Stay

The final component of the economic model is the increase in length of stay caused by poor coordination and communication during discharge planning (see Exhibit 4). As the literature review indicates, this complex activity has a number of "points of failure," and failure to provide the appropriate information to the right recipient can result in

Unproductive use of nurse time creates an artificial shortage of nurses

800M Wasted Because of Poor Physician Communication

All of this wasted time creates a lag in bed turns as the discharge process is stalled.

Any action a hospital can take to streamline processes related to care coordination and discharge planning are likely to have a significant impact on bottom line revenues

EXHIBIT 2

Economic Burden of Wasted Physician Communication Time in Hospitals

Number of physicians in the US ^a	661,400
Average hourly rate ^b	\$84.18
Time spent communicating/shift ^c	45 minutes
Estimated waste – % of communication time ^c	20%
Number of minutes wasted per physician shift	9
Dollars wasted per physician shift	12.63
Hospital shifts/week ^d	2
Weeks worked/year	50
Dollars wasted per physician annually	1262.66
Dollars wasted for physicians in U.S. hospitals annually	835,121,009

^a May 2008 National Occupational Employment and Wage Estimates. Data from BLS (2008).

^b Healthcare Practitioner and Technical Occupations Wage Estimates, U.S. Department of Labor, Bureau of Labor Statistics (computed as weighted average across ten BLS occupational classifications). Data from BLS (2008).

\$12.4B Annually due to Poor Communication among care providers. This equates to an average loss of \$2.2M per hospital in the U.S.

excessive delays in patient discharge and a concomitant waste of scarce hospital beds. Using the total number of discharges from U.S. hospitals in 2006, the national average length of stay, and national average costs per discharge, we estimate that the total economic waste due to hospital overstay attributable to poor communications is about \$6.6 billion annually. Aggregating the three categories of waste, we obtain the results reported in Exhibit 5.

Discussion

According to our estimation, U.S. hospitals waste approximately \$12.4 billion annually due to poor communication among care providers. This equates to an average annual loss of \$2.2 million per hospital on a nationwide basis. For

a specific hospital, the loss could be higher or lower, depending on characteristics such as size, annual physician and nurse staffing levels and staff hours, occupancy level, and average length of stay. The loss, as percentage of hospital revenues, is 1.97 percent. When juxtaposed against the average hospital operating margin of 3.6 percent in 2004 (AHA 2007), the magnitude is particularly striking. The loss due to increase in length of stay dominates the overall economic burden, accounting for approximately 53 percent of the total waste, which excludes the estimated opportunity implications of LOS (see Exhibit 6). Thus, any action that hospitals can take to streamline processes related to care coordination and discharge planning, especially those that involve commu-

**The loss to a hospital because of poor communications as a percentage of hospital revenue is 1.97%
(the average hospital operating margin of 3.6% (AHA2007))
THE MAGNITUDE IS STRIKING**



 QUANTIFYING THE ECONOMIC IMPACT OF COMMUNICATION INEFFICIENCIES IN U.S. HOSPITALS

EXHIBIT 3**Economic Burden of Wasted Nurse Communication Time in Hospitals**

Number of nurses in the US ^a	2,542,760
Average hourly rate ^b	35.22
Percentage employed in hospitals ^c	59%
Time spent communicating/shift (minutes) ^d	75
Estimated waste – % of communication time (minutes) ^d	50%
Number of minutes wasted per nurse shift	37.5
Dollars wasted per nurse shift	22.01
Hospital shifts/week	3
Weeks worked/year	50
Dollars wasted per nurse annually	3,302.23
Dollars wasted for nurses employed in hospitals annually	4,954,094,072

^a May 2008 National Occupational Employment and Wage Estimates, Bureau of Labor Statistics. Data from BLS (2008).

^b Healthcare Practitioner and Technical Occupations Wage Estimates, U.S. Department of Labor, Bureau of Labor Statistics. Data from BLS (2008).

^c Data from BLS (2009).

^d Based on time and motion studies in prior research and primary data gathered through interviews

nication, are likely to have a significant effect on the bottom line.

Our analysis does not include a quantification of lost economic value due to a decline in patient satisfaction, staff satisfaction, or other negative outcomes depicted in the conceptual model caused by poor communication. The Hospital Quality Alliance (HQA) has recently introduced “patient experience” quality measures that assess, among other indicators, patients’ experience of nurse and physician responsiveness (AHRQ 2008). Because poor communication will doubtless negatively affect the patient experience, future extensions to the model should attempt to quantify what is the impact in monetary terms. It is also important to acknowledge that the scope of our analysis is limited to

the quantitative aspects of the efficiency of communication processes; we have not specifically examined the content of the communication. Further work on the quality of what is communicated would provide a more complete picture of the negative consequences of ineffective communication. Additionally, the quality of life in a workplace, particularly a stressful, interruption-driven setting such as a hospital, is strongly influenced by the quality of existing communication processes. The model can be extended to consider the economic loss caused by job dissatisfaction that arises because of poor communication.

Finally, a key piece that is missing from the economic model is the negative effect of poor communication on

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EXHIBIT 4**Economic Burden of Increase on Patient Length of Stay**

Total Economic Burden	
Total loss to U.S. hospitals	12,385,291,197
Total loss per hospital ^a	\$2,155,088
Total expenses for all U.S. registered hospitals	\$607,355,354,000
Average operating margin in 2004	3.60%
Hospital revenues	\$630,036,674,274
Total loss (% hospital revenue)	1.97%

^a Weighted national estimates from HCUP Nationwide Inpatient Sample, 2006. Data from AHRQ (2006).**EXHIBIT 5****Total Economic Burden Caused by Communication Inefficiencies for all U.S. Hospitals**

Number of discharges from U.S. hospitals ^a	39,450,216
Average length of stay ^a	4.6
Average costs ^a	8,360
Estimated overstay – % of length of stay	2%
Overstay duration for each discharge	0.092
Charge per day	1817.39
Dollars spent on each overstay	167.20
Dollars wasted on overstay for all discharges in the United States	6,596,076,115

^a This is the estimated loss per hospital on a nationwide basis. The specific loss to an individual hospital will be higher or lower, depending on hospital size, type of facility, and staffing ratios.**What is the affect of poor communication on patient safety?**

one of the most consequential outcomes for any hospital: patient safety. The literature suggests that medical errors are often an outcome of poor communication (The Joint Commission 2008) and experts believe that quality of care can be positively affected by improving communications (Jha et al. 2003). Future extensions of the model would need to quantify the economic value of patient safety and the cost of medical errors caused by communication lapses.

Given these dimensions of economic waste that are not explicitly captured in the model, we might speculate that the model underestimates the total waste by as much as 50 percent.

Hospital-Level Analysis of the Economic Burden of Communication Inefficiencies

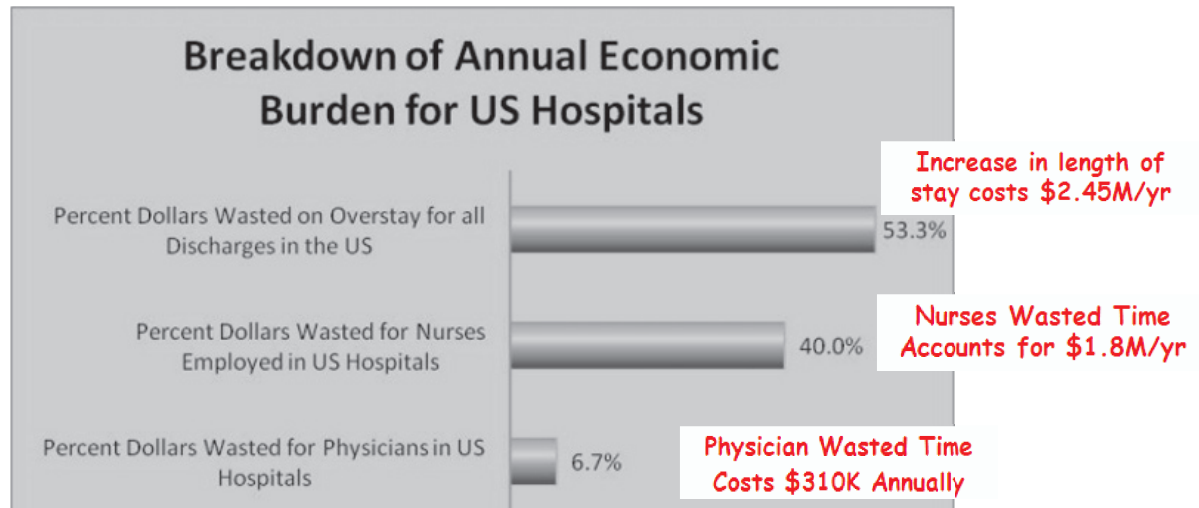
To further understand what the estimates of the economic burden at the national level reveal about losses in a specific hospital, we performed a more

Medical errors are often an outcome of poor communications. Estimates of total waste are as much as 50% for Nurses and Physicians

QUANTIFYING THE ECONOMIC IMPACT OF COMMUNICATION INEFFICIENCIES IN U.S. HOSPITALS

EXHIBIT 6

Breakdown of Economic Burden by Category



A 500 bed hospital loses as much as \$4M/yr because of communication inefficiencies

detailed analysis of wasted nurse time³ in a hypothetical hospital context. A study of nurse staffing patterns conducted by the University of San Francisco from April 1998 to June 2000 reported the following patient-nurse ratios: 1.6 in critical care units, 4.2 for step-down units, and 5.9 in medical surgical units (Donaldson, Brown, and Aydin 2002). Thus, another way to quantify the waste is to consider a 500-bed hospital with an 80 percent occupancy rate (average daily census/total staffed beds). We assumed that the hospital has 12 percent critical care beds, 21 percent step-down beds, and 67 percent medical surgical beds. Using the California staffing ratios, we calculated the overall time wasted and its associated economic burden (see Exhibit 7). This analysis indicates that a

500-bed hospital loses over \$1.8 million annually as a result of communication inefficiencies experienced by its nursing staff.

If we assume that the total economic burden is identically distributed across waste categories for all hospitals, then following from the baseline model, we can apply the loss breakdown depicted in Exhibit 6. The wasted nurse communication time represents 40 percent of the overall loss to the hospital. Thus, the total loss to the 500-bed hospital attributable to wasted physician communication time would be \$308,174, and that attributable to increase in length of stay would be approximately \$2,451,589 (excluding length of stay's opportunity implications). This results in an overall annual economic burden of over \$4 million for the 500-bed hospital.

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EXHIBIT 7**Economic Burden of Wasted Nurse Communication Time in a 500-Bed Hospital**

	Critical Care	Step-Down	Medical/Surgical
Patient/nurse ratio	1.60	4.20	5.90
Total beds	500	500	500
Proportion beds	60	105	335
Annual nurse hours	328,500	219,000	497,390
Hours per shift	10	10	10
Annual nurse shifts	32,850	21,900	49,739
Wasted time per shift	37.5	37.5	37.5
\$ Waste/shift	22.01	22.01	22.01
Overall waste	\$723,029	\$1,094,755	\$482,019
Occupancy rate	0.8	0.8	0.8
Total waste	\$578,423	\$385,615	\$875,804
Total economic burden for 500-bed hospital due to wasted nurse communication time			\$1,839,842

CONCLUSION

Rising costs and medical errors cause significant concern. Policymakers and healthcare experts continue to lament the fact that despite being one of the most expensive systems in the world, the U.S. healthcare system is far from being high-performance (Connolly 2008) and the quality of care is significantly lower than in nations that spend considerably less. Simply put, inefficiencies and waste are rampant throughout the healthcare delivery chain (Tucker et al. 2008). The American Recovery and Reinvestment Act of 2009 allocates significant resources for infusing more information technology into the healthcare enterprise. Our research suggests that technologies targeted at improving communication inefficiencies in

hospitals should be a focus of these investments.

To transform healthcare and guide resource allocation, it is important to isolate the causes of inefficiencies and develop estimates for the contribution of different sources of inefficiency to overall waste (Fraser, Encinosa, and Glied 2008). Our research focused on one aspect of inefficiency—that caused by poor communication among care providers in hospital settings—and its economic impact. To the best of our knowledge, this represents the first study to construct a national model of the economic burden of poor communication processes in hospitals. Our analysis revealed that U.S. hospitals lose over \$12 billion annually as a result of communication inefficiencies. For a 500-bed

The research indicates that technologies targeted at improving communication inefficiencies in hospitals should be a focus for hospital investments.

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7/8/2

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hospital, the annual loss is in excess of \$4 million.

Our economic modeling is based on a set of assumptions and a combination of primary and secondary data. We acknowledge the limitations of the qualitative data that we used to derive the proportion of communication time that is wasted. Future research could conduct detailed time and motion analyses to further validate these numbers. However, the limitations notwithstanding, we believe our estimate of the waste is conservative. Even with the limiting assumptions, the annual loss figure is substantial and clearly points to the need for interventions and policies to address the root causes of inefficiencies. **Hospital administrators and key decision makers must make the identification of communication bottlenecks and breakdowns a key priority in their hospital transformation agenda.** They must also pay attention to problems related to "overcommunication," where caregivers are under continual stress from being contactable anywhere and at any time. Many have argued that in addition to modifying communication process protocols through policies and standards, **a greater and more effective infusion of communication technologies into the hospital context can address communication challenges and aid in connecting to the right person about the right patient at the right time in interpersonal interactions among care providers. Given the substantial economic value that can be realized from improved communications,** U.S. hospitals need to accelerate the adoption and implementation of such technologies. The natural question that arises:

how much is it going to cost to fix this?

Future work should focus on developing detailed cost-benefit analyses for different interventions using data from our baseline model.

One crucial issue with respect to improving communications in hospitals is related to ownership of communication processes. The process improvement literature consistently highlights the need for clear responsibility and accountability for each key process within an organization. Currently, responsibility for ensuring the efficiency and effectiveness of communication activities is not sufficiently demarcated and assigned. To the extent that improving the quality of communications requires technological solutions and a detailed clinical process understanding, a multidisciplinary team that includes the hospital CIO, the Chief Medical Information Officer, the CNO, and the CMO would be able to provide the type of multifaceted understanding of hospital operations and the senior leadership and vision necessary to implement change. In addition, one single individual needs to own the entire communication activity in a hospital. In this way, executive accountability can be exerted when addressing the important and challenging communication issues in hospitals.

NOTES

1. Because our emphasis is on clinical operations, we do not consider purely administrative functions such as patient billing or inventory management.
2. Communication time that is wasted in other care delivery contexts such as medical practices is likely to increase

With better communication technologies, a hospital can address challenges and connect the right person with the right patient at the right time!

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the overall waste to the healthcare system significantly.

3. Because of the variety in hospital settings and case mixes, general physician staffing patterns for hospitals cannot be constructed without making a large number of assumptions. However, as we observed earlier, a hospital can customize the national waste estimates to its specific context quite easily.

REFERENCES

- Agency for Healthcare Research and Quality (AHRQ). 2008. "CAHPS and Quality Improvement: Slide Presentation from the AHRQ 2008 Annual Conference" (Text Version). [Online document; retrieved 5/27/10.] www.ahrq.gov/about/annualmtg08/090908slides/EdgmanLevitan.htm.
- Agency for Healthcare Research and Quality (AHRQ). 2006. "The HCUP Nationwide Inpatient Sample." [Online information; retrieved 5/30/2010.] www.hcup-us.ahrq.gov/db/nation/nis/NIS_Introduction_2006.jsp.
- American Hospital Association (AHA). 2008. "The Economic Contribution of Hospitals." *American Hospital Association*. [Online information; retrieved 05/30/2010.] www.aha.org/aha/trendwatch/2008/twapr2008econcontrib.pdf.
- American Hospital Association (AHA). 2007. "Chart Book Appendix." *American Hospital Association*. [Online information; retrieved 05/30/2010.] <http://www.aha.org/aha/research-and-trends/chartbook/2007chartbook.html>
- Buckles, S. and D. Herrin. 2007. "The Role of Information Technology in Healthcare Communications, Efficiency, and Patient Safety." *Journal of Nursing Administration* 37 (4): 184-87.
- Bureau of Labor Statistics (BLS). 2010. *Occupational Outlook Handbook, 2010-2011 Edition*. [Online document; retrieved 5/27/10.] www.bls.gov/oco.
- Bureau of Labor Statistics (BLS). 2008. "Healthcare Practitioner and Technical Occupations." Bureau of Labor Statistics. [Online information; retrieved 05/30/2010.] http://www.bls.gov/oes/2008/may/oes_nat.htm#b29-0000.
- Chisholm, C. D., A. M. Dornfeld, D. R. Nelson, and W. H. Cordell. 2001. "Work Interrupted: A Comparison of Workplace Interruptions in Emergency Departments and Primary Care Offices." *Annals of Emergency Medicine* 38 (2):146-51.
- Coiera, E., and V. Tombs. 1998. "Communication Behaviours in a Hospital Setting: An Observational Study." *British Medical Journal* 316 (7132): 673-76.
- Coiera, E. W., R. A. Jayasuriya, J. Hardy, A. Bannan, and M. E. Thorpe. 2002. "Communication Loads on Clinical Staff in the Emergency Department." *Medical Journal of Australia* 176 (9): 415-18.
- Connolly, C. 2008. "U.S. 'Not Getting What We Pay For': Many Experts Say Health-Care System Inefficient, Wasteful." *The Washington Post*. [Online article; retrieved 11/30/2008.] www.washingtonpost.com/wp-dyn/content/article/2008/11/29/AR2008112901025.html.
- Donaldson, N. E., D. S. Brown, and C. E. Aydin. 2002. "Nurse Staffing in California Hospitals 1998-2000: Findings from the California Nursing Outcome Coalition Database Project." *Policy, Politics, and Nursing Practice* 2 (1): 20-29.
- Fraser, I., W. Encinosa, and S. Glied. 2008. "Improving Efficiency and Value in Health Care: Introduction." *Health Services Research* 43 (5 Pt 2): 1781-86.
- Friedman, D. M., and D. L. Berger. 2004. "Improving Team Structure and Communication: A Key to Hospital Efficiency." *Archives of Surgery* 139 (11): 1194-98.
- Gottschalk, A., and S. A. Flocke. 2005. "Time Spent in Face-to-Face Patient Care and Work Outside the Examination Room." *Annals of Family Medicine* 3 (6): 488-93.
- Health Resources and Services Administration (HRSA). 2004. "What Is Behind HRSA's Projected Supply, Demand, and Shortage of Registered Nurses?" [Online document; retrieved 5/27/10.] bhpr.hrsa.gov/healthworkforce/reports/behindnproj/index.htm.
- Hendrich, A., M. Chow, B. Skierczynski, and Z. Lu. 2008. "A 36-Hospital Time and Motion Study: How Do Medical-Surgical Nurses Spend Their Time?" *The Permanente Journal* 12 (3): 10.
- Hendrich, A. L. and N. Lee. 2005. "Intra-Unit Patient Transports: Time, Motion, and

QUANTIFYING THE ECONOMIC IMPACT OF COMMUNICATION INEFFICIENCIES IN U.S. HOSPITALS

- Cost Impact on Hospital Efficiency." *Nursing Economics* 23 (4): 157-64.
- Institute of Medicine (IOM). 1999. *To Err is Human: Building a Safer Health System*. Washington, DC: Institute of Medicine, Committee on Quality of Health Care in America.
- Institute of Medicine (IOM). 2001. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: Institute of Medicine, Committee on Quality of Health Care in America.
- Jha, A. K., E. G. Poon, D. W. Bates, D. Blumenthal, B. Middleton, G. J. Kuperman, and R. Kaushal. 2003. "Defining the Priorities and Challenges for the Adoption of Information Technology in HealthCare: Opinions from an Expert Panel." *AMIA Annual Symposium Proceedings* 2003 (1): 881.
- Joint Commission, The. 2008. "Sentinel Event Statistics." [Online document; retrieved 5/27/10.] www.jointcommission.org/SentinelEvents/Statistics.
- Kuruzovich, J., C. M. Angst, S. Faraj, and R. Agarwal. 2008. "Wireless Communication Role in Patient Response Time: A Study of Vocera Integration with a Nurse Call System." *Computers Informatics Nursing* 26 (3): 159-66.
- Little, A. D. 1992. "Telecommunications: Can It Help Solve America's Health Care Problem?" Cambridge, MA.
- O'Leary, K. J., D. M. Liebovitz, and D. W. Baker. 2006. "How Hospitalists Spend Their Time: Insights on Efficiency and Safety." *Journal of Hospital Medicine* 1 (2): 88-93.
- Safran, D. G., W. Miller, and H. Beckman. 2006. "Organizational Dimensions of Relationship-Centered Care." *Journal of General Internal Medicine* 21 (1): S9-15.
- Silvey, A.B. 2009. "Introduction to Root Cause Analysis: Understanding the Causes of Events." [Online information; retrieved 1/19/2010.] www.hsag.com/App_Resources/Documents/Flex_LS1_Silvey_IntroToRCA.pdf.
- Soto, R. G., L. F. Chu, J. M. Goldman, I. J. Rampil, and K. J. Ruskin. 2006. "Communication in Critical Care Environments: Mobile Telephones Improve Patient Care." *Anesthesia & Analgesia* 102 (2): 535-41.
- Tucker, A. L., S. J. Singer, J. E. Hayes, and A. Falwell. 2008. "Front-Line Staff Perspectives on Opportunities for Improving the Safety and Efficiency of Hospital Work Systems." *Health Services Research* 43 (5 Pt 2): 1807-29.
- Weiner, B. J., J. A. Alexander, S. M. Shortell, L. C. Baker, M. Becker, and J. J. Geppert. 2006. "Quality Improvement Implementation and Hospital Performance on Quality Indicators." *Health Services Research* 41 (2): 307-34.
- Williams, R. G., R. Silverman, C. Schwind, J. B. Fortune, J. Sutyak, K. D. Horvath, E. G. Van Eaton, G. Azzie, J. R. Potts, M. Boehler, and G. L. Dunnington. 2007. "Surgeon Information Transfer and Communication: Factors Affecting Quality and Efficiency of Inpatient Care." *Annals of Surgery* 245 (2): 159-69.

PRACTITIONER APPLICATION

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The authors of this paper provide an excellent model for quantifying the economic impact of communication inefficiencies in hospitals. There is great face validity in their conservative estimates, as healthcare executives across the country are acutely aware of the challenges their teams face in coordinating a complex set of interrelated healthcare delivery processes among an array of employed and affiliated caregivers.

Immediately applicable are all of the measures provided in the table data that have been estimated at a per-stay, per-shift level, which hospital executives can apply to their own data to obtain a cost estimate of communication inefficiencies specific to their own hospitals.

The author's model includes resource utilization inefficiencies, effectiveness of core operations, quality of work life, and service quality. While the other three dimensions are a must in any adequate coverage of this topic, the inclusion of quality of work life is timely and refreshing. At a time when primary care enrollees to medical schools are down and nursing shortages are projected for years to come, it is important that we focus on this issue. At my previous institution, the Ohio State University Medical Center (OSUMC), one of our overarching strategic goals is to enhance our reputation as a workplace of choice. The cognitive stress that suboptimal coordination and communication mechanisms creates is clearly something that practitioners must systematically and explicitly address to attract and retain talented healthcare providers now, and certainly in the future.

The authors also appropriately caution against overcommunication, whereby a caregiver is contacted too frequently and, thus, the communication itself becomes a burden. While not within the scope of the author's focus, complementary technologies such as radio frequency identification technologies, whereby caregivers carry a sensor indicating their location in the hospital at any time, can significantly enhance investments in other communication technologies by creating a means of knowing who is most available for a given situation.

The authors call out important future extensions to their model. For instance, data on patient satisfaction has become publicly available. As consumerism continues to reshape patient referral patterns, there is great face validity in future researchers including patient satisfaction in future economic models. Increasingly, patients, and not physicians, will decide where they receive their care. It makes sense to include this in future economic impact models. Additionally, with value-based purchasing affecting future reimbursement rates, patient safety and quality (e.g., preventable readmissions) are clearly important future extensions to the author's model.

Finally, the author's ultimate conclusion is that technologies targeted at improving communication inefficiencies in hospitals should be a focus of hospital investments. While the literature shows that hospitals have been successful at adopting medical technologies (e.g., MRIs, implantable devices), the literature suggests that adoption of technologies focused on the patient care processes (e.g., EMRs, unified messaging technologies) have been far less successful. To ensure success, hospitals should include adequate cultural change management resources in these technology investment packages.