2012

Requisites and Best Practices in the Implementation of Lean Principles Applied to Hospital Quality Improvement Initiatives

Chris Bretl
Grand Valley State University, cebretl@gmail.com

CIS 691 MBI Capstone
Requisites and Best Practices in the Implementation of Lean Principles Applied to Hospital Quality Improvement Initiatives

Chris Bretl

Abstract

Since the 1980s there has been an explosion in the use of formalized methodologies for increasing quality and efficiency. Methods outlined by philosophies such as Total Quality Management (TQM), Six Sigma, Lean, and ISO 9001 have yielded great returns in the manufacturing environment. These techniques have proven successful in reducing costs, increasing production, and improving quality in both manufacturing and service environments. After several generations of exposure to similar yet distinct philosophies of quality management, several hybrid methodologies have arisen to leverage the strength of two or more systems simultaneously (Dahlgaard and Dahlgaard-Park, 2006; Karthi *et al.,* 2011).

Since health care has become an area of continued attention in the pursuit of reducing government waste, it is a natural candidate for the application of the systematic and data driven techniques defined by TQM, Six Sigma, Lean, and ISO 9001 philosophies. The nature of healthcare as a service necessary for wellbeing, the presence of 3rd party payers, and the non-employee relationship between hospitals and healthcare providers contribute to presenting unique challenges when implementing quality improvement initiatives. This paper performs a literature review of the relationship between quality management practices and their effects on quality outcomes focusing on the unique challenges to implementing quality improvement initiatives in a healthcare setting. An approach is suggested using elements of TQM to create a standardized management structure and organizational focus (Irani et al., 2004; Taveira et al., 2003), lean to identify waste, six sigma to reduce redundancy and monitor processes so that small tests of change can be effectively monitored via the Plan Do Check Act (PDCA) cycle, and ISO 9001 to ensure that monitored processes are documented and enforced.

Previous studies have shown Baldrige Award (for Performance Excellence) winning hospitals to have better patient safety records than similar hospitals that have not won the Baldrige Award (Denney et al., 2009; Foster, 2011). We continue this investigation by comparing patient safety in hospitals that choose DNV accreditation to hospitals that choose another accrediting body. The DNV hospital accreditation organization "seamlessly introduces ISO 9001 quality methods into the hospital setting." If the assumption is made that hospitals focused on standardization and process oriented quality improvement initiatives would choose the accreditation agency most closely aligned with its quality improvement philosophy, then DNV accredited hospitals would represent a more process-oriented population than their peers. This paper investigates whether a hospital's investment in a formalized methodology of quality improvement translates into better performance on select AHRQ and SCIP measures of patient safety, patient satisfaction via the HCAPS survey, readmission rates for select conditions, and hospital acquired conditions by comparing DNV accredited to non-DNV accredited hospitals.

Background

Many cite the inception of total quality management with a specific publication such as '*The Principles of Scientific Management*' by Frederick W. Taylor In 1911. Others would only include later more comprehensive works such as those developed in the 40s by Americans such as Deming, Juran and Feigenbaum using Japan as a laboratory and proving ground for their ideas. Still others would only consider incarnations of these principles arising from modern organizations present in the current

market valid, such as the Six Sigma system developed by Motorola in the 1980s. The 1990s brought the Lean methodology stemming from the Toyota total production system, where even human intervention was pushed through the sieve of waste reduction. This paper seeks to bring the goal and tacit knowledge of each method under common roof referred collectively as Process-oriented quality management (PQM) . The principles underlying each of these techniques represent objective fundamentals in the goal of maximizing the ratio of reward to effort. The progression and refinement of explicit knowledge in these areas is not representative of competing philosophies, but rather a hill climbing toward a global maxima in fitting specific techniques to a hidden and highly dimensional ideal. For this reason, the management architectures discussed below are not considered distinct or even milestones, but rather a progression along a gradient with each of the methods having highly overlapping borders with the others. In this way PQM begins with the perfecting of the hand axe by Paleolithic man, progresses through the industrial revolution, and comes of age in the modern incarnation of precise analysis and disambiguation.

Any system of quality management is implemented via the acquisition, acceptance, and dispersion of knowledge. At the core of successful business implementations of quality management philosophies are individuals with a common understanding, vocabulary, and motivation to effect change in their organization. Before the efficacy of a methodology can be evaluated, there must be a reductionist elucidation of the functional components that fall under a common moniker. We investigate TQM, LEAN, SIX SIGMA, and ISO9001 with the goal of understanding explicit knowledge of the practices and tools used in their implementation. Since adaptation of specific cases and generalization is needed for philosophies underlying the tools and methods to be applied across companies and industries with distinct cultural, economic, and organizational makeup, tacit knowledge is also addressed with the goal of providing a generalized framework for the application in the healthcare industry.

Proponents of differing schools of quality management, often fueled by consulting firms specializing in one philosophy or another, often cite the differences in quality management regimens in order to bolster the results of the training or certification they have to offer over competing schools of thought. This out with the old in with the new sales pitch has left many who have been present for more than one quality paradigm shift with the feeling of being sold the “same old wine in new bottles”

Since there is often a financial incentive to portray the system of guiding principles, techniques, and tools as being unique and novel, there is a force internal or external of company management to buy in whole heartedly to a single program. This paper views the common goals of customer focused reduction of waste through consistent executive and managerial goals by focusing on processes and implementing standardization and measurement to be the result of using a synthesis of PQM methods.

TQM:

The Primary strength of TQM is in the mature management structure developed by soliciting data and feedback from front line personnel. Successful implementation of a quality improvement initiative requires buy in from the top executive layer to provide the necessary human and capital resource. In fact, executive buy-in has been shown to significantly correlate with outcome measures of hospital performance in the Italian health system (Macinati, 2008). According Hayes (2007) “executive engagement is one of the most critical factors for Six Sigma to succeed.”

There should also be substantial acceptance and contribution from the front line staff. This coherence of mission is fostered under TQM by setting “Core Values” that represent the shared observations and

tacit knowledge of all levels in the corporation. TQM makes the assumption that employees want to do a good job, and will seek to find ways to better service the customer if they are empowered to do so. In TQM management feedback is solicited from those closest to the process. The involvement front line staff in quality improvement initiative decision making ensures that there is a homogonous dedication to the patient. The lack of such involvement can lead to the view that quality improvement is being forced upon staff by administrators that are out of touch with the reality of day to day operations. This can lead to poor staff compliance. The original 14 points made by Deming are summarized below.

The 14 points. Summarized by the Edward Deming institute http://deming.org below

1. Create constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business, and to provide jobs.
2. Adopt the new philosophy. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.
3. Cease dependence on inspection to achieve quality. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.
4. End the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
5. Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
6. Institute training on the job.
7. Institute leadership (see Point 12 and Ch. 8). The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.
8. Drive out fear, so that everyone may work effectively for the company (see Ch. 3).
9. Break down barriers between departments. People in research, design, sales, and production must work as a team, to foresee problems of production and in use that may be encountered with the product or service.
10. Eliminate slogans, exhortations, and targets for the work force asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force.

    - Eliminate work standards (quotas) on the factory floor. Substitute leadership.
    - Eliminate management by objective. Eliminate management by numbers, numerical goals. Substitute leadership.
11. Remove barriers that rob the hourly worker of his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality.
12. Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, inter alia, abolishment of the annual or merit rating and of management by objective (see Ch. 3).
13. Institute a vigorous program of education and self-improvement.
14. Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

Six Sigma

Six Sigma seeks to bring about process change by focusing on the reduction of variation and redundancy. The goal of achieving a six standard deviation between the mean and the control limit is accomplished by making sure the process is performed the same way every time and that a steady flow of raw material or input information is supplied. In this way, the standard deviation is dramatically reduced allowing for scientific measurements to be observed. Testing the effects of change on a chaotic system do not yield meaningful results, Six Sigma empowers Deming's plan do check act (PDCA) cycle with a standardized process that will react in a controlled way to change. These changes are monitored with simple statistical display tools such as the family of statistical process control charts (SPC).

Six Sigma utilizes specially trained embedded personal certified to apply statistical techniques to process improvement. Summarized roles can be found below
(*Six Sigma Roles and Responsibilities* WWW.Isixsigma.com)

- ☐ Sponsor: Senior executive who sponsors the overall Six Sigma initiative.
- ☐ Leader: Senior-level executive who is responsible for implementing Six Sigma within the business.
- ☐ Champion: Middle- or senior-level executive who sponsors a specific Six Sigma project, ensuring that resources are available and cross-functional issues are resolved.
- ☐ **Black Belt** : Full-time professional who acts as a team leader on Six Sigma projects. Typically has four to five weeks of classroom training in methods, statistical tools and sometimes team skills.
- ☐ **Master Black Belt** : Highly experienced and successful Black Belt who has managed several projects and is an expert in Six Sigma methods/tools. Responsible for coaching/mentoring/training Black Belts and for helping the Six Sigma leader and Champions keep the initiative on track.
- ☐ **Green Belt** : Part-time professional who participates on a Black Belt project team or leads smaller projects. Typically has two weeks of classroom training in methods and basic statistical tools.
- ☐ Team Member : Professional who has general awareness of Six Sigma (through no formal training) and who brings relevant experience or expertise to a particular project.
- ☐ Process Owner : Professional responsible for the business process that is the target of a Six Sigma project.

Lean

Research shows that failure to recognize the overhead associated with quality improvement is a major barrier to successful quality improvement (Macinati, 2008). In the case of healthcare, strict rules surrounding data use and collection as well as the presence of large volumes of narrative and non-coded nominal data present significant overhead in providing feedback and analysis. Lean can be leveraged to free up resource that would normally be spent on wasteful tasks like unnecessary or redundant processing, waiting, or moving between distant work stations. The time saved due to reduced waste can be used to off-set the overhead incurred by quality improvement data acquisition and logging.

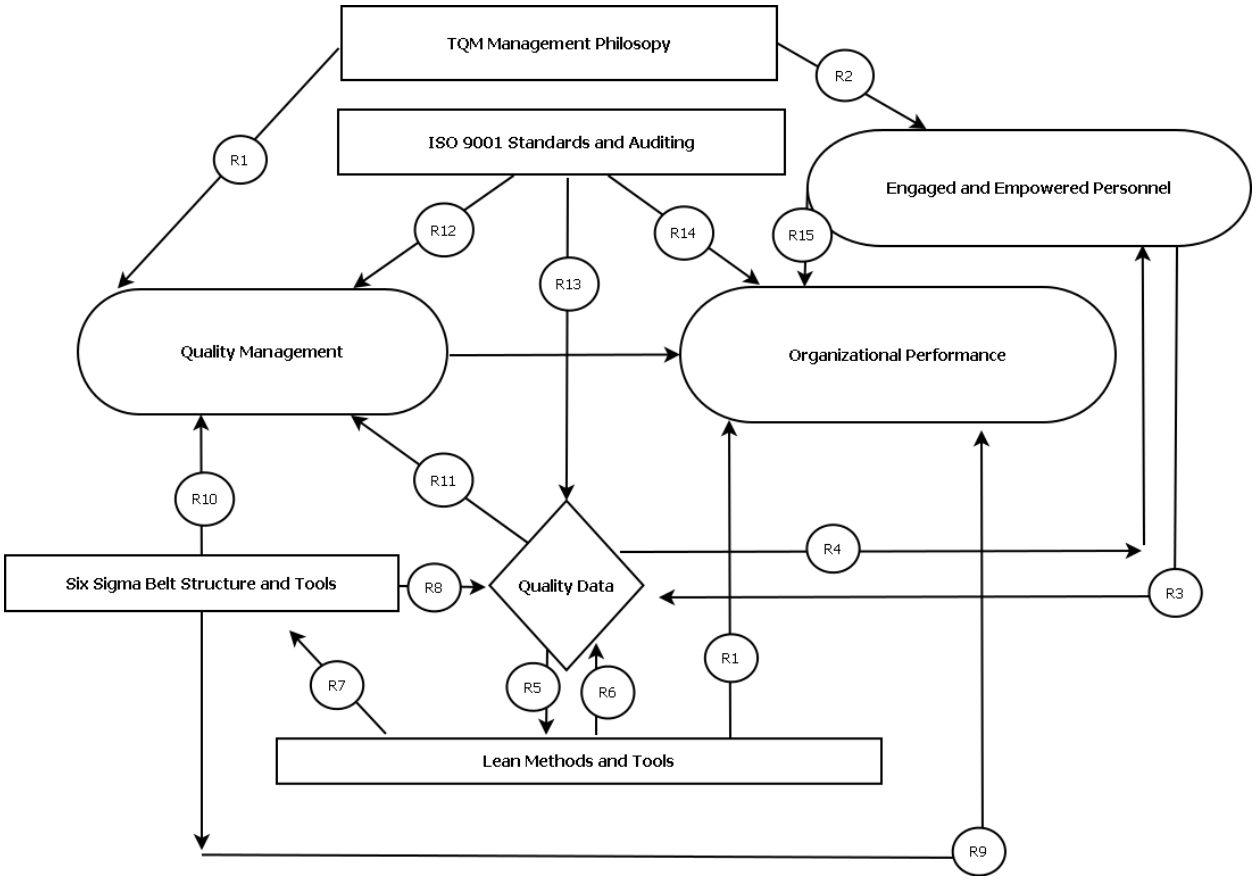
The 7 wastes (Muda) eliminated by lean are

1. Defects: such as medication errors, wrong site surgery, miscoding, Pressure Ulcers
2. Over-production: Un-necessary lab work, duplicate charting, overly lengthy standards of care
3. Waiting: Lab work lead times, Patients waiting for imagery, nursing care bottlenecks

4. Confusion: No standard operating procedure, multiple conflicting standards of care, unnecessary variation, ambiguous orders
5. Transporting: Medications not located on the unit, Lack of electronic imagery, no central medical group building.
6. Inventory: Excess Bedding, More patient rooms than needed, expired meds
7. Motion: Lack of patient lifts, lack of bedside instruments, no in-room medications
8. Excess Processing**:** redundant charting, manual data abstraction, multiple disparate computer systems

Integration of TQM, Lean, Six Sigma, ISO 9001:
Companies embracing differing quality strategies leverage unequally the strengths of the chosen method. Fundamental tradeoffs do exist, such as the tradeoff between specificity and the degree to which a solution can be generalized as it manifests in interdepartmental standards. This is also the case with the implementation of one PQM strategy over another. There exist fundamental tradeoffs in the ability to standardize, prioritize, and document the flow of work which results in greater throughput via smooth queuing and the nimble efficiency gains that result from disruptive innovation. A solution to quality management utilizing the strengths of several systems is suggested below in figure 1.

Figure 1. A suggested model for healthcare quality Improvement.



In this Model

R1 & R2: the 14 points of TQM act to support a common set of core values between management and personnel.

R3: Personnel who are engaged and actively taking part in quality decision making from the charter stage, feel vested in the project outcome and produce quality data.

R4: Quality data further engages the personnel via feedback in the form of performance SPC charts.

R5: Quality data supports the application of lean tools such as Poke-Yoke (error proofing), just in time inventory, bottle-neck analysis, and identify other forms of waste.

R6: Lean contributes to quality data by removing the burden of excess non-value adding tasks.

R7: Lean contributes to the selection of Six Sigma projects by the application of quality data to the project selection process. Waste reduction is set as the method of selection in a project selection matrix.

R8: Lean contributes to quality data by removing redundancy and variation. Anomalous data is also exposed in the analysis and display of outcome measures via SPC monitoring.

R9: Six Sigma projects increase financial performance by increasing efficiency, lowing liability, rework, and price elasticity. Strong performance on quality outcome measures can lead to higher Medicare reimbursement rates.

R10 & R11: Six Sigma Black belts act as consultants to quality management decisions makers, presenting data from processes on the floor so that scientific managerial decisions can be made based on empirical data. The reciprocal relationship helps to clearly define and resource projects during the charter phase. Executive engagement with front line process measures maintains unity in the organizations core values.

R12: ISO 9001 external auditing aids in quality management by ensuring that the work instructions and process standards developed during Six Sigma charter formation are actually being carried out as intended.

R13: The ISO 9001 quality manual and work instructions dictate how the process is to be performed and documented. The procedures for non-compliance and accountability ensure that standardization work is translated into standardized practice.

R14: Rigorous standardization and documentation lead to less ambiguity and confusion. In this way ISO 9001 compliance directly benefits organization performance.

R15: Engaged and empowered Personnel take pride in there work and directly benefit organizational performance by providing helpful feedback on inefficiencies and performing their work with care and diligence.

Rational

There is a strong tradition of tacit knowledge utilized by TQM to integrate the trilogy of aligning staff with executive vision with customer preference. A workforce and executive team with a common goal and understanding of what needs to be accomplished to provide the customer the service or product they want. This is accomplished via bottom up alignment with customer and employee feedback driving corporate decision-making. Barriers to a wholehearted adoption of this strategy would arise in the healthcare industry in several ways. Non-employed Physicians working within a hospital may have differing financial and liability motivations than the hospital itself. A hospital is at least equally directed by changes in government's policy as it is to typical market forces; However, Policy changes influence their effects immediately rather than gradually over time.

Six Sigma offers mature explicit knowledge in its clearly defined and portable roles outlined in its belt based raking system and the tools utilized, proven empirically to be effective in bringing about beneficial change via data driven and scientific decision making. Barriers exist in the overhead required to capture data, the inability of the organization to make its own definitions, induced overhead on cross departmental projects. Given the sensitive nature of health care data, process improvement will likely involve collaboration between nursing, IT, project management, risk management, legal, which would signal the necessity of a central quality department. Sticking with the Six Sigma philosophy, a central quality department is not recommended, as it removes ownership of quality from those it affects most intimately. Macinati (2008) found the presence of a defined quality department to be positively correlated with both objective and subjective measures of performance in the Italian healthcare setting, but no prior research was found comparing central to diffuse quality strategies in a healthcare setting.

ISO9001 Offers portable explicit knowledge in providing a template for quality improvement initiatives. Technical details including the building of the team and assignment of roles are covered in application specific chapters of the ISO9001 implementation plan. The process involves building a timeline and documenting the process and rollout. Assigning responsibilities and determining what corrective actions will be taken when work instructions are not followed ensure that the process is rolled out as designed.

Several studies have shown that executive leadership buy-in and support are key to successful implementation of Process-oriented quality improvement. The inverse, or buy in from stakeholders, is also very important. Employee satisfaction has been shown to be a byproduct of mindful implementation of PQM. * Without a common understanding of the areas open for improvement, leadership seem dethatched from the day to day operations of the organization, and can lose the respect and dedication of those carrying out the work of implementing quality improvement and daily operations. When there is agreement between the staff and executive decision makers about what is important to the patients/customers there can be a synergy of multiple levels in the organization. Affecting change at the front line can be viewed as employee empowerment, when the change brought about removes waste inefficiency or allows the staff to better serve the customer. When change adds burden without a clear incentive, the efforts of quality improvement staff become viewed as Mudda. Clearly buy in and involvement is needed at all levels.

Measurement via SPC is critical to the ability to accurately measure the effects of change during the PDCA cycle. Organizations that do not give sufficient credit to the burden of collecting quality data cannot accurately assess the overhead of PQM project implementation, and would be prone to unintentionally introducing burden to the process they are attempting to Lean. If PQM leave their processes with more non value added tasks than the unaddressed processes, quality initiatives will not receive much support from staff.

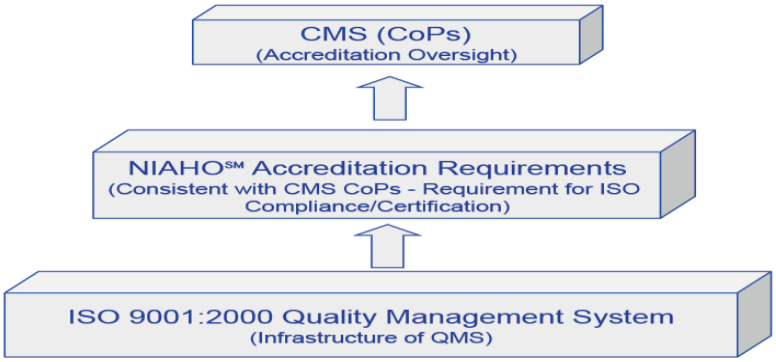
The common focus on customers and restricting effort to value adding activities is somewhat challenged in a healthcare setting in 2 major ways. First, market share may not be an accurate measure of performance in healthcare industry. The customer is often receiving a service with a complexity that is often beyond their capacity to act as an informed and discriminating consumer. Although there is no direct research on the impact publically available metrics have on the public's decision in choosing a hospital, anecdotal evidence suggests that there may be little impact on a patient's choice. Patients may be referred to specialists within the same medical group or with a partnering hospital because of the primary care providers relationship within the healthcare system rather than do to patient's preference. Emergency Department arrival often accounts for a hospital's largest portion of admissions. Under an emergency situation the nearest hospital would almost always be selected regardless of the patient's preference as a consumer. Patients with 3rd party payers such as HMOs that offer incentives to choose certain providers over others also create a barrier to free market pressure. Because of these restrictions, financial measures of success may only be appropriately viewed from a cost savings perspective. Since focusing on the customer and quality of service may be impacted, there is compelling motivation to seek alternative measures to return on assets and profit.

We investigate metrics of customer satisfaction and patient safety as a surrogate to the measures of performance appropriate in more typical manufacturing and service industries. Medicare, the largest 3rd party payer in the US has already started adopting reimbursement practices that levy financial incentives for good performance and penalties for non-compliance or poor performance.

Starting in 2008 conditions referred to as "Never Events" (Appendix C) fell under mandatory reporting by Medicare, with reimbursement being denied for treatment of 17 preventable conditions. Pay for performance will continue with this trend levying fines to poor performing hospitals as part of President Obama's value based purchasing health care law. Starting October 1, 2012 Medicare began a program to transfer payment from poor performing hospitals to those with above average safety and patient satisfaction. A 1% withholding will be made from all 2200 US hospitals submitting bills to Medicare. Hospitals will be penalized or rewarded based 70% on process measures (Appendix D Table 2.1) and 30 percent based on survey results of patient satisfaction (Appendix D Table 2.2) Although Medicare estimates that in 2012 only $850,000,000 will be reallocated, this marks the beginning of a correction in the failure of typical market forces. A separate fine also beginning OCT 1, 2012 levies a 1% reduction in payment for hospitals with high readmission rates for heart failure, pneumonia, or heart attack. Medicare estimates that the first year will result in a savings to tax payers of $280 million with fines increasing to 2% in 2012 and 3% in 2015. There is a commitment in the Whitehouse to continue to tie

reimbursement rates with hospital compliance. Medicare will be increasing the requirements in reporting, using appropriate technology, and providing safe and effective care.

Figure 2.0 Structure of DNV's National Integrated Accreditation for Healthcare Organizations



Methods

In order to add competition to the accreditation of hospitals, public law #110-275 granted DNV the right to act as an accrediting body for the Center for Medicare/Medicaid Services (CMS). This made available the first option other than The Joint Commission (TJC), which was the sole accreditation organization since the inception of Medicare in 1964.

As depicted in figure 2.0, The DNV hospital accreditation organization "seamlessly introduces ISO 9001 quality methods into the hospital setting." If the assumption is made that hospitals focused on standardization and process oriented quality improvement initiatives would choose the accreditation agency most closely aligned with its quality improvement philosophy, then DNV accredited hospitals would represent a more process-oriented population than their peers. An investigation was made to determine whether a hospital's investment in a formalized methodology of quality improvement translates into better performance on select AHRQ and SCIP measures of patient safety, patient satisfaction via the HCAPS survey, readmission rates for select conditions, and hospital acquired conditions by comparing DNV accredited to non-DNV accredited hospitals.

Data was abstracted from the US Department of Health and Human Services Hospital compare website posted October 11, 20012 containing performance information abstracted from the sources listed in table 1.0 below. http://www.medicare.gov/hospitalcompare/

A List of DNV accredited hospitals was obtained from the DNV website, http://dnvaccreditation.com/pr/dnv/hospitals.aspx, and abstracted into a SQL Server database. Cross referencing hospital name and zip code to the Medicare claims data yielded an exact match for 213 of the 260 hospitals published on the DNV website as of Oct 11, 2012.

61 Non-parametric tests of equivalence were performed for DNV vs. non-DNV hospitals for each of the measures of patient satisfaction and safety in seven categories of hospital performance listed in the table 3.0 found in appendix A.

Table 1.0 Measure Data Source

Measure Set	Source
AHRQ PSI Measures	Agency for Healthcare Research and Quality / Medicare Claims FY2011
Process of Care Quality Measures	National Hospital Quality Measures
Heart Failure, AMI, Pneumonia Readmission Rate	Medicare Claims FY2011
Patient Satisfaction Survey	Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS)
Hospital Acquired infections	(CDC) via the National Healthcare Safety Network (NHSN) tool.
Cost per Case	Medicare Claims FY2011
Hospital Acquired Conditions	Medicare Claims FY2011

Table 1.1 Test Results

Measure Set	Number of Metrics	Significant Metrics	Test
AHRQ PSI Measures	6	1	Pearson Chi-Square
Process of Care Quality Measures	37	5	Mann-Whitney U
Heart Failure, AMI, Pneumonia Readmission Rate	3	0	Mann-Whitney U
Patient Satisfaction Survey	3	0	Mann-Whitney U
Hospital Acquired infections	3	0	Mann-Whitney U
Cost per Case	1	0	Mann-Whitney U
Hospital Acquired Conditions	8	0	Mann-Whitney U

RESULTS:
Since implementation of PQM has been shown to be positively correlated with customer satisfaction, an investigation was performed to see if this relationship exists for healthcare. The distribution of scores for each of the survey questions found in Appendix B was compared for DNV-Accredited and Non-DNV hospitals. The distribution of scores for each of the 29 dimensions of patient satisfaction investigated were found to be not significantly different by the Mann-Whitney U test. Other measures found to be non-significant include the 3 readmission measures, Hospital Acquired Conditions, Cost per Case, and Hospital Acquired infections.

When the Categories of [Worse than the US national rate], [No Different than the US National Rate], and [Better than the US National Rate] as determined by the 95% confidence interval are compared for hospitals accredited by DNV vs. non-DNV hospitals, a significant over representation of [Better than the US National Rate] hospitals exist for DNV accredited hospitals in the measure PSI 15 (Accidental cuts and tears from medical treatment) than would be expected if DNV accreditation had no effect on the metric.

Table 2.0 Agency for Healthcare Research and Quality Measures Tested

PSI 4	Deaths among Patients with Serious Treatable Complications after Surgery
PSI 6	Collapsed lung due to medical treatment
PSI 11	Breathing failure after surgery
PSI 12	Serious blood clots after surgery
PSI 14	A wound that splits open after surgery
PSI 15	Accidental cuts and tears from medical treatment

A significant difference was detected in

1. Percent of Patients Who's Unary catheter was removed on the first or second day after surgery

2. Percent of surgery patients who were given an antibiotic at the right time (within one hour before surgery) to help prevent infection

3. Percent of patients who got treatment at the right time (within 24 hours before or after their surgery) to help prevent blood clots after certain types of surgery.

4. Percent of Surgical Patients Who Were Taking Beta Blockers Before Coming to the Hospital, Were Given Beta Blockers Just Before and After Their Surgery.

5. Percent of surgery patients who were given the right kind of antibiotic to help prevent infection

A subtle positive effect was detected between DNV-Accreditation and positive indicators of quality care. A significant correlation was found between DNV-Accreditation and positive performance on one AHRQ PSI quality outcome measure and 5 of 11 surgical care improvement process measures. Hospitals seeking DNV accredidation may be choosing a new option because of past difficulties in passing JCAHO Audits. Additionally, many hospitals are in the 1st or 2nd in the 3 phase accreditation process. As is typical in any self reporting scenario, higher documentation standards and better reporting may be producing less false negatives. I disproportionately low number “Not Available” results for DNV hospitals, suggests that the sub-population may be adhering to voluntary reporting more rigorously than cohorts.

Future research includes acquiring a larger more mature sample of hospitals having achieved DNV accreditation. Additional covariates and potential confounding factors such as hospital size, region, and specialty registry participation should be included in a more robust functional model of hospital performance which includes interaction effects between indicators. Additionally, a targeted survey of hospitals could provide information on which relationships, depicted in figure 1.0 , exist at a hospital, providing a more direct relationship between quality management strategy and measures of quality. The effect of each relationship (R1-R15) could be assessed for its inpact on performance, giving a higher resolution picture of how quality management practices effect patient safety and satisfaction quality indicators.

References

Anand, G., Ward, P. T., Tatikonda, M. V.(2010). Role of explicit and tacit knowledge in Six Sigma projects: An empirical examination of differential project success. *Journal of Operations Management*, 28(4), 303-315

Antony, J. (2011). Six sigma vs lean. *International Journal of Productivity and Performance Management, 60*(2), 185-190. doi: http://dx.doi.org/10.1108/17410401111101494

Carter P., (2010) .Six Sigma. *AAOHN Journal* • Vol. 58, No. 12,

Dahlgaard, J., Dahlgaard-Park S. (2006). Lean production, six sigma quality, TQM and company culture. *The TQM Magazine,* 18(3), 263-281.

Denney, W., St John, C., Youngblood L. (2009). Narrow Healthcare's Quality Chasm; Use Baldrige Criteria to meet your goals and patient needs. *Quality Progress,* 42(5), 38-45.

Dilber M., Bayyurt N., Zaim S., Tarim M. (2005).Critical factors of total quality management and its effect on performance in health care industry: a Turkish experience. Problems and Perspectives in Management;4,220–34.

Foster, D.A. (2012). Comparison of Baldrige Award Applicants and Recipients With Peer Hospitals on a National Balanced Scorecard. http://www.nist.gov/baldrige/upload/baldrige-hospital-research-paper.pdf (accessed 12/1/12).

Hayes, B.J. (2007), "Six sigma critical success factors", available at: www.isixsigma.com/library/content/c020415a.asp

Healthcare Costs: A Primer Retrieved Dec 1, 2012 From http://www.kff.org/insurance/upload/7670-03.pdf

Hubbard, Dean;Klute, Paul. (2011). Salvaging Baldrige *Quality Progress,*44, 10; ProQuest Business Collection pg. 12

Institute of Medicine (U.S.) Committee on Quality of Health Care in America. (2001). *Crossing the quality chasm: A new health system for the 21st century*. Washington, D.C: National Academy Press.

Irani Z., Beskese A. (2004). Love Total quality management and corporate culture: constructs of organizational excellence. *Technovation*, 24, 643–650.

I Six Sigma. Retrieved Dec 1, 2012 From http://www.isixsigma.com/

James, R. L., Jami, L. D., Heineke, J., & Abbass, I. (2009). Implementation of lean and six sigma quality initiatives in hospitals: A goal theoretic perspective. *Operations Management Research, 2*(1-4), 13-27. doi: http://dx.doi.org/10.1007/s12063-009-0021-7

Karthi, S., Devadasan S.R., Murugesh, R. (2011). Integration of lean six-sigma with ISO 9001: 2008 standard. *International Journal of Lean Six Sigma, 2*(4), 309-331. http://dx.doi.org/10.1108/20401461111189416

Kelly, E. W., Kelly, J. D., Hiestand, B., Wells-Kiser, K., Starlings., Hoekstra, J.W. (2010).Six Sigma Process Utilization in Reducing Door-to-Balloon Time at a Single Academic Tertiary Care Center, *Progress in Cardiovascular Diseases*, 53, 3, 219-226

Kohn, L. T. (2000). To Err Is Human : Building a Safer Health System. National Academy Press.

Linderman, K., Schroeder, R. G., Choo, A. S. (2006). Six Sigma: The role of goals in improvement teams, *Journal of Operations Management*, 24, 6, 779-790

Malcom Baldrige Quality Award. Health care criteria for performance excellence, http://www.quality.nist.gov; 2007.

Mehmet, T. T., Bülent Sezen, & Antony, J. (2007). An overview of six sigma applications in healthcare industry. *International Journal of Health Care Quality Assurance, 20*(4), 329-340. doi: http://dx.doi.org/10.1108/09526860710754398

Mohamed, G. A. (2011). Reconstructing six sigma barriers in manufacturing and service organizations. *The International Journal of Quality & Reliability Management, 28*(5), 519-541. doi: http://dx.doi.org/10.1108/02656711111132562

Nakajo, T., Susan, R. M., Weinstein, L., & Sears, D. (2006). How can six sigma aid healthcare? *ASQ Six Sigma Forum Magazine, 5*(2), 37-40. Retrieved from http://search.proquest.com.ezproxy.gvsu.edu/docview/213849020?accountid=39473

Lettice, F.,Thomond, P., Disruptive Innovation: The Challenges for Managing Knowledge
International Ecotechnology Research Centre, Cranfield University

Prajogo, D. I., Sohal, A. S. (2001). TQM and innovation: a literature review and research framework, *Technovation*, Volume 21, Issue 9,539-558
Phipps, R. (2012). Successful lean-six sigma in healthcare: A case study (presentation). *IIE Annual Conference.Proceedings,* , 1-61. Retrieved from http://search.proquest.com.ezproxy.gvsu.edu/docview/1151089799?accountid=39473

Qianmei F., & Manuel, C. M. (2008). Under the knife: A national survey of six sigma programs in US healthcare organizations. *International Journal of Health Care Quality Assurance, 21*(6), 535-547. doi: http://dx.doi.org/10.1108/09526860810900691

Raju PS, Lonial SC. (2002) The impact of service quality and marketing on financial performance in the hospital industry: an empirical examination. Journal of Retail and Consumer Services,9,335–48.

Rath, S. P., Biswajit, D., Mishra, D., Chaudhary, A.
A Paradigm Perspective & Reflective Study of "SIX SIGMA" – Origin to Future with Trends *International Journal of Business and Management Tomorrow* Vol. 1 No. 2

Saraph JV, Benson GP, Schroeder RG. (1989).An instrument for measuringthe critical factor of quality management. Decision Sciences,20,810–29.

Stracke, C. M. (2006): "Process-oriented Quality Management", in: Ehlers, Ulf-Daniel/ Pawlowski, Jan Martin (Eds.): *Handbook on Quality and Standardisation in E-Learning*. Berlin: Springer. 79-96.

Tarí, J. J., Molina,J. F., Castejón, J. L., (2007).The relationship between quality management practices and their effects on quality outcomes, *European Journal of Operational Research*, 183, 2, Pages 483-501

Taveira A., Craig A. ,James B., Karshc B., (2003). Quality management and the work environment: an empirical investigation in a public sector organization. *Applied Ergonomics*, 34, 281–291.

Thompson, F. (1995, Aug 27). Knowing TQM history helps strategy be accepted. *The Commercial Appeal,* pp. 0-C.3. Retrieved from http://search.proquest.com.ezproxy.gvsu.edu/docview/393657514?accountid=39473

The 14 points. Retrieved Dec 1, 2012 From http://deming.org

Yeh, H.,Lin, C.,Su, C., Wang, P. (2011). Applying lean six sigma to improve healthcare: An empirical study. African Journal of Business Management Vol. 5(31),p:2356-12370

Zu, X., Fredendall, L. D. , Douglas T. J., (2008).The evolving theory of quality management: The role of Six Sigma, *Journal of Operations Management*, 26, 5, Pages 630-650

Appendix A

Process of Care Quality Measures Chart Total Measures = 37

(For the complete measure specifications see the Specifications Manual for National Hospital Quality Measures at www.qualitynet.org)

Condition ~ Acute Myocardial Infarction (Heart Attack)		Total Measures = 13	
Measure	Acronym	Add Date	Starter Set?
Patients Given Aspirin at Arrival	AMI 1	Nov 2004	Yes
Patients Given Aspirin at Discharge	AMI 2	Nov 2004	Yes
Patients Given ACE Inhibitor or ARB for Left Ventricular Systolic Dysfunction (LVSD)	AMI 3	Nov 2004	Yes
Patients Given Smoking Cessation Advice/Counseling	AMI 4	Apr 2005	No
Patients Given Beta Blocker at Discharge	AMI 5	Nov 2004	Yes
Patients Given Fibrinolytic Medication Within 30 Minutes Of Arrival	AMI 7	Apr 2005	No
Patients Given PCI Within 90 Minutes Of Arrival	AMI 8	Apr 2005	No
Average number of minutes before outpatients with chest pain or possible heart attack who needed specialized care were transferred to another hospital (a lower number of minutes is better)	OP_3	June 2010	No
Average number of minutes before outpatients with chest pain or possible heart attack got an ECG (a lower number of minutes is better)	OP_5	June 2010	No
Outpatients with chest pain or possible heart attack who got drugs	OP_2	June	No

5. Number of Discharges: varchar (5) Lists the number of discharges.
6. Footnote: varchar (2) Lists the footnote associated with the measure name.
7. Excess Readmission Ratio: varchar (10) Lists the excess readmission ratio.
8. Predicted Readmission Rate: varchar (5) Lists the predicted readmission rate.
9. Expected Readmission Rate: varchar (5) Lists the expected readmission rate.
10. Number of Readmissions: varchar (4) Lists the number of readmissions.
11. Start Date: varchar (10) Lists the start date.
12. End Date: varchar (10) Lists the end date.

Process of Care Quality Measures Chart Total Measures = 37

(For the complete measure specifications see the Specifications Manual for National Hospital Quality Measures at www.qualitynet.org)

Condition ~ Acute Myocardial Infarction (Heart Attack)		Total Measures = 13	
Measure	Acronym	Add Date	Starter Set?
Patients Given Aspirin at Arrival	AMI 1	Nov 2004	Yes
Patients Given Aspirin at Discharge	AMI 2	Nov 2004	Yes
Patients Given ACE Inhibitor or ARB for Left Ventricular Systolic Dysfunction (LVSD)	AMI 3	Nov 2004	Yes
Patients Given Smoking Cessation Advice/Counseling	AMI 4	Apr 2005	No
Patients Given Beta Blocker at Discharge	AMI 5	Nov 2004	Yes
Patients Given Fibrinolytic Medication Within 30 Minutes Of Arrival	AMI 7	Apr 2005	No
Patients Given PCI Within 90 Minutes Of Arrival	AMI 8	Apr 2005	No
Average number of minutes before outpatients with chest pain or possible heart attack who needed specialized care were transferred to another hospital (a lower number of minutes is better)	OP_3	June 2010	No
Average number of minutes before outpatients with chest pain or possible heart attack got an ECG (a lower number of minutes is better)	OP_5	June 2010	No
Outpatients with chest pain or possible heart attack who got drugs	OP_2	June	No

to break up blood clots within 30 minutes of arrival (higher numbers are better)		2010	
Outpatients with chest pain or possible heart attack who got aspirin within 24 hours of arrival (higher numbers are better)	OP_4	June 2010	No
Median Time to Fibrinolysis	OP_1	June 2010	No
Heart Attack Patients Given a Prescription for a Statin at Discharge	AMI 10	Jan 2012	No

Condition ~ Heart Failure	Total Measures = 4		
Measure	Acronym	Add Date	Starter Set?
Patients Given ACE Inhibitor or ARB for Left Ventricular Systolic Dysfunction (LVSD)	HF 3	Nov 2004	Yes
Patients Given An Evaluation of Left Ventricular Systolic (LVS) Function	HF 2	Nov 2004	Yes
Patients Given Discharge Instructions	HF 1	Apr 2005	No
Patients Given Smoking Cessation Advice/Counseling	HF 4	Apr 2005	No

Condition ~ Pneumonia	Total Measures = 6		
Measure	Acronym	Add Date	Starter Set?
Pneumonia Patients Assessed and Given Influenza Vaccination	PN 7	Dec 2006	No
Patients Assessed and Given Pneumococcal Vaccination	PN 2	Nov 2004	Yes
Patients Given Initial Antibiotic(s) within 6 Hours After Arrival	PN 5	Nov 2004	Yes
Patients Given Smoking Cessation Advice/Counseling	PN 4	Apr 2005	No
Patients Given the Most Appropriate Initial Antibiotic(s)	PN 6	Sep 2005	No
Patients Whose Initial Emergency Room Blood Culture Was Performed Prior to the Administration of the First Hospital Dose of Antibiotics	PN 3	Apr 2005	No

Condition ~ Surgical Care Improvement (SCIP)	Total Measures = 11		
Measure	Acronym	Add Date	Starter Set?
Surgery Patients Who Received Preventative Antibiotic(s) One Hour Before Incision	SCIP 1	Sep 2005	No
Percent of Surgery Patients who Received the Appropriate Preventative Antibiotic(s) for Their Surgery	SCIP 2	Jun 2007	No

Surgery Patients Whose Preventative Antibiotic(s) are Stopped Within 24 hours After Surgery	SCIP 3	Sep 2005	No
Surgery Patients Whose **Doctors Ordered Treatments** to Prevent Blood Clots (Venous Thromboembolism) For Certain Types of Surgeries	SCIP VTE 1	Dec 2007	No
Surgery **Patients Who Received Treatment** To Prevent Blood Clots Within 24 Hours Before or After Selected Surgeries to Prevent Blood Clots	SCIP VTE 2	Dec 2007	No
Cardiac Surgery Patients With Controlled 6 A.M. Postoperative Blood Glucose	SCIP 4	Dec 2008	No
Surgery Patients with Appropriate Hair Removal	SCIP 6	Dec 2008	No
Percent of surgery patients who were taking heart drugs called beta blockers before coming to the hospital, who were kept on the beta blockers during the period just before and after their surgery	SCIP CARD 2	Dec 2009	No
Patients having surgery who were actively warmed in the operating room or whose body temperature was near normal by the end of surgery.	SCIP 10	Jan 2012	No
Outpatients having surgery who got an antibiotic at the right time - within one hour before surgery (higher numbers are better)	OP_6	June 2010	No
Outpatients having surgery who got the right kind of antibiotic (higher numbers are better)	OP_&	June 2010	No

Children's Asthma Care	Total Measures = 3		
Measure	Acronym	Add Date	Starter Set?
Percent of Children Who Received Reliever Medication While Hospitalized for Asthma	CAC 1	Aug 2008	No
Percent of Children Who Received Systemic Corticosteroid Medication (oral and IV Medication That Reduces Inflammation and Controls Symptoms) While Hospitalized for Asthma	CAC 2	Aug 2008	No
Percent of Children and their Caregivers Who Received a Home Management plan of Care Document While Hospitalized for Asthma	CAC 3	Sep 2009	No

Outcome Quality Measures Chart Total Measures = 6

Condition ~ Acute Myocardial Infarction (Heart Attack)		
Measure	Add Date	Starter Set?
Hospital 30-Day Death (Mortality) Rates for Heart Attack Compared to US Rate	Jun 2007	No

Hospital 30-Day Readmission Rates for Heart Attack Compared to US Rate	Jun 2009	No

Condition ~ Heart Failure		
Measure	Add Date	Starter Set?
Hospital 30-Day Death (Mortality) Rates for Heart Failure Compared to US Rate	Jun 2007	No
Hospital 30-Day Readmission Rates for Heart Failure Compared to US Rate	Jun 2009	No

Condition ~ Pneumonia		
Measure	Add Date	Starter Set?
Hospital 30-Day Death (Mortality) Rates for Pneumonia Compared to US Rate	Aug 2008	No
Hospital 30-Day Readmission Rates for Pneumonia Compared to US Rate	Jun 2009	No

Structural Measures Chart Total Measure = 1

Measure	Acronym	Add Date
Cardiac Surgery Registry Participation	SM_PART_CARD	Dec 2009

Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) measures

Q No.	HCAHPS Topic Text	HCAHPS Answer Description	HCAHPS Code	Add Date
1	How do patients rate the hospital overall?	Patients who gave a rating of 6 or lower (low)	H_HSP_RATING_0_6	Mar08
1	How do patients rate the hospital overall?	Patients who gave a rating of 7 or 8 (medium)	H_HSP_RATING_7_8	Mar08
1	How do patients rate the hospital overall?	Patients who gave a rating of 9 or 10 (high)	H_HSP_RATING_9_10	Mar08
2	How often did doctors communicate well with patients?	Doctors always communicated well	H_COMP_2_A_P	Mar08
2	How often did doctors communicate well with patients?	Doctors sometimes or never communicated well	H_COMP_2_SN_P	Mar08
2	How often did doctors communicate well with patients?	Doctors usually communicated well	H_COMP_2_U_P	Mar08
3	How often did nurses	Nurses always	H_COMP_1_A_P	Mar08

	communicate well with patients?	communicated well		
3	How often did nurses communicate well with patients?	Nurses sometimes or never communicated well	H_COMP_1_SN_P	Mar08
Q No.	**HCAHPS Topic Text**	**HCAHPS Answer Description**	**HCAHPS Code**	**Add Date**
3	How often did nurses communicate well with patients?	Nurses usually communicated well	H_COMP_1_U_P	Mar08
4	How often did patients receive help quickly from hospital staff?	Patients always received help as soon as they wanted	H_COMP_3_A_P	Mar08
4	How often did patients receive help quickly from hospital staff?	Patients sometimes or never received help as soon as they wanted	H_COMP_3_SN_P	Mar08
4	How often did patients receive help quickly from hospital staff?	Patients usually received help as soon as they wanted	H_COMP_3_U_P	Mar08
5	How often did staff explain about medicines before giving them to patients?	Staff always explained	H_COMP_5_A_P	Mar08
5	How often did staff explain about medicines before giving them to patients?	Staff sometimes or never explained	H_COMP_5_SN_P	Mar08
5	How often did staff explain about medicines before giving them to patients?	Staff usually explained	H_COMP_5_U_P	Mar08
6	How often was patients' pain well controlled?	Pain was always well controlled	H_COMP_4_A_P	Mar08
6	How often was patients' pain well controlled?	Pain was sometimes or never well Controlled	H_COMP_4_SN_P	Mar08
6	How often was patients' pain well controlled?	Pain was usually well controlled	H_COMP_4_U_P	Mar08
7	How often was the area around patients' rooms kept quiet at night?	Always quiet at night	H_QUIET_HSP_A_P	Mar08
7	How often was the area around patients' rooms kept quiet at night?	Sometimes or never quiet at night	H_QUIET_HSP_SN_P	Mar08
7	How often was the area around patients' rooms kept quiet at night?	Usually quiet at night	H_QUIET_HSP_U_P	Mar08

8	How often were the patients' rooms and bathrooms kept clean?	Room was always clean	H_CLEAN_HSP_A_P	Mar08
Q No.	**HCAHPS Topic Text**	**HCAHPS Answer Description**	**HCAHPS Code**	**Add Date**
8	How often were the patients' rooms and bathrooms kept clean?	Room was sometimes or never clean	H_CLEAN_HSP_SN_P	Mar08
8	How often were the patients' rooms and bathrooms kept clean?	Room was usually clean	H_CLEAN_HSP_U_P	Mar08
9	Were patients given information about what to do during their recovery at home?	No, staff did not give patients this information	H_COMP_6_N_P	Mar08
9	Were patients given information about what to do during their recovery at home?	Yes, staff did give patients this information	H_COMP_6_Y_P	Mar08
10	Would patients recommend the hospital to friends and family?	NO, patients would not recommend the hospital (they probably would not or definitely would not recommend it)	H_RECMND_DN	Mar08
10	Would patients recommend the hospital to friends and family?	YES, patients would definitely recommend the hospital	H_RECMND_DY	Mar08
10	Would patients recommend the hospital to friends and family?	YES, patients would probably recommend the hospital	H_RECMND_PY	Mar08

Patient Safety Measures Plain-Text Chart

Patient Safety Indicator (PSI)	Plain-text Measure Name	Add Date
PSI 4	Deaths among Patients with Serious Treatable Complications after Surgery	Oct-11
PSI 6	Collapsed lung due to medical treatment	Oct-11
PSI 11	Breathing failure after surgery	Oct-11
PSI 12	Serious blood clots after surgery	Oct-11
PSI 14	A wound that splits open after surgery	Oct-11
PSI 15	Accidental cuts and tears from medical treatment	Oct-11
PSI 90	Serious Complications	Oct-11
IQI 11	Death after surgery to repair a weakness in the abdominal aorta	Oct-11
IQI 91	Deaths from Certain Conditions	Oct-11

Hospital Acquired Conditions Chart

Hospital Acquired Condition Measure Name	Add Date
1. Foreign object retained after surgery (per 1,000 surgical discharges)	Oct-11
2. Air embolism (per 1,000 medical and surgical discharges)	Oct-11
3. Blood incompatibility (per 1,000 medical and surgical discharges)	Oct-11
4. Pressure ulcer stages III and IV (per 1,000 medical and surgical discharges)	Oct-11
5. Falls and trauma (per 1,000 medical and surgical discharges)	Oct-11
6. Vascular catheter-associated infection (per 1,000 medical and surgical discharges)	Oct-11
7. Catheter-associated urinary tract infection (per 1,000 medical and surgical	Oct-11
discharges)	Oct-11
8. Manifestations of poor glycemic control (per 1,000 medical and surgical discharges)	Oct-11

Healthcare Associated Infections Chart

	Plain-text Measure Name	Add Date
1	Central Line Associated Blood Stream Infections (CLABSI)	Jan-12

Use of Medical Imaging

Use of Medical Imaging		Total Measures = 6	
Measure	Acronym	Add Date	Starter Set?
Outpatients with low back pain who had an MRI without trying recommended treatments first, such as physical therapy. (If a number is high, it may mean the facility is doing too many unnecessary MRIs for low back pain.)	OP_8	June 2010	No
Outpatients who had a follow-up mammogram or ultrasound within 45 days after a screening mammogram. (A number that is much lower than 8% may mean there's not enough follow-up. A number much higher than 14% may mean there's too much unnecessary follow-up.)	OP_9	June 2010	No
Outpatient CT scans of the chest that were "combination" (double) scans. (The range for this measure is 0 to 1. A number very close to 1 may mean that too many patients are being given a double scan when a single scan is all they need.)	OP_11	June 2010	No
Outpatient CT scans of the abdomen that were "combination" (double) scans. (The range for this measure is 0 to 1. A number very close to 1 may mean that too many patients are being given a double scan when a single scan is all they need.)	OP_10	June 2010	No

Outpatients who got cardiac imaging stress tests before low-risk outpatient surgery.	OP_13	July 2012	No
Outpatients with brain CT scans who got a sinus CT scan at the same time.	OP_14	July 2012	No

Top Seventy Medicare Severity-Diagnosis Related Group Chart

	Medicare Severity-Diagnosis Related Group (MS-DRG) Name	MS-DRG ID	Add Date
1	Extracranial procedures w CC	038	Sep-09
2	Extracranial procedures w/o CC/MCC	039	Sep-09
3	Chronic obstructive pulmonary disease w MCC	190	Sep-09
4	Chronic obstructive pulmonary disease w CC	191	Sep-09
5	Chronic obstructive pulmonary disease w/o CC/MCC	192	Sep-09
6	Simple pneumonia & pleurisy w MCC	193	Sep-09
7	Cardiac valve & oth maj cardiothoracic proc w/o card cath w MCC	219	Sep-09
8	Cardiac valve & oth maj cardiothoracic proc w/o card cath w CC	220	Sep-09
9	Cardiac valve & oth maj cardiothoracic proc w/o card cath w/o CC/MCC	221	Sep-09
10	Cardiac defib implant w cardiac cath w/o AMI/HF/shock w MCC	224	Sep-09
11	Cardiac defib implant w cardiac cath w/o AMI/HF/shock w/o MCC	225	Sep-09
12	Cardiac defibrillator implant w/o cardiac cath w MCC	226	Sep-09
13	Cardiac defibrillator implant w/o cardiac cath w/o MCC	227	Sep-09
14	Coronary bypass w/o cardiac cath w MCC	235	Sep-09
15	Coronary bypass w/o cardiac cath w/o MCC	236	Sep-09
16	Major cardiovasc procedures w MCC or thoracic aortic aneurysm repair	237	Sep-09
17	Permanent cardiac pacemaker implant w CC	243	Sep-09
18	Permanent cardiac pacemaker implant w/o CC/MCC	244	Sep-09
19	Perc cardiovasc proc w drug-eluting stent w/o MCC	247	Sep-09
20	Acute myocardial infarction, discharged alive w MCC	280	Sep-09
21	Acute myocardial infarction, discharged alive w CC	281	Sep-09
22	Acute myocardial infarction, discharged alive w/o CC/MCC	282	Sep-09
23	Heart failure & shock w MCC	291	Sep-09
24	Heart failure & shock w CC	292	Sep-09
25	Heart failure & shock w/o CC/MCC	293	Sep-09
26	Chest Pain	313	Sep-09
27	Stomach, esophageal & duodenal proc w/o CC/MCC	328	Sep-09
28	Major small & large bowel procedures w MCC	329	Sep-09
29	Major small & large bowel procedures w CC	330	Sep-09
30	Major small & large bowel procedures w/o CC/MCC	331	Sep-09
31	Hernia procedures except inguinal & femoral w MCC	353	Sep-09
32	Hernia procedures except inguinal & femoral w CC	354	Sep-09
33	Hernia procedures except inguinal & femoral w/o CC/MCC	355	Sep-09
34	Cholecystectomy except by laparoscope w/o c.d.e. w MCC	414	Sep-09

35	Laparoscopic cholecystectomy w/o c.d.e. w MCC	417	Sep-09
36	Laparoscopic cholecystectomy w/o c.d.e. w CC	418	Sep-09
37	Laparoscopic cholecystectomy w/o c.d.e. w/o CC/MCC	419	Sep-09
38	Spinal fusion except cervical w MCC	459	Sep-09
39	Spinal fusion except cervical w/o MCC	460	Sep-09
40	Bilateral or multiple major joint procs of lower extremity w MCC	461	Sep-09
41	Bilateral or multiple major joint procs of lower extremity w/o MCC	462	Sep-09
42	Revision of hip or knee replacement w MCC	466	Sep-09
43	Revision of hip or knee replacement w CC	467	Sep-09
44	Revision of hip or knee replacement w/o CC/MCC	468	Sep-09
45	Major joint replacement or reattachment of lower extremity w MCC	469	Sep-09
46	Major joint replacement or reattachment of lower extremity w/o MCC	470	Sep-09
47	Cervical spinal fusion w MCC	471	Sep-09
48	Cervical spinal fusion w CC	472	Sep-09
49	Cervical spinal fusion w/o CC/MCC	473	Sep-09
50	Biopsies of musculoskeletal system & connective tissue w MCC	477	Sep-09
51	Biopsies of musculoskeletal system & connective tissue w CC	478	Sep-09
52	Biopsies of musculoskeletal system & connective tissue w/o CC/MCC	479	Sep-09
53	Back & neck proc exc spinal fusion w CC/MCC or disc device/neurostim	490	Sep-09
54	Back & neck proc exc spinal fusion w/o CC/MCC	491	Sep-09
55	Major shoulder or elbow joint procedures w CC/MCC	507	Sep-09
56	Major shoulder or elbow joint procedures w/o CC/MCC	508	Sep-09
57	Other musculoskelet sys & conn tiss O.R. proc w MCC	515	Sep-09
58	Diabetes w MCC	637	Sep-09
59	Kidney & ureter procedures for neoplasm w MCC	656	Sep-09
60	Kidney & ureter procedures for neoplasm w CC	657	Sep-09
61	Kidney & ureter procedures for neoplasm w/o CC/MCC	658	Sep-09
62	Kidney & ureter procedures for non-neoplasm w MCC	659	Sep-09
63	Transurethral procedures w MCC	668	Sep-09
64	Other kidney & urinary tract procedures w MCC	673	Sep-09
65	Other kidney & urinary tract procedures w CC	674	Sep-09
66	Other kidney & urinary tract procedures w/o CC/MCC	675	Sep-09
67	Transurethral prostatectomy w CC/MCC	713	Sep-09
68	Transurethral prostatectomy w/o CC/MCC	714	Sep-09
69	Uterine & adnexa proc for non-malignancy w/o CC/MCC	743	Sep-09
70	Female reproductive system reconstructive procedures	748	Sep-09