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ABSTRACT

The push for value-driven healthcare has resulted in numerous calls for increased transparency and accountability across the healthcare industry. This paper provides an a priori perspective to perioperative process transparency and accountability within a hospital environment by describing, examining, and discussing case-study research across a hospital's perioperative and auxiliary services. Based on a 66-month longitudinal study of a large 909 registered-bed teaching hospital, this paper investigates how the complexity of technological change dynamics, integrated information systems, and a patient-centric perspective contribute toward opportunities for patient transparency and accountability within a hospital's perioperative processes. This paper also provides theoretical and practical implications, as well as study limitations.

Keywords

Integrated hospital information systems, perioperative process, patient accountability, patient transparency

INTRODUCTION

Wears and Berg (2005) notes how information systems (IS) and/or information technology (IT) only yield high-quality healthcare when its use patterns are tailored to knowledge workers and their environment. From the process context, integrated hospital information systems reflect interaction points and outcomes between and within healthcare, accounting, and financial processes, where IS provide both the means and metrics for measurement. Hence, integrated hospital IS architecture reflects hospital organizational structure, its processes, its culture, and its patient stakeholders.

Herzlinger (2006) notes a contrasting view, as technology itself becomes a barrier across the healthcare industry. Autonomous organizational units yield disparate information, create redundancies, hoard resources, and obscure organizational efforts (Herbold, 2005). Similarly, the inability to share information across and between healthcare groups impedes efficiency and cost-effectiveness (Grimson, Grimson, and Hasselbring, 2000). However, integrated hospital IS offer strategical, tactical, and operational continuity. Through its implementation and application, integrated IS reinforce strategy, information sharing, synergy, and improvement (Zani, 1970; Karimi, 1988; Silver, Markus, and Beath, 1995). Therefore, the complexity of hospital IS integration and its implementation pose opportunity for organizational structure, process, and culture change that effect patient stakeholders and their outcomes. To this end, IS and IT continue to have increasingly greater central roles within the healthcare industry (Connor, Ponte, and Conway, 2000; Raghupathi and Tan, 2002; Garg, Adhikari, McDonalid, Rosas-Arellano, Devereaux, Beyene, Sarn, and Haynes, 2005).

This paper examines perioperative process transparency and accountability perpetuated via integrated hospital IS. The investigation reviews an ongoing longitudinal study within a large, teaching hospital where the perioperative process underwent radical innovation, resulting in structure, culture, and process improvements. The resulting organizational actions and subsequent extension of an integrated clinical IS beyond the hospital's perioperative process, into its auxiliary services, provided improved perioperative process transparency and accountability across the primary and ancillary hospital services at the patient level.

The order of this paper is as follows. The next section reviews previous literature as well as understanding perioperative processes within the hospital environment. Following the literature review, we present the methodology, case-study background, recent results, and our analysis of the observed effects. In identifying a front-line approach toward patient-

centric perioperative transparency and accountability perpetuated via an integrated hospital IS, this paper prescribes an a priori environment to foster its occurrence. The conclusion discusses implications and limitations of this study.

LITERATURE REVIEW

Hofstede (1984) describes organizational culture as "the way things are done" (p. 3). Moreover, organizational structure and its culture evoke shared meaning with similar responses among its constituents (Bate, 2000). A distinctive organizational structure and its culture require development as opposed to acquisition or imitation (Wilkins, 1989). To this end, organizational structure and culture networks values, norms, and assumptions across the organization (Johnson-Cramer, Parise, and Cross, 2007). Yet within healthcare and in particularly the hospital environment, a significant amount of imitation behavior exists that is distinguishable from systematic analysis (Kaissi and Begun, 2008). Similarly, integrated hospital IS network data and information across the hospital environment for review, as well as analysis and decision support. Ross (2003) associates limited organizational IS and IT capabilities with limited organizational capabilities. Empowering the hospital environment with fully integrated hospital IS provides a basis for strategic, tactical, and operational capabilities, as well as the means and metrics to distribute and network accountability and transparency.

Integrated Hospital IS

A hospital's organization chart reflects the architecture of organizational authority, responsibility, and workflow. Likewise, IS architecture identifies information flow, sub-component perspective, functionality, structural relationships, and defined dynamic interactions (Nunamaker, Chen, and Purdin, 1991). With respect to IS architecture within the organization, integration is an attempt toward renovation (van Deursen, 1999), where hospital IS are integrated for improvement. With respect to individuals in the hospital environment, integration is the application of individual and combined efforts from multi-disciplinary groups to perform hospital services for patient stakeholders' improvement that provides a patient-centric outcome.

Unfortunately, many organizations accede disparate organizational culture, disparate organizational structure, and disparate IS architecture. Similarly, American hospitals reflect English designs originating from the mid-19th century and the basis for the American physician model is largely an 18th century tradition of professionalism (VHA Health Foundation, 2006). Within healthcare organizations, professionalism competes with managerialism as a cultural dichotomy that leads to power struggles and yields potential friction, conflict, and disharmony (Flynn, 1999). This dichotomy has cultural roots in mindsets focusing on tribalism, individualism, and/or conservatism (Bate, 2000), which fail to facilitate accountability, transparency, or a patient-centric focus. Integrating disparate IS cuts across political boundaries, manipulates organizational structure, transforms organizational culture, and alters organizational power distribution (Burkhardt and Brass, 1990; Keen, 1981; Robey and Boudreau, 1999). Integrating hospital IS network the efforts of individual and multi-disciplinary groups across the hospital environment, which provides opportunity for process improvement and facilitates improved accountability, transparency, and patient-centric outcomes.

Accountability and Transparency

Integrated hospital IS provide measurement and subsequent accountability for healthcare quality and cost, creating a dichotomy between quality versus cost that represents the foundation for healthcare improvement (Dougherty and Conway, 2008). Healthcare quality measurements reflect clinical effectiveness and accountability, as indicated from the frequency in patients' receipt of their five rights—the right treatment for the right patient in the right dose in the right way at the right time. These healthcare quality metrics are routinely measured within current hospital clinical IS and reported to governing bodies such as the Joint Commission on Accreditation of Healthcare Organizations. Moreover, the very nature of healthcare seeks to relieve illness and pain, where different approaches in epistemology broaden the healthcare cost margin of error (Berwick, 2008). Integrated hospital IS capture cost associated with patient clinical care and provide accountability for service provided to the individual patient stakeholder. The healthcare quality versus healthcare cost tradeoff requires systematic analysis and optimization across the healthcare industry to foster accountability, where measurement is the first step in clinician-based and practice-based improvement (Conway and Clancy, 2009). Within integrated hospital IS, quality and cost measurements reflect actual hospital process performance that is measurable against healthcare industry benchmarks, standards, or best practices. Comparison between actual versus standard quality and cost metrics allow hospitals to gauge performance, continuous improvement, and patient-centric accountability.

The U.S. Department of Health and Human Services defines transparency as a consumer comparison, between health care cost and health care quality, to make informed choices among clinicians and hospitals based on value (USDHHS, 2006). However, the current transparency paradigm within the healthcare industry lacks patient utility concerning decisions

regarding specific diseases and treatment options (Becker, 2008). Furthermore, healthcare policy-makers and patient-purchasers face untenable cost estimates in underperforming healthcare systems (Conway and Clancy, 2009). Hence, maintaining the status quo of the current transparency paradigm does not appear to be effective. Alternative transparency efforts are needed. Given these perceptions, this study proposes redefining patient-clinician transparency for the front-line of healthcare delivery through the seamless integration of healthcare IT. For this definition, through the context perspective of an integrated hospital IS, transparency becomes a function of visible healthcare responsibility—reflecting care coordination within the hospital processes. In respect to this case-study, transparency allows patient tracking within the hospital workflow by all stakeholders.

Integrated hospital IS offer broad data collection, data analysis, and information reporting capabilities to its stakeholders concerning healthcare delivery, its quality, and its associated cost. Contrastingly, the individual patient is rarely considered as having an active IS stakeholder position between pre-admission to post-discharge processes. While admitted for hospital services and procedures, patients are the object and means for healthcare cost and quality measurement, which increases the measurements' relevance or salience. Patient stakeholders often view hospital processes as black boxes, even though clinicians thoroughly explain procedures prior to their authorization. Also during hospital procedures, the patient often extends there IS stakeholder position through agency to family or friends. Hence the patient, the patient's family, and/or the patient's friends require active stakeholder positions for information reporting on patient progress and outcome during hospital processes and procedures. An integrated hospital IS or IT implementation trajectory that actively includes the patient stakeholders between admitting to discharge yields opportunity to develop more patient-centric organizational structure and culture to foster improved patient-centric accountability and transparency.

RESEARCH METHOD

The objective of this study is to investigate perioperative patient transparency and accountability via an integrated hospital IS. Case research is considered to be particularly appropriate (Eisenhardt, 1998; Yin, 2003). An advantage of the positivist approach (Weber, 2004) to case research allows concentrating on a specific hospital service in a natural setting to analyze the associated qualitative problems and environmental complexity. Hence, our study took an in-depth case research approach.

Our research site is a large teaching hospital (University Hospital), licensed for 909 beds and located in the southeastern region of the United States. University Hospital is the only magnet hospital in the state and U.S. News and World Report recognized University Hospital as a Best Hospital in 17 of the last 19 years. Concentrating on one research site facilitated the research question investigation and allowed the continued collection of longitudinal data. This study spans activities from October 2004 through March 2010, with particular historical data available from 2002 and 2003. During the 66-month study, we conducted field research and gathered data from multiple sources including interviews, field surveys, site observations, field notes, archival records, and documents reviews.

UNIVERSITY HOSPITAL'S PERIOPERATIVE SERVICES

The initial perspective of this research focuses on the perioperative processes within University Hospital's Perioperative Services. Perioperative Services is the functional group, within University Hospital, that provides surgical care for inpatients and outpatients during immediate pre-operative, intra-operative, and immediate post-operative periods. The specialized surgical procedures and patient care that occur within the perioperative process requires multidisciplinary, cross-functional surgical teams to maneuver within a complex, fast-paced environment.
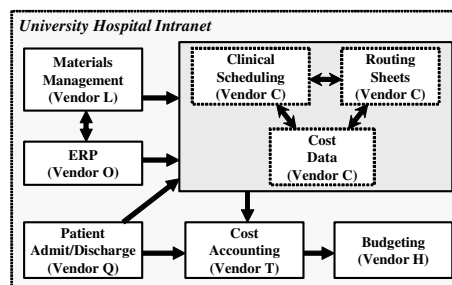
Figure 1 - IS architecture (October 2004)

Figure 1 depicts University Hospital's IS architecture for perioperative services as of October 2004. University Hospital had six main IS: (1) a large-scale hospital materials management IS, which included pharmacy, material and medical device

management (Vendor L); (2) a large scale enterprise resource planning IS (Vendor 0); (3) a patient record Admit/Discharge IS (Vendor Q); (4) a cost accounting IS (Vendor T); (5) a financial budgeting IS (Vendor H); and (6) a clinical scheduling IS (Vendor C) that included clinical scheduling, routing sheets, and cost data. The integrated IS have uni-directional constraints placed on sensitive information. The institutional intranet serves as portal access to extend each of the six IS. User authentication via the intranet was single entry with particular user-IS rights and privileges negotiated upon authentication.

Perioperative Services in November 2004

University Hospital opened a new diagnostic and surgical facility in November 2004, which covers 12 stories rising over three-fourths of a city block. Perioperative services relocated across three floors, with operating rooms (OR) located over two floors and Central Sterile Supply (CSS) located separately on the third.

The technology-rich environment also included interfaces to the clinical scheduling IS, distributed over wall-mounted monitors throughout the perioperative facilities, with anesthesia and perioperative staff schedules dynamically linked. Color-coded displays on the monitors instantly informed all perioperative staff and physicians when a case was completed or shifted from one room or scheduled time slot to another. The data generated within the clinical scheduling IS also fed a real-time patient charting system that combined qualitative data from standard observations.

The new perioperative facilities expanded OR capacity by 33%. The additional OR rooms required additional surgeons, nurses, anesthesiologists, nurse anesthetists, and other perioperative staffing. Within six weeks of occupying the new perioperative facility, scheduling metrics reflected the chaos as existing perioperative procedures and policies were not effective in the new facilities. On-time surgical case starts plunged to 18% during December 2004. Within perioperative services, having 82% of scheduled surgeries backlogged risks patient care and safety. Within a highly competitive hospital industry, having only 18% of scheduled surgeries start on time is unacceptable.

A quickly convened executive committee that included the CEO, the CFO, the CIO, the chief nursing officer, and top representatives of surgeons and anesthesia empowered an executive team to evoke change. The executive team consisted of surgeons, nurse leaders, anesthesiologists, perioperative management, and numerous task forces. The executive team's charter was to focus on patient care and safety, attack difficult questions, and remove inefficiencies. No issue was off-limits. All initiatives were data-driven from the existing integrated hospital IS. Supporting data demonstrated problem areas, strengths to highlight, and provided the direction for continuous improvement. Each identified benchmark presented a new goal proposal, along with a strategy for implementation.

Continuous Improvement through March 2007

The management restructuring and soft innovation methodology developed within Perioperative Services fostered data-driven process improvement to perioperative processes (Ryan, Doster, Daily, and Heslin, 2008). Two years after the executive team's charter, the perioperative management reorganization resulted in improvements among metrics of on time OR starts, increased OR suite utilization, and RN staff vacancies. These metrics offered confirmation of perioperative process improvement within a rapidly changing hospital environment. Comparatively, patient satisfaction and nursing satisfaction metrics also improved for perioperative services during FY2005 and FY2006 with departmental survey scores above the overall intuitional mean.
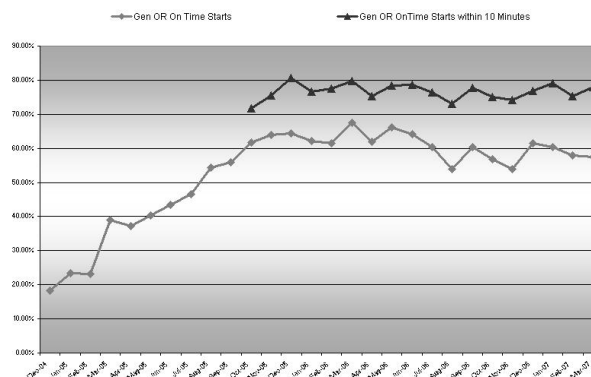

Figure 2 – Monthly Percentage of On-time OR Starts December 2004 to May 2007

Figure 2 displays the percentage of on-time OR surgical case starts for each month between December 2004 and May 2007. Fifty-five percent of all scheduled OR cases from October 2005 to May 2007 started on time. In October 2005, a new operational metric was established to track surgical case OTS within 10 minutes. Figure 2 also represents the percentage of surgical case on-time starts within 10 minutes through May 2007. Over 70% of all schedule OR cases from October 2005 to May 2007 started within 10 minutes of the case's scheduled time.

Perioperative Process Metrics and Benchmarks through April 2010

Figure 3 depicts a graph of OR suite utilization between October 2005 and April 2010. The OR suite utilization metric is a function of OR use during available scheduling blocks between 7:00 a.m. to 7:00 p.m.. The OR suite utilization metrics illustrated in Figure 3 include an average 8% annual growth in University Hospital's OR cases over each fiscal year.
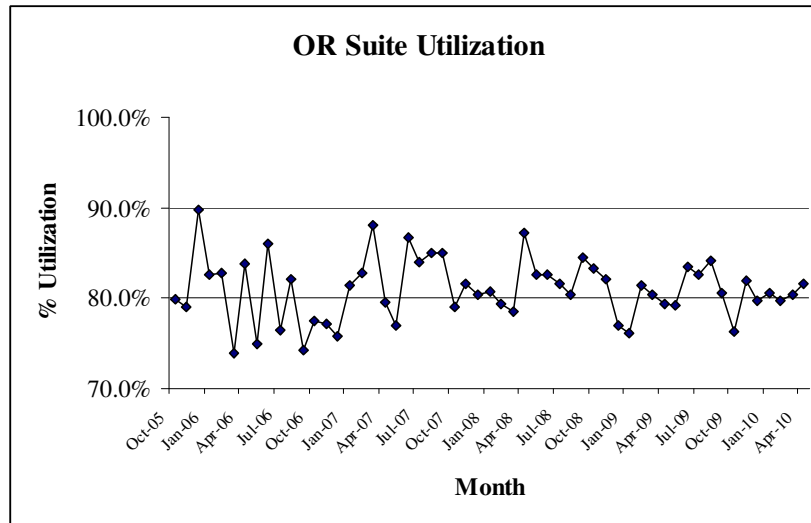
Figure 3 – OR Suite % Utilization from October 2005 to April 2010

Utilization rates prior to October 2005 were not reflective of actual surgical caseloads. Since October 2005, roughly all OR suites have been used between 75% and 85% of their available scheduling blocks. If trends suggest the need for additional hours, then additional blocks of time are scheduled. Surgeons also accepted a revised block schedule change where OR suites are released for other surgeons within a division 72 hours out and to any surgeon in any division at 48 hours out. Currently, 38.6% of OR suites are released from assigned surgical specialty blocks and rescheduled to other surgeons in different surgical specialties having patients requiring procedures.

U.S. Government statistics in 2001 reported the national average for RN vacancies ranged from 12% to 20% (GAO, 2001). Likewise, University Hospital's institutional vacancy rate averaged 21% during similar periods and averaged 11.2% for FY 2007. Perioperative process improvements in OR suite scheduling, flexible work shifts, and perioperative nursing education reduced nursing staff vacancies from over 40% in FY 2004 to an average vacancy rate of 7.6% over FY 2005 and FY 2006 for perioperative services. Since FY 2007, University Hospital's Perioperative Services has experienced a 0.0% RN vacancy rate with a waiting list of other University Hospital RNs wanting to transfer into the division. Soft innovations (Ryan, et al., 2008) contributed to minimizing the perioperative nursing staff vacancy rates below University Hospital's institutional rate and the national average.

EXTENDING THE CLINICAL IS IMPLEMENTATION – PROJECT IMPACT

Perioperative Services is the primary source of admissions to University Hospital. Given the state of Perioperative Services in early 2005, streamlining hospital-wide patient flow was virtually impossible without first streamlining patient flow through the OR. The structural, process, procedural, and cultural changes achieved in Perioperative Services over FY2005 and FY2006 allowed the executive committee to move forward in early 2007 to extend the clinical scheduling IS across University Hospital and address hospital-wide patient flow. The project, labeled IMPACT, had as its goal the improvement of patient flow and patient satisfaction through the multidisciplinary use of patient tracking technology. The new areas

integrating with Vendor-C's clinical scheduling IS were Admissions, PREP having 42 beds, Post Anesthesia Care Unit (PACU) having 45 beds, CSS, and all other ancillary services. The integration and implementation project encompassed 11 task forces covering surgeon's orders, clinical documentation, electronic medical records, pharmacy, physician workflow, critical care, knowledge and content, technical metrics, communications, and testing/training/transition.

IMPACT, the hospital-wide IS integration effort, provided perioperative tracking information on surgical patients (e.g. both outpatient and in-patient) from admission into University Hospital through PACU discharge, including the in-patient's location after PACU discharge. Beyond the enterprise application integration and software coding efforts, the most visible interface into the dissemination of perioperative process information across Admissions, PREP, and PACU were electronic patient status boards. The deployed boards were in each functional area and the perioperative patient information adhered to HIPAA compliant formats. Figure 4 depicts Clinical IS departmental views of the electronic boards in PACU.
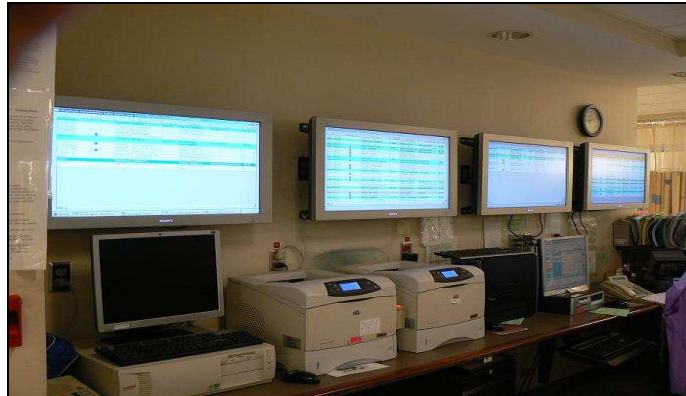
Figure 4 - Patient IMPACT Boards in PACU

Through the IMPACT project's implementation, each functional area across University Hospital has the capability to track perioperative patients, anticipate their arrival, and interact electronically with a surgical patient's perioperative records as well as electronic medical records as required. Additional flat panel displays on wall mounted information boards in each OR waiting room also provided patient tracking status for patient's family members. The coded patient information boards in each OR waiting room also ensures patient privacy and HIPAA compliance. Figure 5 depicts patient information boards in one of the OR waiting rooms.
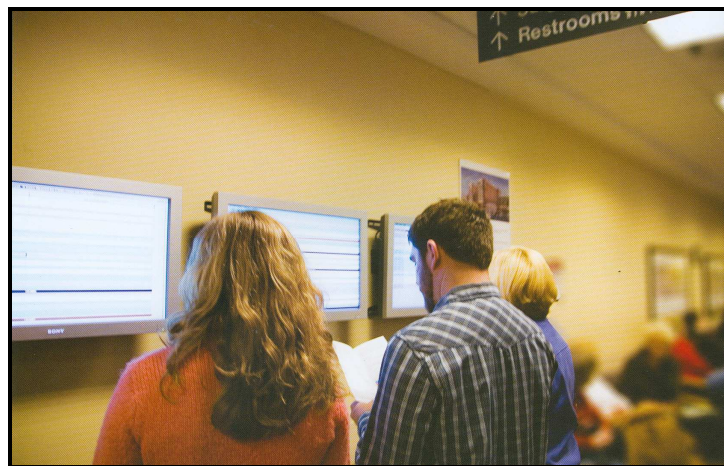
Figure 5 - HIPPA Compliant Waiting Room Patient Information Boards

Figure 6 depicts the brochure that the clinical staff gives to all patient family members, which explains the Family Link Information Boards in each OR waiting room. Prior to the completion of the Family Link patient boards, family members often went hours while the patient was in perioperative services without communication or clinical staff interaction. The Family Link brochure, customized for each patient's family, provides a tracking number to cross-reference the patient's

identity with the patient's location and status. The patient's family members track the patient's status by scanning for the tracking number location on a Family Link Information Board and interpreting the current color code.

Figure 6 - Family Link Brochure

ANALYSIS AND DISCUSSION

The following narrative summarizes our case within the integrated hospital IS context. The movement and relocation of the perioperative processes provided University Hospital's surgical patients with a technology-rich environment, whose radical innovation disrupted perioperative patient flow and endangered perioperative patient care. Data-driven process changes drove incremental improvement through the perioperative processes, resulting in improved patient flow through the OR and ultimately across the primary and ancillary hospital services.

University Hospital's Perioperative Services, over the 66-month study, maintained holistic goals. At the operational, tactical, and strategic levels, the integrated IS architecture facilitated each team and task force with perioperative data as a common foundation to evaluate and measure improvement. The following sections offer plausible explanations, results, or benefits derived from extending the clinical scheduling IS across University Hospital, as well as providing perioperative process accountability and patient-centric transparency.

University Hospital's IS architecture was fully integrated to support data and information requests as needed for data analysis, metric identification, benchmarking data, and/or monthly improvement indicators. The clinical scheduling IS was instrumental in collecting and distributing perioperative data for work flow reporting, analysis, and decision support. During the IMPACT project implementation, all task forces covering surgeon's orders, clinical documentation, electronic medical records, pharmacy, physician workflow, critical care, knowledge and content, technical metrics, communications, and testing/training/transition were data-driven. The existing integrated clinical scheduling IS provided the supporting data and served as the transaction processing system and perioperative process engine that monitored and tracked each patient through the perioperative processes.

Through implementation of the IMPACT project, an operational data store of integrated patient healthcare information is quickly accessible and distributable to all interested stakeholders, including the patient's family and/or friends. Perioperative process data is also quickly accessible and distributable for healthcare quality and cost benchmarking against standards and norms as well as specific physician or administration needs. Figure 7 reflects four of the benchmark metrics that University Hospital uses to measure and manage its perioperative processes.
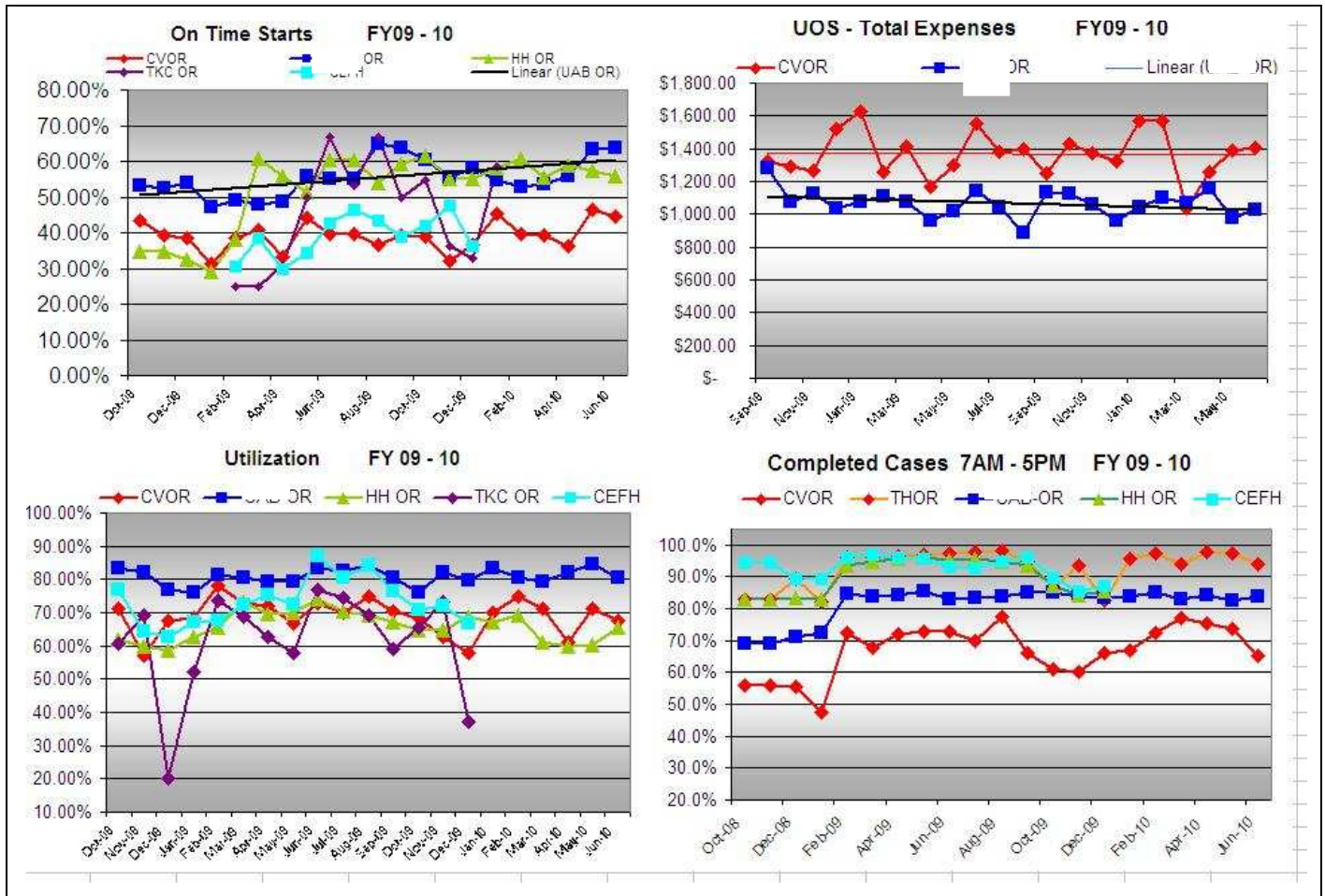
Figure 7 – Perioperative Process Metrics and Benchmarking

By extending the clinical scheduling IS integration across the hospital, other hospital departments and services gain access to the clinical scheduling IS modules and more importantly, the entire hospital staff has integrated data and networked access to track patients through perioperative processes. Family members of patients also have the capability to track the patient through the perioperative process. Family Link offers a unique opportunity for customer self-service via push technology. After installation of the Patient Information Boards in late Q4 of 2007, the Press-Gainey patient survey results for Q1 and Q2 2008 indicated an increase in patient satisfaction. Figure 8 depicts four of the Press-Gainey patient survey responses between Q2 2006 to Q2 2008.

Similar to the Press-Gainey survey results, University Hospital has also gained regional, national, and international recognition. The American Alliance of Healthcare Providers recognized University Hospital for superior customer service as the Hospital of Choice Award in 2008 and also recognized University Hospital as a finalist for Hospital of the Year. With respect to changes over the past six years in University Hospital's Perioperative Services, the department has become renowned for its management, practices, and work environment. Regional, national, and international hospitals have sent perioperative staff to visit, tour, and observe. Lastly, the United States Government's Health and Human Services hospital comparison tool ranks University Hospital above the state and national average with respect to its overall rating and patient recommendation scores. The URL of the comparison tool is http://www.hospitalcompare.hhs.gov.
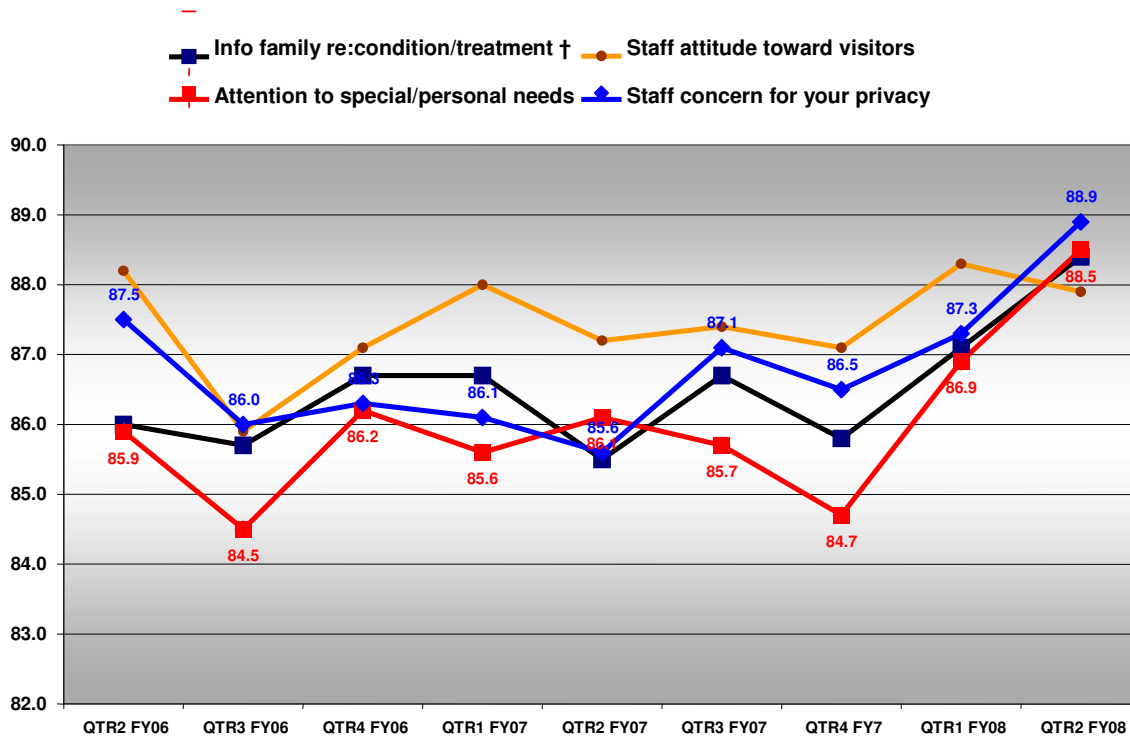
Figure 8- Press-Gainey Survey Results

CONCLUSIONS

From the initial OR crisis in December of 2004, the nature of the evolved task forces within Perioperative Services provided the foundation to drive perioperative process improvement, perpetuated via the integrated hospital IS. The resulting improvements across Perioperative Services had to occur interactively, which required Perioperative Services structure and culture to develop interactively toward a patient-centered perspective.

The developed Perioperative Services structure and culture focuses on high-quality healthcare with cost containment that promotes partnership, equality, and responsibility. By extending the clinical scheduling IS through the IMPACT implementation, the included departments resulted in multiple partnerships that engage and collaborate rather than compete and confront. Empowered individuals, integrated IS, process accountability, and patient transparency influenced perioperative process change dynamics toward incremental process improvement.

Traditionally, integrated individuals within teams or task groups do not have the organizational authority to evoke change. However, high-level executive positions can transfer their authority to the integrated team as an agent of process improvement to provide the influence needed to evoke and achieve the required process change.

Our case study contributed to IT literature within healthcare through investigating how integrated hospital IS can perpetuate perioperative process accountability and transparency with an a priori perspective to foster its occurrence. This study was limited to a single case, where future research should broaden the focus to address this issue along with others that the authors may have inadvertently overlooked. The case examples presented in this study can serve as momentum for perioperative process accountability and transparency comprehension and extension, while the results in this study should be viewed as exploratory and in need of further confirmation. Researchers could choose to further or expand the investigation, while practitioners could apply the findings to create their own version of perioperative process accountability and transparency within their hospital environment.

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