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The Source for Quality

Transforming the Business of Healthcare



Superior Quality. Sustainable Results.

Our organization.

Our services

Juran Healthcare has developed methods to enable your hospital system to deal with short and long-term problems facing your organization. Our methods to improve the patient experience and outcomes, reduce costs, and improve financial and operational performance are needed by all systems to guarantee that you attain and sustain superior results. These methods can be used as an added component to your Business Operating System or Performance Excellence Initiatives, or can be used independent of your programs to attain faster results. Our Juran Healthcare Professionals can work with your Executives, managers, and staff to improve performance – FAST.

We wrote the rules.

We can change the game.

We walk the talk.

Juran can demonstrate real results and culture change.

Juran Healthcare clients experience real results, increased ROI and revenue, improved safety and clinical outcomes, positive cultural shifts, enhanced customer satisfaction, and ongoing success. Juran has participated in launching Quality Improvement initiatives globally for over 20 years.

Juran Services & Capabilities

Strategic Consulting Services	Consulting & Assessment Services	Training & Certification Services	Transformational Change Services
Strategic Plan Alignment & Deployment	Baldrige Readiness Assessment	Lean & Six Sigma	Performance Excellence Implementation
Business Process Management	Organization Health Check	Quality by Design	Leadership & Project Coaching
Service Line Management	Patient Safety	Patient Safety Program	Balanced Scorecards
Lean Facility Design	Product Cost Reduction	Quality Control & Assurance	EHR Implementation & Management



Client results.

Patient throughput

Improving registration process of one day stay and observation patients

Problem: Incorrect registration processing of one day stay and observation assignments was leading to Medicare denials. These denials caused losses in revenue, decreased accounts receivable, and decreased productivity because of claims rebilling.

Improvement Process: Over the last few years, the Office of Inspector General (OIG) focused on the area of correct billing for one day stay and observation patients. Non-compliance in this area led to financial penalties, negative publicity, and additional audits.

The project team identified the registration process as a vital contributor to incorrect billing. Specific critical-to-quality (CTQs) measures were identified from voice of the customer and included, accurate patient ordering and accurate patient typing. Further, the team realized that the Registration Department did not always receive the patient orders thus, they relied solely on communication from nurses or unit secretaries for the order, resulting in false data. By determining this root cause, the team solved the problem by requiring a copy of the order be sent to the Registration Department and patient type be assigned only upon direct order receipt. Project implementation and completion occurred in eight months.

Standardization of the registration process resulted in decreased defects per million opportunities (DPMO), cost, and rework avoidance. By implementing improvements in the registration process, the team decreased Medicare denials, increased accounts receivable, increased productivity because of decreases in rework, and decreased meetings with the OIG.

Further, Six Sigma practice enabled implementation of standardized registration for one day stay and observation patients at three of the four facilities.

The project improved communication between departments, nurses, and case managers, allowing cooperation between these teams and ensuring correct registration of patients. Productivity improved because of less rework and a faster billing cycle.

Results: Through registration standardization, the hospital realized a \$308,000 savings in cost avoidance (average charges for one day stay patients [\$2,200] x number of incorrectly billed cases [140]) and a \$37,770 savings in rework (20 hours a week), for a total savings of \$345,770.



Project

The project goals were to achieve 100% correct patient assignment for One Day Stay and Observation at the time of registration, ensure correct orders on all patient charts, and improve accuracy of registration of observation patients to 75% within six months, and 100% within seven months. By using the Six Sigma methodology, communication among departments and staff improved. This resulted in an increase in productivity and a faster billing cycle.

Client results.

Patient throughput

Compliance with door-to-balloon core measures

Problem: A large not-for-profit hospital was struggling to meet the Centers for Medicare and Medicaid Service's (CMS) new standard for door-to-balloon time, which was reduced from 120 minutes to 90 minutes in July of 2006. Based on the third and fourth quarters of 2006, the hospital's aggregate mean/index rate for door-to-balloon time within 90 minutes was only at 47 percent. The hospital knew that non-compliance with the new standard could result in lost revenue from CMS and have a negative impact on clinical outcomes, patient satisfaction, and length of stay.

Improvement Process: The scope of the project included all patients who met the CMS requirements for Percutaneous Coronary Intervention (PCI) within 90 minutes. The boundaries of the process began when the patient entered the Emergency Department (E.D.), and ended when the balloon was inflated during the PCI. The team selected the DMAIC process as its improvement method. A Six Sigma DMAIC project is defined as a project that eliminates a chronic problem that is causing patient dissatisfaction, defects, costs of poor quality (COPQ), or other deficiencies in performance.

Define – Using performance data from the last half of 2006, the team determined the current process capability. During this time frame, 104 patients received PCI within the scope definition of the project. Of these 104 patients, only 51 received PCI within the 90-minute window. In order to understand how the customers and stakeholders felt about the process, and to further define their needs, the project team conducted voice of the customer interviews with physicians, E.D. staff, and Cath Lab staff. The interviewees believed that the cause of delays included staff timeliness of arrival to the Cath Lab, timeliness of diagnosis in the E.D., and the timeliness of placing the call to the Cath Lab staff.



Project

A team consisting of representatives from the Cath Lab, E.D. clinical informatics, pharmacy, and the Quality Department was selected to improve door-to-balloon time, using the Six Sigma DMAIC methodology as its improvement method. Voice of the Customer, process maps, cause-effect diagrams, and Failure Mode and Effects Analysis (FMEA) were used to identify a number of potential root causes for the delayed door-to-balloon time.

Compliance with door-to-balloon core measures

The team spent time documenting the current process using a process flow diagram. By analyzing this process map, the team revealed many failures within the process that could potentially be root causes. The team broke the patients into two groups: those walking into the E.D. and those arriving by ambulance. For patients walking into the E.D., the team identified that the process from door-to-balloon consisted of 40 steps. The team performed Lean value analysis and identified a surprising revelation: only five of those steps (12.5%) were value added. Twenty-one of the steps (52.5%) were considered business-required non-value added. This meant that 14 steps (35%) of the process were completely non-value added. The process for patients arriving by ambulance was similar to that of walk-ins. These patients went through 44 steps, only five of which were value added (11.4%). Twenty-four steps were business-required non-value added (54.5%) and 15 steps (34%) were non-value added.

Measure – The team collected data on the process. The current mean door-to-balloon time was just over 93 minutes, with a standard deviation of 22 minutes. This represents a process capable of meeting the 90-minute target only 55% of the time. In statistical terms, the process

produced 451,923 defects per million opportunities (DPMO) for a short-term sigma of 1.62. This indicated a great amount of variation in the process.

Using a cause-effect diagram, the project team identified some of the major theories causing delayed door-to-balloon time. They included:

- The current process for placing the call to the Cath Lab team
- Variation in E.D. physician practice
- Variation in Cardiologist practice
- Incomplete/inaccurate documentation/abstraction
- Emergency Medical Services EKG is not used to make the initial diagnosis of STEMI (AMI with ST elevation on the EKG indicating infarction)

Analyze – Using the process maps, cause-effect diagrams, baseline measurements, Failure Mode and Effects Analysis (FMEA), and voice of the customer (VOC), the team identified a number of potential root causes of the delayed door-to-balloon time. These theories were tested using statistical analysis, and a number of theories were proven to be vital Xs.

Improve and Control – With several proven theories, the team generated a number of potential improvement strategies to reduce door-to-balloon time. The team narrowed the list of potential improvements, using such tools as the weighted selection matrix, and they identified several to be implemented. “Red Rules,” which are non-negotiable steps in the process with defined accountability, were developed. Some included:

- Revise the Code-Save-A-Heart order set and flow sheet
- Shift from retrospective to prospective data collection
- Revise Physician progress notes to indicate the reason for the delay

Results: At the onset of the project, only 47% of patients met the door-to-balloon standard of less than 90 minutes. After the pilot improvement solutions were implemented, the door-to-balloon compliance rate rose to 82%, which was a statistically significant improvement. The sigma level increased from 1.62 to 2.41. The team continued to work on improvement solutions and compliance continued to improve after October 2008. The team was satisfied with the results and determined to continue using Six Sigma DMAIC to identify the next round of root causes.

Client results.

Patient throughput

Improving compliance with heart failure discharge instruction

Problem: A not-for-profit healthcare system found that adherence to clinical quality observed metrics for inpatient heart failure discharge instruction (HF-1) was consistently below national standards. For FY 2006, the average observed rate of compliance was 45.3%. Noncompliance could result in penalties with reimbursements from the Centers for Medicare and Medicaid Services (CMS), additional costs because of the potential of harmful events, and a decrease in patient satisfaction.

Improvement Process: The project team selected non-compliance with heart failure discharge instruction (HF-1) because it contributed to 49% of defects within the heart failure category. The beginning boundary for the project was the time a patient was admitted to the hospital. The ending boundary was the time a patient was discharged from the hospital.

The project team conducted voice of the customer (VOC) interviews with members of each customer group. Following the collection of the customers' voices, responses were translated to the underlying key issues that the customers

were communicating. Once key issues were identified, the team translated the key issues to critical-to-quality (CTQ) needs. The key issue cited was assigned a CTQ of "having a defined process for heart failure discharge instruction." Critical-to-quality needs were then translated into Ys. In this case, the Y was "compliance to a standardized discharge process."

The team selected the Six Sigma DMAIC process as its improvement method.

The Chief Financial Officer calculated the cost of poor quality (COPQ) for the project team:

- The number of heart failure cases in one year = 1,214
- Average Medicare reimbursement/case = \$5,617.54
- Total reimbursement = \$6,819,693.50
- 1% payback to CMS for poor performance = \$68,196.94 (Below the National Standards and Joint Commission public websites for heart failure discharge

- instructions compliance)
- Defects per million opportunities (DPMO) = 546,787
- Sigma level = 1.38 (short term)

The project team spent time understanding and analyzing the current process for completing heart failure discharge. Several potential failures to the process were identified. Some included:

- Assigning heart failure as a working diagnosis
- Not putting the correct discharge instruction form on the patient chart
- Heart failure discharge form not available when needed

Using a cause-effect diagram, the project team further identified potential causes of non-compliance with the heart failure discharge instructions.

Utilizing Juran's Pareto Analysis, the project team was able to identify the vital few Xs that were contributing to non-compliance with heart failure discharge instruction. They found that compliance was impacted by:

- The nursing unit discharging the patient
- The specific type of pre-printed physician heart failure discharge instruction form

Improving compliance with heart failure discharge instruction



Project

The project team consisted of a wide variety of clinical and support personnel. Its members represented outcomes management, nursing, respiratory, professional practice, medical staff, and finance. The team selected the Six Sigma DMAIC process as its improvement method. Using Juran's Pareto Analysis, VOCs, cause-effect diagrams, and FMEA, the team developed improvement strategies and was able to reach its goal of a 90% compliance rate with heart failure discharge instruction.

- The hospital employees' knowledge level of the six discharge instruction elements: A patient's activity level, his/her diet, his/her discharge medications, any potential follow-up appointments, his/her weight monitoring, what a patient should do if their symptoms worsened

The project team developed several improvement strategies for the proven vital few Xs including:

- Standardizing the pre-printed physician cardiac forms to include all six instruction elements
- Standardizing the discharge process across all nursing units
- Standardizing the most effective type of discharge instruction
- Improving the staff's knowledge level of the heart failure discharge
- Standardizing and simplifying the heart failure discharge instruction process

Failure modes and effects analysis (FMEA) is a tool that identifies possible failures in a process or product. The project team used this tool to identify the following as potential process failures. Some included:

- No heart failure discharge form available
- Inadequate discharge planning
- Multiple discharge forms and types
- No single, definitive process owner

Results: Based on a three-month pilot, the project was able to reach its goal of a 90% compliance rate with heart failure discharge instruction. A control plan was developed to monitor the observed rate of compliance and the use of the heart failure discharge form on a monthly basis.

Client results.

Patient throughput

Length of stay for heart failure DRGs

Problem: In a medium-sized acute care hospital, inpatients assigned DRG 127 (heart failure and shock) had an average length of stay (ALOS) of 5.18 days. This was 1.08 days greater than the geometric mean length of stay of 4.1 days (CMS). Of 491 patients discharged over one year, only 280 (57%) were discharged less than 4.1 days after admission, yielding a process sigma of 1.68. This resulted in an increased risk for negative patient outcomes because of delays in the delivery of care, as well as an increase in the cost of care.

Improvement Process: The project Y was average length of stay (ALOS), measured in days for all adult inpatients coded with DRG 127² (heart failure and shock). This included patients entering the facility through the Emergency Department (E.D.), direct admits from a physician, or patients arriving from another healthcare organization. The beginning boundary for the project was the time the admission order was logged. The ending boundary was when the patient was discharged from the bed and left the floor. Excluded from the project was the patient's stay in the E.D., and observation patients (held <48 hours).

To better understand the current process, length of stay data were gathered and the process was characterized in terms of the major workflows. Over the preceding year, 57% of DRG 127 patients had a length of stay less than or equal to the target of 4.1 days. This had an associated baseline sigma level of 1.68 and cost of poor quality of \$1,001,000 annually. A SIPOC high-level process map and detailed process maps were created for the following workflows: E.D., inpatient flow, floor arrival, critical care transfer, ongoing assessment, and discharge. This effort provided all team members with a deeper understanding of the overall process.

After analyzing these process maps, the team brainstormed potential causes of extended length of stay and organized them into possible cause categories. A cause-effect diagram was constructed for each possible cause category. Using the diagram, the team was able to further identify possible root causes. Subject matter experts organized these theories by common groupings. As a result 25 possible root causes were identified. To narrow the group, the

team prioritized the root causes based on the degree of expected impact on length of stay, and the degree of control the team had over them.

A detailed data-collection plan was created to document data sources, sample sizes, data analysis tools, and responsible parties for each of the possible root causes. In most cases, data were available in electronic logs, but new data had to be collected for others. Graphical analysis tools used included box plots, scatter plots, Pareto charts, and bar charts. In addition to descriptive statistics (average, median, standard deviation), statistical analysis tools including non-parametric hypothesis tests, regression, and Chi-square analysis were used. Some hypothesized root causes were:

- Inpatient holding process was not standardized
- Socially-related discharge needs assessments were not comprehensive
- Socially-related discharge needs were not identified early in admission

Rigorous analysis of the data revealed the vital few Xs driving

² Based on CMS-DRG 127 classification; this changed after the project start to include MS-DRGs 291, 292 and 293.

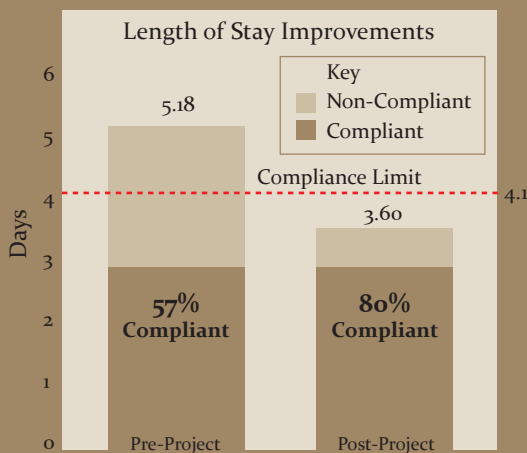
Length of stay for heart failure DRGs



Project

The project goal was to increase the percentage of patients with DRG 127 (heart failure and shock) that are discharged in less than 4.1 days (98 hours from admission) to 95% within six months for a process sigma of 3.18. The team selected Lean Six Sigma as its improvement methodology. Eighteen possible root causes were identified and solution strategies were developed. All solutions were rated against 13 specific performance criteria using a Pugh concept selection matrix.

Project Results



extended length of stay. Some included:

- Inpatient holding process not standardized
- CHF standard orders were not used (no parameters)
- There was delay between the discharge order and the time the patient leaves the floor.

The team brainstormed possible solution strategies that would address each of the vital few Xs causing extended length of stay for congestive heart failure patients. Some included:

- Patient holding: Develop ways to get the patient out of the E.D. faster; improve and expedite care for patients that are held.
- CHF Standard Orders: Reduce variation in practices by developing an order set and interdisciplinary pathway and provide for the education of physicians and hospital staff in their use.
- Delay in DC orders to leave floor: Develop a better communication process in relationship to the anticipated discharge date and the needs starting at day one of admission.

Additional detailed solutions were developed to enable these strategies. These solutions were rated against 13 specific performance and business criteria using a Pugh Concept Selection Matrix. The selected solution was piloted over a four-week period. During the pilot,

the team collected data on length of stay and key process variables to ensure individual components of the overall solution were properly implemented and effective.

The pilot was successful in reducing length of stay to an average of 2.6 days for patients with hospitalists attending, with 91% of patients discharged within 4.1 days of admit. The team documented process changes on the original process maps and developed an implementation plan to formally roll out the new process.

A control plan was developed to ensure the improvements and gains would be sustained over the long term. Key elements included the control subjects (length of stay, readmission rate, and proven Xs), measurements (sensor, frequency, sample size), and actions (criteria for taking action, responsibilities).

Results: Results are being monitored as an ongoing activity. To date, the ALOS has been reduced 31%, from 5.18 days to 3.6 days and continues to drop towards the level shown possible in the pilot. Compared to the baseline of 57% of patients discharged within 4.1 days, more than 80% are now discharged within 4.1 days. Readmission rates are being monitored to ensure there is no increase.

Client results.

Patient throughput

Length of stay for respiratory DRGs

Problem: In a medium-sized (approximately 150 beds) acute care facility, Medicare inpatients in high-volume respiratory DRGs were experiencing large variances compared to Medicare average length of stay (ALOS). During January 1 through October 31, 2006, Medicare inpatient ALOS for respiratory DRGs (o79, o88, 475) was 6.3 days compared to the Medicare mean of 6.2 days.

Improvement Process: An analysis of Medicare DRGs revealed three high-volume respiratory DRGs with large variance to Medicare ALOS. These were:

- o79: Bacterial pneumonia with complications
- o88: Chronic obstructive pulmonary disease (COPD)
- 475: Respiratory diagnosis with ventilator support

Length of stay is defined as the total time in days beginning when a patient is admitted to an in-patient floor until that patient leaves the hospital. A process improvement team was assembled based on these specific DRGs. The roles represented were:

1. Project Champion: Patient Care Executive
2. Process Owner: Utilization Management Director
3. Team Leader: Juran Healthcare Black Belt
4. Core Team: Physicians, Nurses

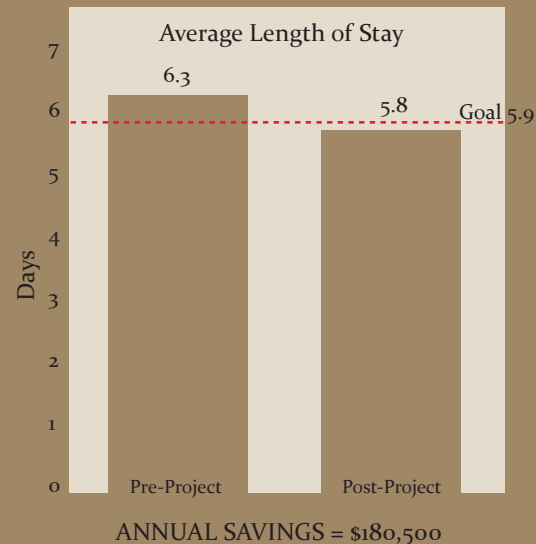
To understand the existing process, a high-level process map (SIPOC) was created. This map identified major process steps, boundaries (starting and stopping points), inputs, suppliers of inputs, process outputs, and customers (recipients of outputs). As it was a major output of the inpatient care process, the ALOS for Medicare respiratory inpatients became the project Y. Data collection and analysis revealed the current baseline performance and established clear, aggressive improvement targets in both process and financial terms:

Metric	Hospital Current	Medicare Mean	Hospital Goal
Cost of Poor Quality (annual)	\$750,000	N/A	\$90,000
Medicare Respiratory ALOS	6.3 days	6.2 days	5.9 days

A subsequent Pareto Analysis showed the team that different hospital units contributed to patient length of stay by varying degrees. This helped the



Project Results



Project

The project goal was to reduce the Respiratory Medicare average length of stay to 5.9 days. A process improvement team was assembled based on specific DRGs. The team used Juran's Pareto Analysis to help identify potential root causes. They constructed a Value Stream Map to document actual cycle times for tasks involved in cardiac and pulmonary patient care, and conducted a Rapid Improvement Event (RIE) to identify and remedy root causes.

Length of stay for respiratory DRGs

team focus on identifying root causes within the “vital few” contributors to extended length of stay, rather than the “useful many” secondary contributors.

To further characterize the baseline process, the team constructed a Value Stream Map. This tool was used to document actual cycle times for tasks involved in cardiac and pulmonary patient care. While collecting the data was labor-intensive, the information was crucial in providing concrete evidence as to where the greatest opportunity lay for improvement.

It was determined that a Rapid Improvement Event (RIE) was an appropriate means to identify and remedy root causes. An RIE is a highly facilitated series of steps that applies Lean tools and techniques to rapidly improve a specific work area. This decision was supported by an assessment that indicated causes of delay in patient flow were dependent upon procedural and organizational problems rather than errors or defects in execution of the process. The approach was as follows:

Day 1: VA/NVA Decomposition Analysis

A decomposition of the value stream into its value-added and non-value added components showed that the vast majority of time was not adding value (e.g., waiting, delay,

searching).

Examples of non-value added time for the respiratory DRGs included: diet delay in stress testing was due to caffeine with meals; vent management-code status was not identified on admission; other-labs, chest x-ray reports were not available during physician rounding.

Day 2: Identification and Prioritization of Causes

The team brainstormed specific root causes contributing to non-value added time. Causes were filtered through an impact/control matrix that helped identify high-priority causes that had the greatest impact on the problem and were within the team’s control.

Day 3: Improvement Plan

For each of the highest-priority causes, specific actions were identified to eliminate or substantially reduce the occurrence and associated non-value added time. An improvement plan was drafted to assign due dates and responsibilities for specific tasks. Examples of improvements included: creating a real-time pending lab results log in the Lab with color-coded alerts when results are due; allowing the Case Manager or Nursing to order patient evaluation earlier in a patients stay without a physician order; updating the Physician Resuscitation order set to include limited interventions; implementing a daily huddle with

Case Managers and Hospitalists to review the plan of care, and identify changes in the level of care, identify barriers to progressing patients, and update the anticipated discharge date; starting discharge planning upon admission; and updating patient white boards to include the anticipated discharge date, tests, and treatments.

Detailed action plans ensured the tasks, needed to deploy each improvement, were clearly documented with responsible parties and due dates. Implementation was conducted on a rolling basis as solutions were completed. To ensure the gains were maintained after project completion, a control plan was developed to track key success measures: Ys (ALOS for Medicare DRGs) and Xs (e.g., vent days, test-related avoidable days).

Control charts were created as visual aids to monitor ongoing performance and quickly identify possible special causes of variation in performance. By applying these feedback loops, causes of variation can be diagnosed and eliminated, thereby allowing for continuous improvement over the long term.

Results: Respiratory ALOS was reduced from 6.3 to 5.8 days (0.4 days less than Medicare average), resulting in a \$180,500 annual savings.

Client results.

Operating room throughput

First case operating room on-time starts

Problem: Current on-time starts for first cases is 46.9%, which delays the Operating Room surgical schedule. This may impact patient, staff, and physician satisfaction, overtime costs, and potential revenue. Patient satisfaction surveys indicated excessive wait times and non-value added activity during the surgery preparation process.

Improvement Process: Define Value – In order to understand the needs and impressions of customers and stakeholders, team members gathered the voice of the customer from patients, Outpatient Surgery and Operating Room staff, and physicians through surveys, interviews, observations, etc. The resulting comments were grouped into key issues and translated into measurable critical-to-quality requirements (CTQs) to include:

- Patient arrival time
- Staff arrival time
- Anesthesia arrival time
- Surgeon arrival time
- Patient ready for surgery (checklist complete and accurate)

Measure Value – The main deliverable from the Measure Phase is to understand the current state by creating a current state value stream and collecting

baseline data on the CTQs. In order to make changes quickly, the project team decided to conduct a Rapid Improvement Event (RIE) to work through the final phases of the project. The first day of the RIE, the project team walked the process and collected current state baseline data by following a patient from their arrival to Outpatient Surgery through their arrival in the Operating Room. The team documented the current process using a value stream map. The value stream map was a visual model depicting how patients flow through Outpatient Surgery and assisted in understanding where and when value-as defined by the customer is provided.

Analyze Process – The main deliverable of the Analyze Phase is to create the future state value stream map, which is the visual representation of what the process will look like after improvements are complete. The current state value stream map was used to identify the value-added, non-value added, and business-required non-value added activities, as well as subsequent opportunities for the elimination of waste and improvement in flow for the patient. Value criteria applied were:

- **Value-added** – An activity that

transforms patient care or experience to achieve patient expectations that they are willing to pay for.

- **Non-value Added** – An activity that takes time or resources, but does not add value to the customer's requirement.
- **Business Required Non-value Added** – An activity that does not add value to the customer, but nonetheless, is required because of business regulations, to support business fiscal needs or mitigate risk.

Opportunities from the value stream analysis included the following:

- Reduce wait times upon arrival
- Eliminate patient batch surgical preparation
- Reduce hand-offs and improve patient flow
- Reduce wait times in pre-operative room
- Reduce variation in staff arrival times and establish Service Level Agreements (SLA)

Once the opportunities were identified and prioritized, the project team created the future state value stream by utilizing Lean principles and tools to eliminate the waste of non-value added activities.

First case operating room on-time starts



Project

First case on-time start is a chronic problem after multiple attempts to improve the process through change management and PDSA. The hospital made the decision to adopt Lean principles, apply the tools to solve this problem, and improve the process in the eyes of the patient. The hospital assembled a project team championed by the Chief Medical Officer to learn Lean principles and solve the problem.

Improve Process – At the end of the first day of the RIE, the project team made the following changes:

1. Staggered patient arrival times (2 patients every 30 minutes to reduce batch sizes)
2. Created standard work for CNA at the front desk and added page nurse when the patient arrives
3. Combined process steps and

- standard work for nurses to reduce wait times between steps (complete vital signs, start I.V., assessment, medications and fluids)
4. Established service level agreements with Anesthesia and Surgeons to arrive 15 minutes before surgery start time
5. 6S front desk and pre-operative case cart
6. Establish a day-before chart review by Anesthesia

The RIE team communicated and trained the staff on the changes in the afternoon on day one. The team also created standard worksheets as a reference for the staff on the process changes. The changes were implemented on day two, and the project team collected data and then met with key stakeholders to evaluate the implementation. The project team made no changes, implementing once again on day three and collected data.

Control Process – The purpose of the Control Phase is to maintain process changes and monitor results. The current Operating Room daily log was revised to include the CTQs. Operating Room staff and Outpatient Surgery managers were responsible for reviewing the daily log and investigating any outliers going forward.

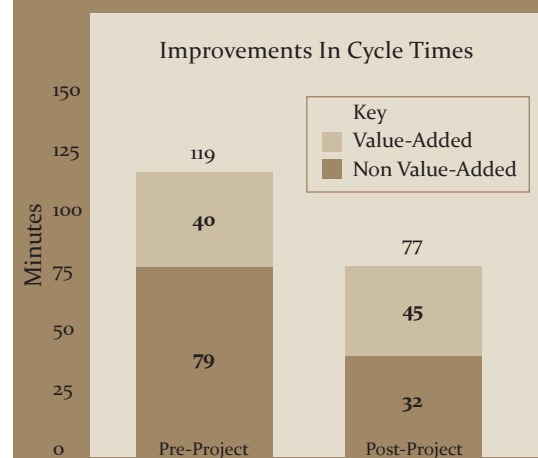
Results: At the end of days two and three, the project team created a Lean and CTQ scorecard in

order to share results with the project Champions. The changes successfully improved the patient experience by reducing wait times and improving flow. The team also identified that the most important CTQ for improving 1st case start time was surgeon arrival time. The project team, through rapid improvement, was able to achieve the following results:

- A reduction in overall lead time from 119 minutes to 77 minutes (35%)
- An increase in overall value-added time of 24%
- A reduction in overall non-value added time of 24%
- A reduction in the number of hand-offs from 8 to 5 (38%)

Based on the CTQ scorecard, the team discovered that the vital root cause of 1st case late starts was surgeon arrival time. The team solicited help from their Champion to address surgeon late arrival time in order to meet their overall target.

Project Results



- Overall value-added time improved by 24%
- Overall non-value-added time reduced by 24%

Client results.

Patient safety

Pressure ulcer prevention and reduction

Problem: A medium-sized hospital conducted a prevalence and incidence study that identified an 18% incidence rate of hospital-acquired pressure ulcers. This rate was unacceptably high compared to a 7% national benchmark incidence rate.

Improvement Process:

Define – The team developed a SIPOC high-level process map to identify suppliers, inputs to the process, high-level process steps, outputs from the process, and customers which are impacted by the process. After condensing the customer list to the vital few – patients, families, nurses, physicians, and ancillary services – the following question was asked:

“What is important to you regarding your skin care when in the hospital, especially wounds caused by pressure, commonly called bed sores?”

Analysis of the answers, or the voice of the customer, helped determine the elements critical to quality in the process. The three key issues discovered were:

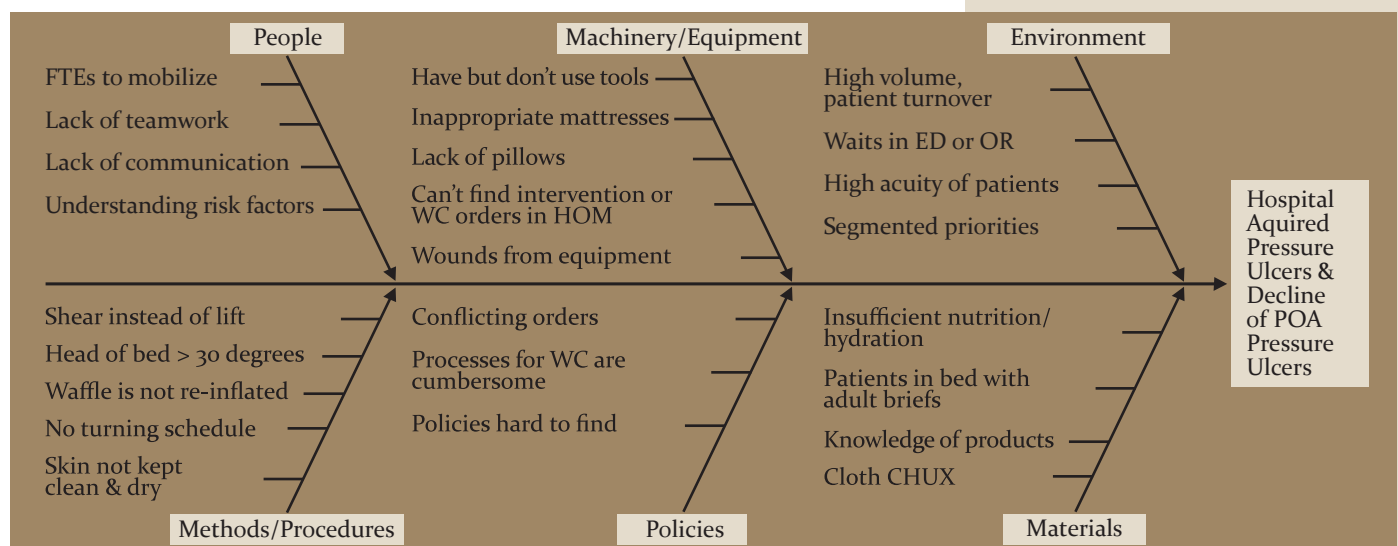
- Maintain skin integrity
- Education and standardized integrated process
- Communication and collaboration

Measure – The team set out to measure the current state of the process and determine the baseline status against which any future changes could be compared. After



Project

A team was formed to conduct a Six Sigma DMAIC (Define, Measure, Analyze, Improve, and Control) project to reduce hospital-acquired pressure ulcers by identifying potential root causes and developing creative methods to bring the rates down to the target. The scope of the project was from inpatient admission to discharge.

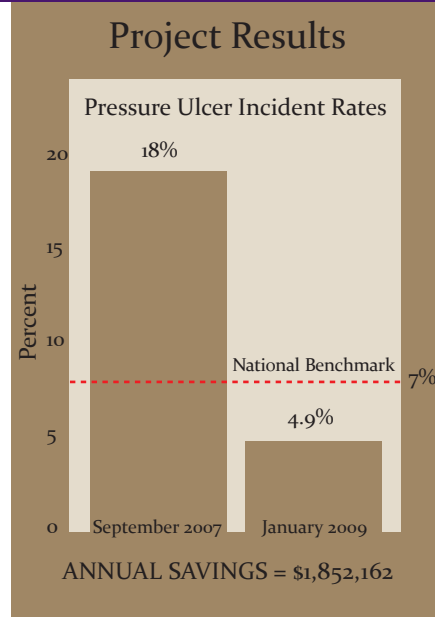


Pressure ulcer prevention and reduction

validation of the measurement system and the collection of data, the team determined that the current process operated at a sigma level of 2.4, reflecting the 18% incident rate. Aiming to achieve a maximum target incident rate of 5%, the process would improve to a capability of 3.2 sigma. The team constructed a cause-effect diagram to identify the potential factors (Xs) that contribute to hospital acquired pressure ulcers (Y).

Analyze – Analysis of the cause-effect diagrams consolidated the overwhelming number of possible root causes to a list of eleven. Data were collected for each of the eleven Xs and were analyzed to determine if statistical evidence supported the claim. Six of the eleven possible root causes were eliminated from the list because of a lack of evidence showing statistically significant relationships with pressure ulcer incidence. The remaining five were consolidated into three final root causes of high incident rates of pressure ulcers acquired in the hospital and taken into the Improve Phase.

Improve – Improvements to address and ameliorate the vital few proven root causes included: verification of patients at risk; assessment of skin within eight hours of admission, and once a shift thereafter; documentation of Braden scores; use of visual identifiers for at-risk patients; use of chair waffles; no diapers in bed or while sitting in a chair; stocking five pillows in



each patient's room for use in repositioning; limit patients sitting in a chair to one hour or less; acquisition of new pressure redistribution mattresses; standard wound care order set; and Save Our Skin Champions on each unit. Upon implementation of all solutions, immediate and statistically significant improvement was observed.

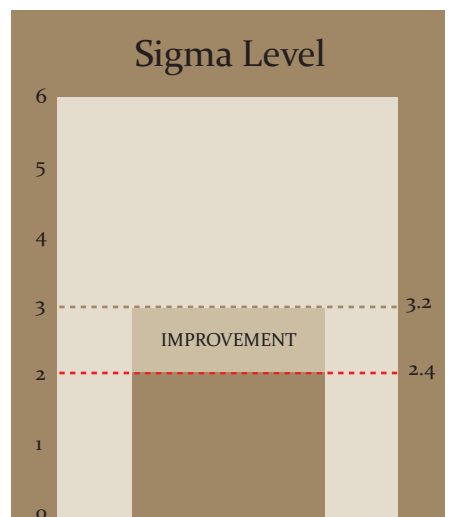
Control – The Control Phase provides tools and the methodology necessary for an organization to meet the challenges of maintaining and sustaining improvements to the process. The pressure ulcer prevention team utilized the following tools:

- Control plan: Provides roadmap of action plans for maintaining and sustaining process improvements
- Communication plan: Describes how and when information about process changes will be disseminated to staff throughout the hospital and affected areas
- Training plan: Outlines the

- schedule for training the staff of new process changes
- New and revised policies and procedures: Documentation representing revised processes

After the process was fully implemented and in place for several more months, the team learned that their target incident rate of 5% and sigma level of 3.2 had been achieved. Only four cases were recorded out of 81 patients during the 2nd quarterly incidence study following the project. In January 2009, an incidence study showed an incident rate of 4.9%.

Results: Perseverance and commitment by the team to the Six Sigma methodology made the project a great success. The hospital surpassed the national incident rate benchmark of 7%, and at the time of project completion, surpassed their own target of 5% to achieve a 4.9% incident rate in January 2009. Actual savings from the project reached \$1,852,162 annually, and with continued monitoring, the team is likely to see even greater savings in the future.



Client results.

Emergency department

E.D. patient financial responsibility

Problem: A not-for-profit hospital system noticed that many of its patients were routinely leaving the E.D. without providing complete insurance verification information or making appropriate financial arrangements. This information was critical to ensure a timely and accurate billing process, and maintain cash flow. In addition, the hospital system was collecting only 30% of the charges billed for E.D. patients that were treated and released, as well as collecting less than \$300 per day in co-pays.

Improvement Process: Using the previous year's data, the hospital outlined its current process capabilities. There were total charges of roughly \$71 million from 65,756 hospital visits. The median billed charge per visit was \$1,080. As previously calculated during its eight-week analysis of E.D. gross revenue charges, there were \$356,000 in unbilled accounts. This translated to forty-one defects per week (\$356,000/\$1080/8 weeks).

Using a cause-effect diagram, the hospital team identified some potential root causes that were contributing to unsecured accounts. Some included:

- **People** – Each E.D. person's level of training and experience, possible bad habits, and which registrars were available.
- **Patients** – The severity of the patient's physical state, as well as their lucidity. Each patient's primary language was also a potential factor, along with whether or not he or she had their insurance card on hand.
- **Facility** – The location of the registration station(s), as well as the number of unsecured exits from the E.D. In addition, there was no defined checkout process or location within the E.D.

The hospital system tracked the total E.D. visits by day of the week and time of the day over an 18-month period. It found that patients generally arrived in a predictable pattern, regardless of the day. Peak times were highest on Mondays and lowest on Saturdays. With this knowledge the hospital could appropriately develop staffing patterns that matched patient arrival patterns.

Failure Modes and Effects Analysis (FMEA) is a tool that identifies possible failures in a process or product. Using FMEA the hospital found that:



Project

A multi-disciplinary project team was selected to improve the billing process in the E.D. The team selected the DMAIC (Define, Measure, Analyze, Improve, and Control) process as its improvement method. The hospital's goal was to increase the collection ratio to 40% within six months and increase the amount of cash collected from patients at the time of service from \$300 per day to \$1,200 per day.

E.D. patient financial responsibility



- Left Without Being Seen (LWBS) was the primary failure for unsecured accounts. The majority of accounts were not secured because of patients who left from the lobby without being seen. Over a third of the accounts were not secured because the patient left before being checked out.
- Co-pays were being collected on just more than 3% of the patients in the E.D.
- The majority of E.D. patients did not have co-pays due.

Utilizing Juran's Pareto Analysis, the hospital team was able to identify the vital few Xs that were contributing to the unsecured patient accounts. They found that:

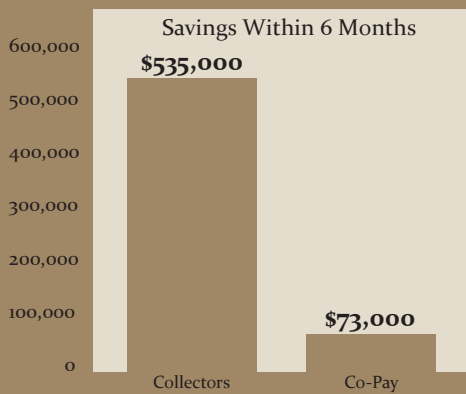
1. Patient activity impacted the unsecured accounts: Higher patient volumes were predictive of a greater number of unsecured accounts.
2. Patient flow in the E.D.: There were many ways for patients to exit undetected and there was no defined checkout process. Checkout at a patient's bedside was inconsistent.
3. Patients who left without being seen were a major source of unsecured accounts: No attempts were being made to collect registration information for patients who were waiting in the lobby.

Implementation and Control: Once detail-level designs were created and approved, the project team developed an implementation and control plan that included:

- Bedside registration of emergency patients using wireless data entry
- Central intake/registration of non-emergent patients (level 3-5)
- A hard-wired checkout process where all patients are to be escorted to the checkout desk
- Integrated clinical care process and registration
- Visual alerts to improve communication between providers and registrars when patients were available to complete registration
- Process transparency and operational metric reporting
- Training for registrars and clinical staff of the process changes and new data-collection tools
- Adding a back-up workstation to the checkout desk for peak periods of patient flow
- Collecting data on key metrics at the end of every shift
- Instructing hospital registrars to always ask for co-pays and inform patients of their financial obligation

Results: The number of incomplete accounts for patients leaving the E.D. declined from 4% per month to less than 1% per month within a six month time frame. This was a statistically significant difference and represented an improvement in the number of accounts the hospital could now bill and expect to collect on.

Project Results



TOTAL ANNUAL SAVINGS = \$608,000

Client results.

Financial improvements

Revenue cycle cash collection

Problem: In a medium-sized acute care facility, undocumented charges were causing \$720,000 in lost revenue annually. Additionally, there were frequent underpayments, resulting in further losses in revenue of \$1.18 million.

Improvement Process: With the Chief Financial Officer as Champion, the project team was led by a Juran Healthcare Black Belt. The team consisted of operations staff representing Medical Surgical, Surgery, Ancillary Services, Coding, Women's Health, Registration, and business office functions.

Following the Six Sigma DMAIC (Define, Measure, Analyze, Improve, and Control) improvement methodology, the team first completed a project charter to define the problem, goal, scope, business case, team members, resources, and timeline. The baseline process performance was characterized by obtaining customer requirements, mapping the current process, and comparing current performance against customer requirements. Following this, possible causes of the revenue problems were identified and then rigorously tested to identify the vital few root causes of revenue loss. Finally, the team developed solutions to eliminate or substantially reduce the incidence of root causes and implemented these in conjunction with a control plan to ensure the successes of the new processes were maintained. Using three high-level process maps (pre-scheduled procedures, direct admits, and E.D. admits) and fourteen detailed sub-process maps, the team established the process boundaries that were within scope and identified the critical customer groups as patients, physicians, Medicare, medical records, billing, and coding. Interviews with customers to capture the voice of the customer identified thirteen critical needs to be met in order to deliver desired performance and ultimately reduce undocumented charges and underpayments. Some critical needs included:

- 100% complete and accurate documentation of charges
- 100% complete and accurate capture of charge information
- Easy process for documenting supply charges

Based on this customer input, two outputs (project Ys) were identified:

- Undocumented charges
- Underpayments with subcategories of denied days and denied accounts

JURAN



Project

A multi-disciplinary team led by a Juran Healthcare Black Belt was selected to improve undocumented charges and under-payments. The team selected Six Sigma as its improvement methodology. Using data-collection plans, graphical analysis tools, cause-effect diagrams, and implementing all improvements the project delivered more than \$10 million annually in improved cash collections.

Revenue cycle cash collection



The team developed a data-collection plan and measured performance of the Ys. Refining earlier estimates documented in the project charter, the team determined current baseline performance was generating 22% undocumented charges and underpayment defects annually, resulting in \$2.54 million in annual revenue loss. In accordance with the project charter, a clear project goal was established to reduce the dollar losses from \$2.54 million to \$254,000.

To understand possible root causes of poor process performance, the team used cause-effect diagrams in conjunction with 5 WHY analysis. Cause-effect diagrams are used to help organize possible theories as to cause. For possible root causes of undocumented charges, the team identified the potential cause categories as documentation errors, mismatch of physician orders with service or other documentation, and data entry errors. For possible root causes of underpayments, the team identified possible cause categories as orders, authorization, and registration.

A detailed data-collection plan was created to document data sources, sample sizes, data analysis tools, and responsible parties for each of the possible root causes. Graphical analysis tools were used to test relationships and effectively communicate results. Statistical analysis tools were used in testing the hypothesized root causes and included Chi-square analysis. In conjunction with other subject-matter experts, the team brainstormed alternative solutions for each of the proven causes and rated these using a criteria-based selection matrix. Some of the solutions implemented to reduce undocumented charges and underpayments included:

- **Floor Variation:** Assign responsibility; define best practices and standardize; cross-train staff
- **E.D. Admits:** Identify frequently missed charges; bundle charges always incurred; reduce number of supply items that need to be documented
- **Human Error:** Identify most frequent errors/causes; simplify charge process flow; limit number of staff involved; standardize forms; reward success
- **Decentralization:** Centralize charge capture
- **Stickers:** Eliminate stickers
- **No Audit System:** Mandate charge audits in units; audit per unit; create mechanism to simplify charge audits; validate missing items

For each of the solutions, detailed action plans were developed. These plans clearly documented the specific tasks needed to deploy solutions and assign responsibility and due dates. To ensure the gains were maintained after project completion, a control plan was developed to track key success measures (first-year gains). Run charts were created as visual aids to monitor ongoing performance and easily identify possible special causes of variation in performance.

Results: Reduction in undocumented charges and underpayments were evident in specific success measures (comparisons with prior year):

- Found charges: more than \$750k in first year
- Emergency Room supply charges: 4% increase in average supply charges per E.D. visit
- Visibility to revenue by managers: no new charges identified
- Improved verification process: more than 25% reduction in denials
- Appeals resulting in improved reimbursement: more than 80% of denied days reversed through improved appeals process; more than 80% reduction in reimbursement variance in dollars
- Cash collections at point of service: 100% increase (doubling)
- Cash collections per adjusted patient day: 9.5% improvement to \$250 per adjusted patient day

Client results.

Electronic medical records

Electronic medical record transformation

Problem: A large medical group consisting of nearly four dozen primary and specialty care physician clinics was in the process of implementing a new electronic medical record system (EMR) with a major software vendor. As a part of the implementation, an initiative was launched to redesign and improve all aspects of the primary and specialty care processes. By aligning process transformation and EMR implementation, the goal was to improve patient satisfaction, increase operational efficiency, improve productivity, reduce costs, and enhance revenues.

Improvement Process:

Define – Design for Six Sigma (DFSS) projects require a deep understanding of customers and their needs. To better understand the process, its boundaries, and customers, a high-level SIPOC process map was created that clearly identified major elements:

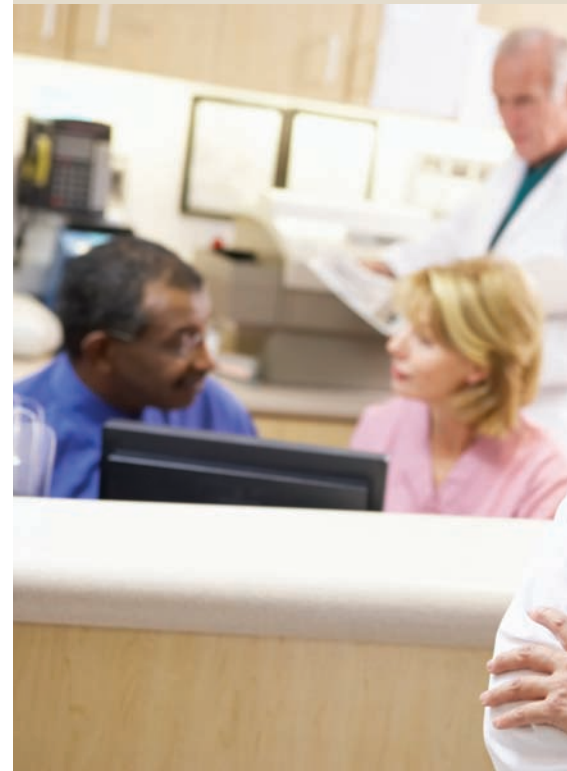
- Suppliers of inputs (e.g., patients, physicians, insurance companies)
- Inputs to the process (e.g., orders, authorizations, clinical information)
- Process steps (typically 5-9 steps, e.g., scheduling, registration, patient prep)
- Outputs of the process steps (e.g., prescriptions, referrals, charges)

- Customers that receive outputs of the process (e.g., patients, claims clearinghouses)

Key customer groups were identified from the SIPOC and subsequently prioritized.

Measure – Each customer group was rated against customer ranking criteria, which included: customer and patient satisfaction, quality, patient outcomes, employee satisfaction, process effectiveness, and profitability. In order to understand how the customers and stakeholders felt about the process and to further define their needs, the project team conducted voice of the customer surveys, obtained results from Press-Ganey satisfaction surveys, and analyzed internal patient complaint data. From the VOC, key issues were identified and specific, measurable critical-to-quality requirements (CTQs) were developed.

Analyze – The organization had numerous independent initiatives and improvement goals. After consideration of alternative approaches, it was decided that the greatest impact and least duplication of effort would be achieved through an umbrella design that integrated the various



Project

A multi-disciplinary team was selected to improve clinical processes in conjunction with the implementation of a new electronic medical record system. The team selected the Design for Six Sigma process as its improvement method. The team followed the DMADV (Define, Measure, Analyze, Design, and Verify) steps in the process to identify and design features based on customer needs.

Electronic medical record transformation



initiatives. These included the EMR, Advanced Medical Home, Advanced Access, Lean, and Patient Safety programs. It was recognized that the scope of the umbrella design was sufficiently deep and broad that it would radically change the organization. Over time, changes were planned with regard to the patient experience, knowledge and skills management, and care delivery. For each SIPOC process step, the more detailed functionalities were identified. For example, patient scheduling provides the functionality of ensuring that the provider and patient predictably come together at the same time and place. Features then were identified from each of the organization's initiatives and mapped back to the functions and CTQs to ensure the features would be capable of addressing customer needs and facilitate prioritization.

Design and Verify – To facilitate design of features by the ongoing initiatives into a coordinated blueprint, a package of templates was created, including the following:

- **Transformation Tool:** A comprehensive list of features that assigns priority for design, feature owners and characterizes feature by attribute (relationship to EMR, Six Aims, etc.) into meaningful, manageable groups.
- **Deliverables Checklist:** A list of deliverables for each feature that are needed as part of its design, including detailed specifications, workflows, human resource needs, policies and procedures, facility, equipment, and supply needs.
- **Collaboration Matrix:** A tool that assists in identifying owners and collaborators, thereby ensuring that the right set of stakeholders work together to develop a more complete design that meets all needs and reduces rework.
- **Process Workflow Inventory:** A comprehensive list of workflows formally decomposed into levels (macro, business process, sub-process, activity). This provides an internally consistent and systematic means of creating and classifying workflows, and helps coordinate design and reduce duplication of effort.
- **Control Plan:** A control plan was created to ensure that designed features would continue to perform as planned over the long term. Metrics were based on the Customer and Process Design Scorecards.

Results: At the onset of the project, the medical group was pursuing a number of different major initiatives in isolation of each other, risking conflicting plans, uncoordinated design and implementation of changes, and duplication of effort. At the end of the Analyze Phase, there was a common list of features and definitions along with a means of prioritizing these across all of the initiatives. Design is moving forward with clearly identified owners and collaborators, with an umbrella project management structure to ensure a coordinated, system-wide outcome.

Our workshops.

The Juran way forward

We believe that your Performance Excellence System must support the mission, vision, and values of your unique organization to be most effective. It should be patient-centered and improve the patient's experience, while developing the skills and competencies of all staff, to create a Performance Excellence culture. Juran Healthcare's goal is to become your Performance Excellence Partner, provide guidance, and support as you create your improvement strategy and deployment roadmap.

Our Visioning Workshops were designed to assist System Leaders and the Board to create a common vision of what Performance Excellence is, create an organizational structure and infrastructure, and understand the roles and responsibilities of key stakeholders. Workshops can be tailored to address your needs including topics, frequency, and length of workshop.

The Role of Leadership in Creating a Performance Excellence Culture.

This series of Workshops, ranging from ½ day to one day, is designed to educate and assist leaders in creating a Performance Excellence culture and lead the change initiative. Topics can include:

- What is Performance Excellence?
- The power of having the Board on-board
- What is leadership's role in creating and leading significant change?
- How to link Performance Excellence with the overall organizational strategic plan and goals

- How to create an environment of trust and empowerment to promote Performance Excellence
- How to integrate Performance Excellence into hospital routines

The Role of the Board in Safety and Performance Excellence.

This series of workshops ranges in length from two to four hours and provides guidance to hospital boards committed to leading their organization's safety and Performance Excellence program. Practical advice and insight into how effective boards drive the safety and Performance Excellence program are covered. Topics could include:

- What Boards need to know about Safety and Performance Excellence
- How committed is the Board to Safety and Performance Excellence
- How Boards can make a difference in leading the Safety and Performance Excellence program

The Performance Excellence Organization – Is It Right For You?

This one-day workshop is designed to assist leaders to create the optimal organizational infrastructure to support Performance Excellence. The session will focus on different models and group interaction will analyze the pros and cons of each. Break-out teams will be asked to create the optimal infrastructure to support a Performance Excellence system for your organization.



Our Team

Juran staff is a mix of healthcare executives and professional process improvement practitioners who are exceptional coaches and trainers. All have prior experience in healthcare operations.

Lean Enterprise: Service Line and Business Process Management.

Juran will provide a roadmap that will show you how to assess your current organizational structure and utilize value stream management techniques and dashboards to transform your organization to a Lean Health Care Enterprise. A Lean enterprise combines business process management and service line management to remove unwarranted variation and customize processes that meet the needs of specific patient populations. There are a few key Lean underlying principles required to succeed:

- Structure is organized around product families or clinical service lines
- Product families or service lines provide specialized and focused care
- Flow and process Lean principles are applied at the clinical service line level to transform those systems of care that deliver value to the patient

There is no need to waste time with “trial and error” approaches while searching for the right solution. We’ll help you to implement methods the right way. Using the most appropriate tools, you can achieve sustainable results in less than 60 days.

Rapid Six Sigma DMAIC Teams.

A Juran-led, fast-paced, data-driven process used to improve system processes not performing adequately and to achieve bottom line results in 90 days. DMAIC is an acronym for five interconnected phases: Define, Measure, Analyze, Improve, and Control. One of the reasons it often takes so long to get projects completed is because it is hard to get people

together. By scheduling extended, highly-focused working sessions, Juran-led teams will diagnose root causes and implement remedies that lead to breakthrough improvements in key work processes in less than half the time typically experienced. Controls will be implemented so that results are sustained long term.

6S to Improve Workplace Performance.

Juran’s 6S is a process designed to ensure workplace organization and safety, streamline departmental work flows, enable standardization of important patient-care processes, and assure patient safety. The training event focuses on understanding and implementing the six steps in the process including Sort, Set in Order, Sweep and Shine, Standardize, Self Discipline, and Safety. Workshop days can range from several hours to several weeks based on the scope of work.

Value Stream and Key Process Mapping Events.

Juran will provide a one-day intensive interactive session on the principles of Value Stream and Process Mapping: step-by-step instruction on how to create a value stream map and how to identify value-added and non-value activities, opportunities for eliminating waste and balancing workload and constraints in critical processes.

Lean Rapid Improvement Events.

A frequent complaint of process improvement initiatives is that it takes too long to implement improvements and realize the gains. Using proven Lean concepts and methodologies, healthcare organizations can get

a jumpstart on improvements and achieve significant benefits sooner by focusing on the three critical value streams for the hospital: Inpatient Flow, E.D. Flow, and Surgical Flow.

Patient Safety Assessment.

Juran’s Patient Safety assessment is conducted by Juran Safety Experts and is a comprehensive evaluation of your organization’s patient safety culture. The assessment entails review of current patient safety metrics, direct observations of staff on the unit, and interviews with all levels of staff within the organization.

Basic Quality Improvement Tools.

The key to organizational effectiveness – even survival – is full-scale breakthrough improvement. What many have failed to understand is that the long-term success of their efforts requires more than supplying their project teams with a cursory knowledge of the quality improvement processes. This workshop will provide an overview of the problem-solving improvement process.

Root Cause Analysis.

Juran’s Root Cause Corrective Action workshop provides a systematic approach to managing patient safety events and identifying root causes to prevent recurrence. The training event focuses on how the current healthcare system fails and how serious safety events occur; steps to identify root causes of safety events; performance improvement and permanent corrective actions to prevent recurrence of serious safety events; and accountability models.

Our promise.

We practice what we teach.

We are fully committed to our clients and believe that our clients' success is our success. The essential end product of our analysis, our training, and our consulting is for our clients to be fully prepared to move forward using our methods, practices, and tools in their business when each engagement draws to a close.

We seek to understand each company's wants, needs, and expectations, and we always strive to exceed them. We plan for each client's eventual self-sufficiency by utilizing a "train-learn-apply-practice-master" approach. We have our own comprehensive Juran Management System that drives and maintains our business. Planning for self-sufficiency is part of every Juran engagement. The process improvement and problem-solving steps we use are clear, transferable, and applicable to the wide-range of issues organizations face.

Juran. The right consultant for you.

Juran is the right consultant to improve your performance. Our services and training, publications, support materials, and personnel are unparalleled. We are experts at preparing system leaders, managers, and the workforce with the practical skills and in-depth knowledge needed to achieve tangible, rapid results on the job. The learning experience offered through our mentoring, training, and certifications is designed to provide our clients the means to accelerate their performance improvement efforts, deliver enhanced value and quality to internal and external customers, and increase their organization's profitability.

Our Mission

Our mission is to create value for society and our customers through superior quality and sustainable results.

Our Vision

Our vision is to be recognized by our customers as the best source for attaining superior quality and sustainable results.



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