Targeted Strategic Alignment via Real-time Perioperative Performance Dashboards

Full Research Paper

Jim Ryan
Auburn University at Montgomery
jryan@aum.edu

Barbara Doster
University of Alabama-Birmingham Hospital
bdoster@uabmc.edu

Sandra Daily
Cullman Regional Medical Center
sandra.daily@crmchospital.com

Carmen Lewis
Troy University
cclewis@troy.edu

Abstract

This study examines business process management practices of business analytics via balanced scorecards and performance dashboards within hospital processes to target and achieve improvement aligned to strategy. The study maps specific perioperative metrics in the hospital environment to clinical results and demonstrates how business process management is applicable for aligning perioperative clinical outcomes to hospital strategy. Identification of existing limitations, potential capabilities, and the subsequent contextual understanding are contributing factors that yield measured improvement within the hospital's perioperative process. Based on a 150-month longitudinal study of a large 1,046 registered-bed academic medical center, this case study investigates the impact of integrated systems to qualify and quantify business analytics to improve hospital efficiency and effectiveness across patient quality of care, patient satisfaction, operational efficiency, and financial cost effectiveness. The theoretical and practical implications and/or limitations of this study's results are also discussed.

Keywords

Business process management, perioperative dashboards, balanced scorecards, and strategic alignment.

Introduction

The focus of healthcare in the United States has shifted toward monitoring and improving clinical outcomes to meet regulatory and reimbursement requirements due to the American Recovery and Reinvestment Act of 2009, the Health Information Technology for Economic and Clinical Health Act, the Affordable Care Act, and the Joint Commission on Accreditation of Healthcare Organizations (TJC) / Centers for Medicare & Medicaid Services (CMS) core measures (Blumenthal, 2012). Meeting these performance and reporting challenges requires leveraging information systems (IS) and technologies (IT) (PwC, 2012). Consequently, widespread healthcare IS/IT adoption necessitates the need for realized value (Jones et al., 2014). Furthermore, hospital administration could benefit by considering the strategic IS and business alignment challenges from other industries experienced over the past decades (Luftman & Ben-Zvi, 2010) as well as within healthcare (Bush, 2009). This study investigates the alignment of clinical perioperative performance to hospital strategy through business process management (BPM).

With respect to individual patient care, hospital perioperative processes and sub-processes (e.g. the preoperative, intra-operative, post-operative, and central sterile supply activities) are sequential where each activity sequence paces the efficiency and effectiveness of subsequent activities as well as overall patient outcomes. As a result, hospital processes are tightly coupled to patient flow, patient safety, patient quality of care, and stakeholders' satisfaction (i.e. patient, physician/surgeon, nurse, staff, and hospital administration). Implementing improvements across these areas to positively impact clinical outcomes is both a challenge and an opportunity for hospital stakeholders. From an operational perspective, perioperative processes require multidisciplinary, cross-functional teams to maneuver within complex, fast-paced, and critical situations—the hospital environment (McClusker et al., 2005). Ultimately, this challenge affects patient quality of care, operational efficiency, and financial performance.

The perioperative process is typically the primary source of hospital admissions, averaging between 55 to 65 percent of overall hospital margins (Peters & Blasco, 2004). Macario et al. (1995) identify 49 percent of total hospital costs as variable with the largest cost category being the perioperative process (e.g. 33 percent). Nonetheless, the perioperative process is one of many core processes nested within the hospital environment that yield overall clinical performance. However, managing and optimizing quality, efficient, and cost-effective perioperative processes to yield improved clinical outcomes are critical success factors (CSFs), both operationally and financially.

This study highlights BPM practices of business analytics via balanced scorecards (BSCs) and performance dashboards to document, manage, and execute hospital strategy within perioperative processes in an academic medical center. The investigation method covers a longitudinal study of an integrated hospital IS, including an integrated clinical scheduling IS (CSIS). The implementation of the agile CSIS and subsequent contextual understanding of data monitored within hospital processes prescribed opportunity for measured improvements. Specifically, the extension of BSCs and performance dashboards across different managerial levels (e.g. strategic, tactical, and operational) provides a framework to target and measure improvement and evoke process change aligned to hospital strategy via departmental and individual action. The planning and development of the BSCs and dashboards also yield change dynamics for overall hospital performance, while identifying nested hospital process complexities.

The following sections review previous literature on BPM, key performance indicators (KPIs), and healthcare quality measures. Following the literature review, we present our methodology, case study background, as well as observed effects of the BSC and performance dashboard efforts. By identifying a holistic framework for analysis, evaluation, and synthesis between hospital strategy, process metrics, as well as established internal and external benchmarks and improvement techniques, this paper prescribes an a priori environment to support alignment of hospital processes to hospital strategy via targeted improvement. The conclusion also addresses study implications and limitations.

Literature Review

Industry competition, first mover advantage on innovations, adaptation of better management practices, and/or government regulations are examples of the many factors that drive process improvements. Traditionally, the hospital environment lacked similar industrial pressures beyond government regulations. However, hospital administration currently face increasing pressure to provide objective evidence of patient outcomes in respect to organizational quality, efficiency, and effectiveness (CMS, 2005; CMS, 2010; PwC, 2012), all while preserving or improving clinical quality standards. To this end, industrial and operations management practices of BSCs and performance dashboards, borrowed from BPM, provide a framework to target and measure improvement (Jeston & Nelis, 2008; Kaplan & Norton 1996; Tenner & DeToro, 1997).

Business Process Management (BPM)

This study uses the BPM definition provided by Jeston and Nelis (2008, p. 10) as "the achievement of an organization's objectives through the improvement, management, and control of essential business processes." The authors detail how analysis and synthesis are integral to BPM, where there is no finish line for improvement. Hence, this study views BPM as an organizational commitment to consistent and iterative process performance improvement that meets organizational objectives. To this end, BPM embraces redesign concepts of continuous process improvement (CPI), process best practices (PBPs), or business process re-engineering (BPR).

CPI is a systematic approach toward understanding the process capability, the customer's needs, and the source of observed variation. Tenner and DeToro (1997) views CPI as an organizational response to an acute crisis, a chronic problem, or an internal driver. The incremental realization of improvement occurs through an iterative cycle of analysis, evaluation, and synthesis or plan-do-study-act (Walton, 1986) to minimize observed variation. CPI encourages bottom-up communication at the operational level and requires process data comparisons to control metrics. Doubt can exist as to: whether the incremental improvement addresses symptoms versus causes; whether the improvement effort is sustainable; or whether management controls the process (Jeston & Nelis, 2008).

As an alternative to CPI, PBPs can lead to superior performance by offering higher rewards (i.e. 50 percent or less) with similar low risk, moderate costs, as well as longer and more complex implementations (Jeston & Nelis, 2008). PBPs encourage the imitation or adaptation of external best practices coupled with internal expertise. However, PBPs require more resource allocations versus CPI and a higher degree of understanding about the targeted process, which can lead management to under-estimate the resource requirements necessary for success.

BPR offers more radical process redesign, assuming more risk with greater reward potential when compared to CPI or PBPs. Jeston and Nelis (2008) noted three key terms that differentiate BPR from CPI or PBPs—fundamental, radical, and dramatic change. BPR is a project-oriented effort that utilizes top-down improvement, managed by external and internal expertise, to achieve breakthrough improvement. BPR offers the highest reward potential, with upwards of 1,000 percent (Jeston & Nelis, 2008). However, the high potential rewards have very high risk, very high costs, as well as the longest implementation duration and most difficulty. A BPR project requires extensive resource allocations as opposed to CPI or PBPs, as well as seeking an order of magnitude improvement by questioning necessary work relevance and reinventing new ways to accomplish work.

As BPM requires alignment to strategic objectives, a BSC approach (Kaplan & Norton, 1996) embraces the ability to quantify organizational control metrics aligned to strategy across perspectives of: (1) process; (2) customer; (3) financial; and (4) learning/growth. Business analytics is the body of knowledge identified with the deployment and use of technology solutions that incorporate BSCs, performance dashboards and management, definition and delivery of business metrics, as well as data visualization (Turban et al., 2008). Business analytics within BPM focus on the

effective use of organizational data and information to drive positive business action (Jeston & Nelis, 2008). The effective use of business analytics demands knowledge and skills from subject matter experts and knowledge workers. Similarly, Wears and Berg (2005) concur that IS/IT only yield high-quality healthcare when use patterns are tailored to knowledge workers and their environment. Therefore, BPM success through BSCs and performance dashboards has a strong dependence on contextual understanding of end-to-end core business processes (Jeston & Nelis, 2008).

Key Performance Indicators (KPIs)

Performance measurement is essential for purposeful BPM, as information before and after the intervention is an integral part of process improvement. Early in the IT literature, Ackoff (1967) proposed embedding feedback as a control to avoid management misinformation. Consequently, organizations define data metrics as KPIs to assist management in monitoring CSFs for organizational action (i.e. business processes) (Munroe & Wheeler, 1980; Rockart, 1979; Zani, 1970). Similarly, the perioperative process is increasingly information intensive and doubt exists as to whether management can meet the demands for cost effectiveness (Catalano & Fickenscher, 2007), in part due to perioperative processes complexities (Fowler et al., 2008). For example, operating room (OR) schedules are tightly coupled to an individual OR suite, patient, and surgeon. When preoperative tasks are incomplete or surgical supplies/instruments/devices or personnel are not readily available at time of surgery, the scheduled case is delayed as well as the subsequent scheduled cases in the particular OR suite or for the particular surgeon.

Operational and tactical KPIs in managing and optimizing a hospital's perioperative process are numerous, but should include: (1) monitoring the percentage of surgical cases that start on-time (OTS) or first-of-the-day surgical case on-time starts (FCOTS), (2) OR turn-around time (TAT) between cases, (3) OR utilization (UTIL), and (4) labor hours per patient care hours as expended units-of-service (UOS) (Herzer et al., 2008; Kanich & Byrd, 1996; Peters & Blasco, 2004; Tarantino, 2003; Wright et al., 2010). Tarantino (2003) noted how lower OR TAT and a flexible work environment are CSFs for physician satisfaction, which in turn is a CSF for hospital margin. In contrast, inefficient and ineffective processes yield poor operational and tactical KPI metrics (i.e., OTS, TAT, UOS, or UTIL) that affect strategic CSFs of patient safety, patient quality of care, surgeon/staff/patient satisfaction, and hospital margin (Marjamaa et al., 2008; Peters & Blasco, 2004).

Healthcare Quality Benchmark Standards

Healthcare industry benchmark standards focus on patient quality of care via self-reported outcome measures or patient satisfaction survey results that have evolved over time. The CMS and the Hospital Quality Alliance (HQA) began publicly reporting inpatient quality reporting (IQR) outcomes on 30-day mortality measures for acute myocardial infarction (AMI) and heart failure (HF) in 2007 and for pneumonia (PN) in 2008 (CMS, 2010). Patient satisfaction measures began development as the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey in 2002, under the collaboration effort between CMS and the Agency for Healthcare Research and Quality (AHRQ), both under the Department of Health and Human Services. The evolved HCAHPS survey measures report patient perspectives on care received across items that encompass ten key topics: (1) communication with doctors, (2) communication with nurses, (3) responsiveness of hospital staff, (4) pain management, (5) communication about medicines, (6) discharge information, (7) cleanliness of the hospital environment, (8) quietness of the hospital environment, (9) overall rating of the hospital, and (10) whether the patient would recommend the hospital to family and friends (HCAHPS, 2012).

CMS (2005) began encouraging improvements in Medicare beneficiaries' quality of care via pay-for-performance (P4P) or value-based purchasing (VBP) as a CMS payment model that rewards healthcare providers for meeting certain performance measures in quality and efficiency. Interestingly, a study found hospitals that were reporting P4P metrics achieve modestly greater quality improvements than hospitals engaged only in public reporting (Lindenauer et al., 2007). As an additional rule to P4P, CMS included disincentives of reducing payments for negative consequences of care that should never occur, as defined by the National Quality Forum, including hospital infections under the surgical care improvement project (SCIP) (NQF, 2008).

Methodology

The objective of this study is to examine BPM practices of business analytics via BSCs and performance dashboards within hospital core processes that target and measure improvement opportunities via departmental and individual action aligned to hospital strategy. To this end, case research is particularly appropriate (Eisenhardt, 1989; Yin, 2003). Paré (2001) recommended using a positivist case study methodology to build and test theories in IS research. A positivist approach in case research allows focus and analysis of the associated qualitative problems and environmental complexity (Weber, 2004). Hence, our study took an in-depth case research approach.

Our research site (e.g. University Hospital) is an academic medical center, licensed for 1,046 beds and located in the southeastern United States. University Hospital is a Level 1 Trauma Center, with a robotics program across eight surgical specialties as well as a Women's/Infant facility. University Hospital's recognition includes Magnet since 2002 and a Top 100 Hospital by U.S. News and World Report since 2005. Concentrating on one research site facilitated the research investigation and allowed collection of longitudinal data. This research spans activities from

August 2003 through January 2016, with particular historical data since 1993. During the 150-month study, we conducted field research and collected data via multiple sources including interviews, field surveys, site observations, field notes, archival records, and document reviews.

Case Background

Perioperative Services (UHPS) is the University Hospital department designated to coordinate and manage perioperative patient care across Pre-admissions, Admissions, Surgical Preparations (PRE-OP), Central Sterile Supply (CSS), OR Surgery and Endoscopy, and Post Anesthesia Care Units (PACU). The workflow through CSS reprocesses all reusable surgical instruments/devices and moves supplies to pre-operative, intra-operative, and post-operative activities. The following sections highlight tools, events, and outcomes that have shaped the UHPS BPM approach.

CSIS Implementation

UHPS implemented a new, agile CSIS in 2003, after using its prior CSIS for 10 years. The new CSIS supports OLAP tools, a proprietary structured query language, and both operational and managerial data stores (i.e., an operational and a separate perioperative data mart). Flexible routing templates or surgical preference cards (SPC) allow standardization of surgical care data (i.e., particular supplies and instruments needed) or SPC customization for specific surgeons and/or procedures. Since the CSIS implementation, over 7,750 generic and custom SPC configurations facilitate the surgical specialty services (SSS) represented in Table-1. Similarly, the agile CSIS data marts serve as the central repository for perioperative process data used to support improvement initiatives.

Surgical Specialty Service (SSS)	SPCs
BURN – Trauma burns	26
CARDIO –Cardiovascular & Thoracic	946
ENT – Ear, Nose, & Throat	1,030
GI – Gastro-intestinal	460
GYN – Obstetrics, oncology, incontinence	611
NEURO – Neurological	763
ORAL - Oral Maxil Facial	236
ORTHO – Orthopedic, joint/device	1,208
PLAS – Plastic surgery	681
SURG ONC – Surgical oncology	329
TX – Transplants (liver, renal)	194
TRAUMA – Trauma, MASH	203
URO – Urology	533
VASCULAR – arteries & blood vessels	558

Table 1 – Current SSSs and CSIS SPCs

November 2004

University Hospital built a new diagnostic and surgical facility (e.g. North Pavilion) that opened in November 2004. UHPS relocated CSS onto one floor (e.g. 3rd) with Pre-OP, ORs, and PACU on each of the two floors above CSS (e.g. 5th and 7th). The North Pavilion campus expanded UHPS to cover an additional floor and nine ORs (i.e., 33% capacity increase) to provide 40 state-of-the-art OR suites, each having new standard as well as surgical specialty equipment. Within six weeks of occupancy, a scheduling KPI reflected chaos. Surgical case OTS plunged to 18% during December 2004. Having only 18% OTS is unacceptable in a highly competitive hospital industry, as 82% of scheduled surgeries experience delays and risk patient care and safety.

In January 2005, UHPS expressed concerns before a quickly convened meeting of c-level officers and top nursing, surgeons, and anesthesia representatives. The meeting yielded a hybrid management structure and governance in the formation of a multidisciplinary executive team, chartered and empowered to evoke change. The executive team consisted of perioperative stakeholders (i.e., surgeons, anesthesiologists, nurses, and UHPS). The executive team's charter was to focus on patient care and safety, attack difficult questions, and remove inefficiencies. No issue was off-limits.

Perioperative Process Improvements

University Hospital's executive team launched a process improvement effort in 2005 to address the perioperative crisis. This CPI effort resulted in the executive team enlisting numerous task forces to address specific problems and opportunities, which became the foundation for their current BPM approach. Since 2005, UHPS has focused data-driven analysis of KPIs to gauge process variance, identify improvement opportunities from variances, and improve end-to-end workflow. Using this systematic BPM approach, improvement efforts have targeted various activities and areas within the perioperative process and sub-processes as identified in Table 2.

In 2009, UHPS expanded its management beyond the initial 32 general ORs (GENOR) and 8 cardio-vascular OR suites (CVOR) within the North Pavilion campus to the other campuses of University Hospital Health System (UHHS) OR facilities including 16 OR suites at the Highland campus (HHOR) and 8 endoscopy labs at the TK Clinic campus. In 2011, UHPS also assumed management of the preoperative assessment, consultation, and treatment (PACT) clinic to manage the preoperative patient flow into UHHS ORs. Two additional general ORs have been equipped since 2013 at the North Pavilion campus to bring UHPS management to 58 ORs and 11 endoscopy labs.

Perioperative Process Improvement Project	Fiscal Year
Implemented the current CSIS	2003
Relocated CSS and ORs to North Pavilion Building	2004
Changed governance—initiated CPI effort via soft innovations	*2005*
Initiated OR modified block / heuristic scheduling rules and periodic reviews	2006
Addressed hospital-wide patient flow via project Impact (EMR, patient tracking, CPoE, etc.)	2007
Established perioperative performance reporting at strategic, tactical, and operational levels	2008
Developed a preoperative assessment, consultation, and treatment (PACT) clinic	2011
Began RFID phased implementation across intra-operative activities	2012
Implemented a redesigned supply/instrument/device CSS-to-OR-to-CSS workflow	2013
Completed automation of unit-of-service CSIS charge capture via EMRs	2014
Enhanced CSS instrument/device reprocessing and tracking	2015
Initiated web-enabled real-time operational OR performance dashboards	2016

Table 2 – Perioperative Process Improvement Timeline

Observed Effects

The identification and definition of perioperative KPIs, as well as other core UHHS process metrics, has been an iterative evolution for hospital and UHHS administration since 2005. A consistent focus has been on data-driven, end-to-end process improvements, with process control measures collected through the CSIS and benchmarked to external industry standards or prior months' metrics. While reviewing what could have been done better during the initial process improvement efforts, administration recognized the need to involve perioperative stakeholders in the entire improvement efforts and not just end-result to-do lists. Consequently, the executive team launched an initiative in 2008 to begin the categorization, qualification, and quantification of perioperative process measures for performance management and control feedback as well as meet regulatory requirements for CMS and TJC. The perioperative BPM effort established BSC (e.g. process, customer, and financial) measures and a means to disseminate the process feedback to perioperative stakeholders at strategic, tactical, and operational levels. The BPM approach was expanded in FY2010 to reinforce UHHS strategy across all core hospital processes, since perioperative is one of several core hospital processes. After an introduction to the overall UHHS strategy that drives the BPM approach, the following sections detail how UHHS strategic goal alignment occurs within the perioperative process via strategic, tactical, and operational BSCs and performance dashboards.

UHHS Strategy—AMC21

Updated in 2010 and labeled AMC21, UHHS' strategic vision reaffirms the core healthcare industry quality standards coordinated and adopted by CMS and TJC, while complimenting core hospital process measures.

> *UHHS will be the preferred academic medical center of the 21st century with characteristics where: a) patients want to come for care; b) employees want to work; c) faculty want to practice and conduct research; d) students, residents, and fellows want to learn; e) and donors want to give to a better future.*

Table 3 lists the pillars that support AMC21 goals, which enable the realization of AMC21 vision. The four pillars are perspectives or lenses to view the accomplishment of AMC21 strategic goals while achieving the AMC21 vision, where the pillars also map to the four perspectives of a BSC approach: 1) process (e.g. quality); 2) customer (e.g. satisfaction); 3) financial (e.g. financial performance); and 4) learning/growth (e.g. knowledge advancement).

AMC21 Pillars	AMC21 Goals
▪ Quality ▪ Satisfaction ▪ Financial Performance ▪ Knowledge Advancement	1. Delivering Outstanding Patient Care 2. Developing advancements in scientific discovery and biomedical research 3. Providing a strong foundation of education and training for professionals

Table 3 – UHHS AMC21 Pillars and Goals

AMC21 Reach for Excellence (RFE) Goal Setting

To align departmental and stakeholder efforts with AMC21 strategy, UHHS administration implemented an intranet-based goal setting and reporting tool to leverage existing process data via integrated IS and provide an extended business intelligence application layer. The "Reach for Excellence" (RFE) layer provides an annual process management review capabilities for qualitative and quantitative measures, across UHHS, that are measurable and aligned through AMC21 pillars to support AMC21 goals and vision. The purpose for the RFE layer is to provide a

more objective tool to measure process and stakeholder performance toward tactical and operational efforts in support of AMC21 strategy.

RFE goals are quantitative and designed to measure objective outcomes. Rather than identify tactics, projects, or activities, RFE goals, as objective outcomes must be aggressive and realistic, where fewer is better. RFE goals will change focus as AMC21 progress advances. Consequently, each year UHHS administration reviews opportunities for improvement and identifies the most important outcomes needed. Many goals do not change each year as they are important outcomes for success. However, the iterative nature of the goal setting process yields more aggressive targets for those familiar goals. Hence, administrators set RFE goals so stakeholders focus on specific efforts and the targeted RFE outcomes align to AMC21 strategy via stakeholder action—a very powerful process management tool.

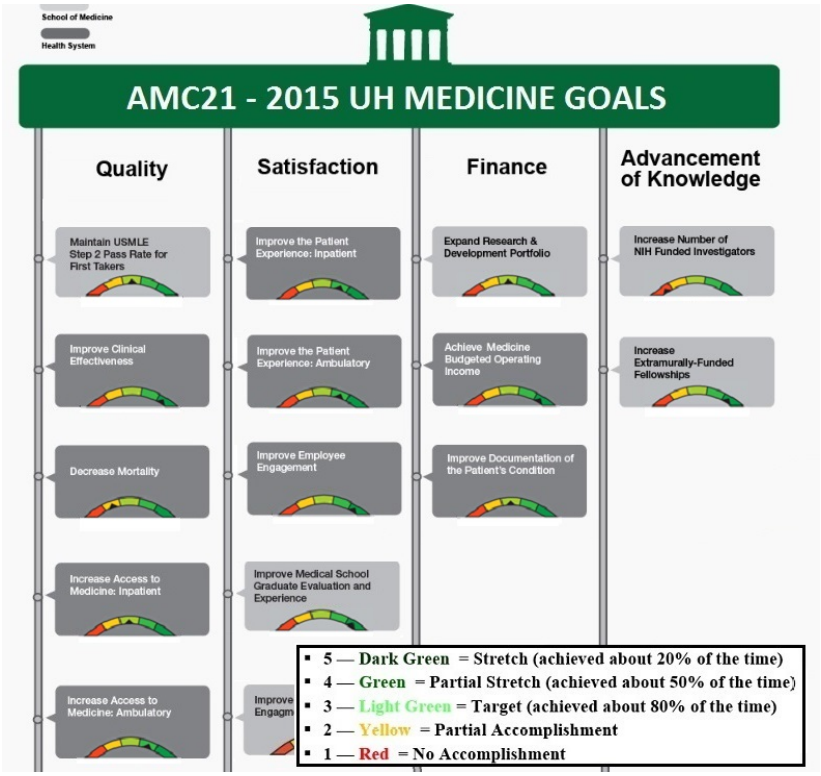

Figure 1 – AMC21 FY2015 RFE Goals

Figure 1 illustrates the AMC21 dashboard reflecting FY2015 (October 2014 to September 2015) UHHS RFE goals aligned via pillars to support AMC21 strategy. The School of Medicine goals (6) are distinguishable from UHHS (9) and each goal carries a color-coated rating and indicator on performance.

Tactical Performance Dashboards

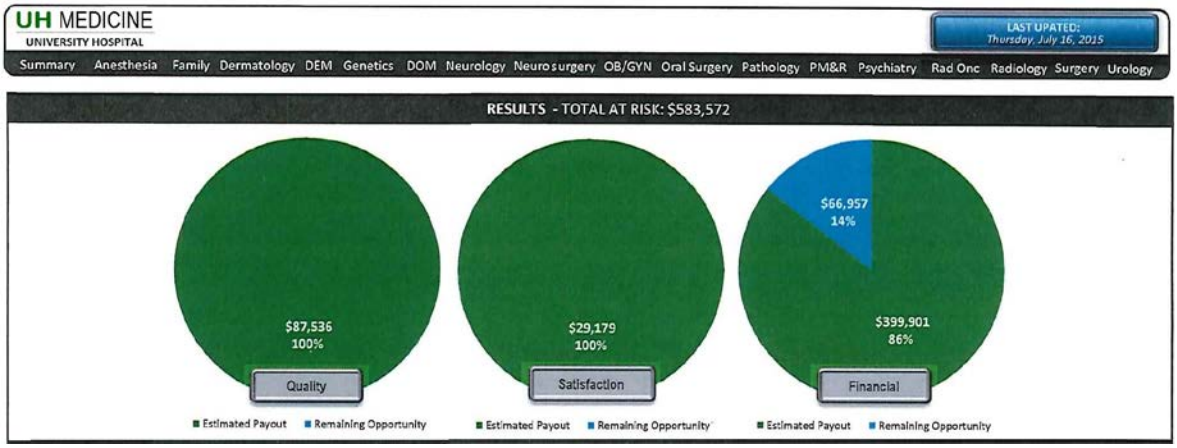

Figure 2 – FY2015 AMC21 RFE Performance Dashboard for a SSS Department

Individual department and employee goal setting towards achieving AMC21 RFE goals is a formalized activity integrated into UHHS departmental resource budgeting as well as individual employee evaluation and performance reviews. To this end, all hospital departments and process stakeholders (e.g. physicians, surgeons, nurses, staff, and administrators) have action plans that map to tactical AMC21 RFE goals and align through pillars to ultimately realize AMC21 goals and vision. Departmental budget funding is a function of how well the department met RFE departmental goals. Similarly, employee merit increases are linked to individual employee's RFE goal attainment.

Figure 2 depicts a RFE performance dashboard for a SSS department during early Q4 FY2015. This SSS departmental budget had $583, 572 set to be earned (e.g. At-Risk) via RFE target achievement. As of mid-July, all of the department's quality ($87,536) and satisfaction ($29,179) targets were met, as well as 86% of the financial ($399,901) targets. The remaining 14% ($66,957) of the financial RFE target payout was at risk unless specific RFE financial targets were met during Q4.

FINANCIAL

INDICATOR	FY15 METRIC GOAL / TARGET	FY15 FINAL MEASUREMENT PERIOD	BASELINE RESULTS & PERIOD	CURRENT RESULTS	CURRENT MEASUREMENT PERIOD	CURRENT STATUS	ESTIMATED FY15 PAYOUT
HOSPITAL CARE DELIVERY (a): OR Cases (UH and Hinds combined)	Increase overall fiscal year budgeted surgery cases: Level 3 [$200,000]: Increase over 5% Level 2 [$150,000]: Increase 3-5% Level 1 [$100,000]: Increase 1-2% FLAT [$50,000]: Baseline FY15 Budget	FYTD Aug-15	FY15 Budget: 33,040	Actual 24,595 | Budget 24,290 | Variance 305; 1.26% increase	FYTD Jun-15	MET - LEVEL 1	$ 100,000
HOSPITAL CARE DELIVERY (b): On Time Starts (UH and Hinds combined)	Increase the percent of on time starts for the first cases: Level 3 [$50,000]: ≥ 90 Level 2 [$37,500]: 89 - 85 Level 1 [$25,000]: 84 - 80	FY15 Q3 (4/1/15 - 6/30/15)	FY14 Q4: 79.67%	91.19%	FY15 Q3	MET - LEVEL 3	$ 50,000
HOSPITAL CARE DELIVERY (c): Patient Out to Cut	Reduce time from patient out to cut of next patient: Level 3 [$75,000]: Avg turntime of 1:44 Level 2 [$50,000]: Avg turntime of 1:51 Level 1 [$25,000]: Avg turntime of 1:58	FY15 Q3 (4/1/15 - 6/30/15)	FY14 Q4: 2hrs 0mins*	1 hr 55mins	FY15 Q3	MET - LEVEL 1	$ 25,000
HOSPITAL CARE DELIVERY (d): Block Release Time	Continual adherence to policy created April 2014 [$25,000]	By 8/31/15	Block Release Policy Adopted April 2014	Currently Adhering to Policy	FYTD Jun-15	MET - FLAT	$ 25,000
HOSPITAL CARE DELIVERY (e): Timely Discharge Orders	Increase the number of discharge orders signed prior to 10 AM for the Dept-007 Discharge Service: Level 3 [$50,000]: 65% Level 2 [$37,500]: 60% Level 1 [$25,000]: 55%	3 months ending 8/31/15 (6/1/15 - 8/31/15)	FY14 Q4: 54.42%	67.38%	Rolling 3 months ended 6/30/15	MET - LEVEL 3	$ 50,000
RESOURCE UTILIZATION (e): Cost Reduction on specific supplies	Department will work with Perioperative Services to determine cost savings opportunities. Savings will be calculated by Perioperative staff and split 50/50 with the hospital.	By 9/30/15		$12,401 | Savings based on Hemostatic agent spend 5/2 - 6/19/15	As of 6/22/15	MET - FLAT	$ 12,401
AGGREGATE DOCUMENTATION SCORE	Increase Aggregate Documentation Improvement Score ≥ 15 based on results: Level 3 [$50,000]: ≥ 21 Level 2 [$37,500]: 19-20 Level 1 [$25,000]: 15-18	FY15 Q2 - Q3 (1/1/15 - 6/30/15)	FY14 Q2-Q3: 15	20	FY15 Q2	MET - LEVEL 2	$ 37,500
AMBULATORY ACCESS (a): Arrived Appointments	Increase the total number of patients seen (arrived) in FY15 compared to total number of patients seen (arrived) in FY14: Level 3 [$50,000]: ≥ 3% increase Level 2 [$37,500]: 2 - 2.99% increase Level 1 [$25,000]: 1 - 1.99% increase	FYTD Jun-15	FYTD Jun-14: 9,350	10,411 | 10.87% increase over baseline	FY15 Q1-Q3	MET - LEVEL 3	$ 50,000
AMBULATORY ACCESS (b): % Bumped w/in 30 Days	Reduce the number of bumped appointments within 30 days to ≤ 2%: Level 3 [$50,000]: ≤ 2% Level 2 [$37,500]: 2.01% - 3% Level 1 [$25,000]: 3.01% - 5%	FYTD Jun-15	FYTD Jun-14: 1.0%	1.56%	FY15 Q1-Q3	MET - LEVEL 3	$ 50,000
							$ 399,901
							MAX FINANCIAL PAYOUT: $466,858

Figure 3 – FY2015 AMC21 RFE Financial Pillar Targets for a Specific SSS Department

Drilling into any of the pillar pie charts on Figure 2 shows the associated target details (e.g. KPI details) and estimated payout to date. Most RFE targets have multiple levels with the budget payout determined by the level achieved. Figure 3 depicts nine RFE financial targets this particular SSS department had achieved, which accounted for the $399,901 payout. The four white-highlighted targets map to the RFE goal of "Improve Documentation of the Patient's Condition" and the four pink-highlighted targets map to the RFE goal of "Achieve Medicine Operating Income," both under the financial pillar from Figure 1. The one gray-highlighted target is a resource reduction cost improvement where the department keeps 50% of the savings and maps it to the latter RFE financial goal.

The SSS department's RFE performance depicted in Figure 2 earned 5% ($29,179) of the "At-Risk" budget ($583,572) from satisfaction surveys returned by hospital and SSS clinic patients. SSS clinic patients receive CGCAPHS surveys relative to the SSS clinic and physician group the patient attended, while hospital patients receive HCAPHS surveys for their hospital stay. Figure 4 depicts the quarterly results of HCAPHS patient surveys through mid-July 2015 as well as the multi-level target thresholds, where below threshold scores are red and above threshold scores are green.

Subject: Weekly HCAHPS Update

FY15 Goal:

High Performance: 9 domains ≥ 50th percentile + 7 domains ≥ 75th percentile
Above Target: 9 domains ≥ 50th percentile + 6 domains ≥ 75th percentile
Target: 9 domains ≥ 50th percentile + 5 domains ≥ 75th percentile
Threshold: 9 domains ≥ 50th percentile + 1-4 domains ≥ 75th percentile
Below Threshold: Any domains ≤ 50th percentile

Areas of greatest focus: Resoponse domain: we will continue to monitor the communication about meds domain and will begin to report by unit if it continues to score lower than recent trends

Current Performance: Target

Current Measurement period: FY15 Q4 – Surveys received between 7/1/15 – 9/30/15

Domain	FY15 Q1	FY15 Q2	FY15 Q3	FY15 Q4TD
Nurses always communicated well	78th	78th	78th	70th
Doctors always communicated well	80th	74th	83rd	80th
Patients always received help quickly	51st	45th	55th	51st
Pain was always well controlled	76th	69th	73rd	69th
Staff always explained about meds	80th	74th	77th	53rd
Room/bathroom kept clean and area around room quiet	73rd	72nd	70th	76th
Yes patient given info about discharge/recovery	66th	60th	57th	65th
Care transition	87th	88th	82nd	82nd
Patient's overall rating of hospital (9&10)	89th	90th	90th	88th

Figure 4 – FY2015 HCAHPS Targets & Scores

The SSS department from Figure 2 and Figure 3 received an "At-Target" rating for the hospital's HCAPHS scores in FY2015 Q3. Figure 4 defines each of the 9 HCAPHS survey domains and the relative percentile responses for FY2015. As depicted in Figure 4, nine of the domain scores for Q3 were greater than the 50th percentile and five domain scores were greater than the 75th percentile—yielding the $14,589 satisfactory target payout (50%). The other 50% of the satisfactory target payout

($14,589) was for level one performance on CGCAPHS scores during FY2015 Q3 where three domains were greater than the 50th percentile. CGCAPHS and HCAPHS targets align with RFE goals "Improve the Patient Experience: Inpatient" and "Improve the Patient Experience: Ambulatory." Both goals are under the satisfaction pillar in Figure 1.

The quality targets payout ($87,536) from Figure 2 was 15% of the SSS department's "At-Risk" budget, which was met over four targets (e.g. target specifics intentionally blinded). Three of the targets ($75,000 combined) map to the RFE goal of "Improve Clinical Effectiveness." The remaining target ($12,536) maps to the RFE goal "Decrease Mortality," and both RFE goals are listed under the quality pillar in Figure 1.

Operational Perioperative Performance Dashboards

Before FY2016, UHPS tallied perioperative BSC measures into electronic dashboards and pushed the results out to stakeholders. Figure 5 depicts an on-demand dashboard query of January 2016 UHHS OR case scheduling metrics. For a given time period (e.g. real-time to historical) and a location, OR room, or SSS, the dashboard query will visualize the OR case scheduling metrics as well as FCOTS and subsequent OTS. Complete cases are verified by UHPS. Also, the add-on case gauge reflects the criticality of 25% add-on case volume to resource capacities. "Case Cancelled on DOS" is a Pareto chart identifying surgeons who have the most cases cancelled on the day the surgery was scheduled to occur. The "Patients entering PACU" graph depicts cumulative peak volume times of OR patients entering post-anesthesia care over a 24-hour frequency. Lastly, the "Number of Cases with Late Starts" is a Pareto chart identifying surgeons with the highest surgical cases that did not start according to the OR scheduled time. Targets associated with OR case scheduling metrics from Figure 5 map to the SSS department's RFE finance targets on Figure 3 and to the two UHHS financial pillar RFE goals on Figure 1.

Figure 5 –Performance Dashboard for OR Case Scheduling

Additional operational dashboard queries measure perioperative performance beyond OR Scheduling. The real-time dashboards reflect operational performance across PACT, Pre-OP, Intra-OP, PACU, CSS, and UHPS Clinical Quality (UHPS CQ) from CSIS data within the RFE business intelligence layer. Table 4 lists the additional KPIs visualized.

PACT	Pre-OP	Intra-OP	PACU	CSS	UHPS CQ
% Patients Seen	Length of Stay	OR Utilization	Length of Stay	# Immediate Use Sterilization	SCIP Measures
% Walk-ins	Arrival Time	Block Utilization	# of Patient Holds	Damaged Tray Rates	Patient Back within 24 Hours
% Patient No Shows	% Missing Evaluations	OR TAT	Bed Assigned to Ready to Move	PM Plan Adherence Rates	Deaths within 48 Hours
Missing Documents	Delay Reason	In Room to Cut Time	Ready to Sign Out to Sign Out	Trays over 25 lbs.	OR Procedure exceeds consent
PACT Volume		Case Duration Estimate	Ready to Move to Occupy Bed	Vendor Tray Non-Compliance	Emergencies
Appointment Length		Average Delay Minutes		SPC Update Reviews	Reintubation in PACU

Table 4 –KPIs Visualized in Other Perioperative Performance Dashboard Queries

Observed BPM Framework

The strategic, tactical, and operational execution of AMC21 goals via RFE targeted outcomes of stakeholder efforts has evolved since AMC21 began in FY2010. Figure 6 depicts how UHHS positions BPM techniques to align its processes with its strategy. UHHS developed and maintains its AMC21 mission, vision, and core goals outside the scope of

BPM. Hospital processes flow across UHHS and provide the workflow channels where clinical outcomes occur, collected by the integrated CSIS and other UHHS IS as process data, which reflect associated UHHS stakeholder efforts. BPM techniques at the operational level measure and monitor KPIs of core and ancillary hospital processes across performance dashboards to evaluate clinical outcomes against targeted benchmarks to maintain or improve results.

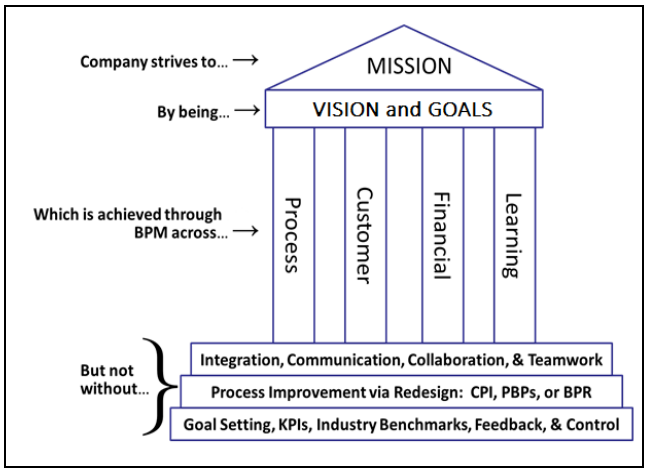

Figure 6 – BPM Framework Aligned to Strategy

RFE goals reflect annual AMC21 priorities via BSC pillars. UHHS administrators identify RFE goals so stakeholders will focus on specific efforts and achieve targeted RFE outcomes, aligning stakeholder efforts to AMC21 priorities. Departmental and individual targeted RFE outcomes reflect AMC21 goal priorities with associated monetary payout incentives, providing pay for performance similar to the CMS. Process feedback and data-driven analysis of KPIs occur across operational, tactical, and strategic levels to encourage multi-level BPM engagement to identify and introduce RFE goal priorities, industry benchmarks, targeted outcomes, and associated payouts.

Given sufficient BPM engagement with AMC21 priorities and RFE payout incentives, departmental and individual stakeholders focus their efforts toward targeted outcomes across BSC pillars to achieve targeted performance aligned to AMC21. Using this systematic and multi-level BPM approach, process improvement interventions also occur within particular lower-performing processes to target specific improvements as identified bottom-up and/or top-down by process stakeholders, subject matter experts, knowledge workers, and UHHS administration. BPM across BSC pillars and successful process improvements yield targeted performance and change aligned to AMC21 strategy.

Conclusion

Empowered individuals, integrated IS, and a holistic framework for BPM aligned to hospital strategy allows UHHS administration to direct strategic, tactical, and operational performance. The BPM approach via RFE goal measures and targets, BSCs, and performance dashboards give departmental and employee stakeholders process performance feedback and focus via an end-to-end (e.g. holistic) view through quality, satisfaction, and financial perspectives as well as alignment of day-to-day actions to overall hospital strategy. To this end, stakeholders understand improving the quality within hospital processes improves clinical effectiveness of patient outcomes to ultimately decrease patient mortality rates. Similarly, patients are customers who realize multiple experiences during their hospital stay which impact their opinions and overall customer satisfaction. Furthermore, revenue or profit margins are clearly financial, as well as increasing the number of patient discharges prior to 10 AM, adherence to OR Block Release Time policy, or increasing the number of FCOTS within a given SSS.

Adopting the holistic BPM framework for RFE goal setting and performance targets at departmental and individual levels further educates hospital stakeholders on the benefits of strategic alignment as well as process measurement, control, and improvement. The cycle of analysis, evaluation, and synthesis within the BPM framework reinforces communication and stimulates individual as well as departmental and collective organizational learning.

Our case study contributes to the healthcare IT literature by examining how CPI, KPIs, BPM, BSCs, performance dashboards, and strategic alignment are applicable to the hospital environment. This study also prescribes an a priori BPM framework to foster their occurrence. Additionally, this paper also fills a gap in the literature by describing how hospital process data is both a performance measure and a management tool.

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 healthcare process management methodology, comprehension, and extension. The study's results should be viewed as exploratory and in need of further confirmation. Researchers may choose to further or expand the investigation; while practitioners may apply the findings and KPIs to create their own version of process management, control, and improvement within the hospital environment.

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