2012 John M. Eisenberg Patient Safety and Quality Awards

Memorial Hermann: High Reliability from Board to Bedside

Innovation in Patient Safety and Quality at the National Level

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Article-at-a-Glance

Background: In 2006 the Memorial Hermann Health System (MHHS), which includes 12 hospitals, began applying principles embraced by high reliability organizations (HROs). Three factors support its HRO journey: (1) aligned organizational structure with transparent management systems and compressed reporting processes; (2) Robust Process Improvement™ (RPI) with high-reliability interventions; and (3) cultural establishment, sustainment, and evolution.

Methods: The Quality and Safety strategic plan contains three domains, each with a specific set of measures that provide goals for performance: (1) "Clinical Excellence;" (2) "Do No Harm;" and (3) "Saving Lives," as measured by the Serious Safety Event rate. MHHS uses a uniform approach to performance improvement—RPI, which includes Six Sigma, Lean, and change management, to solve difficult safety and quality problems.

Results: The 9 acute care hospitals provide multiple opportunities to integrate high-reliability interventions and best practices across MHHS. For example, MHHS partnered with the Joint Commission Center for Transforming Healthcare in its inaugural project to establish reliable hand hygiene behaviors, which improved MHHS's average hand hygiene compliance rate from 44% to 92% currently. Soon after compliance exceeded 85% at all 12 hospitals, the average rate of central line–associated bloodstream and ventilator-associated pneumonias decreased to essentially zero.

Conclusion: MHHS's size and diversity require a disciplined approach to performance improvement and systemwide achievement of measurable success. The most significant cultural change at MHHS has been the expectation for 100% compliance with evidence-based quality measures and 0% incidence of patient harm.

In 2006 the Memorial Hermann Health System (MHHS) embarked on a high-reliability journey by applying principles embraced by high reliability organizations (HROs).[1] HROs are able to avoid preventable adverse events in environments where accidents could be expected because of environmental risk and complexity.[2,3] Five HRO principles enable MHHS to achieve consistency and eliminate variation across the system: preoccupation with failure, reluctance to simplify, sensitivity to operations, commitment to resilience, and deference to expertise.[4] The most significant expectations of the MHHS HRO journey (the goals of 100% compliance with evidence-based quality measures and a 0% incidence of patient harm[5]) apply to all measurable aspects of patient care[6]—and make MHHS extremely sensitive to variance.

In 2006 through 2008, MHHS executives, in collaboration with expert consultants from HROs in health care and other industries, helped design a high-reliability educational experience. In the course of a year (2007–2008), all 20,000 MHHS employees, as well as thousands of physicians, received three to four hours of classroom training in high reliability. Kitchen, clerical, maintenance staff, and volunteers were included because everyone working in a health care facility can prevent

an accident—indeed it is their first job at MHHS. A good example of our safety behaviors is the "one-second stop," which is to be made before taking an action, administering a medication, or performing a procedure. The one-second stop is the foundation of many safety success stories and patients saved at MHHS.

By applying HRO principles, MHHS concentrated leadership and employee attention on high-reliability behaviors, evidence-based care, and harm prevention across the system. Three main factors, as follows, support the MHHS journey to high reliability:

1. Aligned organizational structure and strategy with transparent management systems and compressed reporting processes
2. Robust Process Improvement™ with high-reliability interventions
3. Cultural establishment, sustainment, and evolution

In this article, we describe how MHHS has developed and deployed these factors in its pursuit of high reliability.

Methods

Setting

MHHS, the largest not-for-profit hospital system in Texas, consists of 9 acute care hospitals, a children's hospital, 2 rehabilitation hospitals, and 18 ambulatory surgical centers and more than 100 other ambulatory facilities. Some 21,500 employees, including approximately 7,500 nurses and 5,000 physicians, provide care for more than 250,000 inpatients annually.

Aligned Organizational Structure and Strategy

The MHHS Organizational Structure is provided in Appendix 1 (available in online article). The MHHS Quality and Safety Strategy statement is "To lead healthcare to superior patient outcomes through creation of a high-reliability culture with evidence-based quality and patient safety as our core value." The Quality and Safety strategic plan contains three domains, each of which has a specific set of measures that provide goals for performance. The outcomes focus is determined annually by the MHHS board and senior leadership, and defined in the "Big Dot" Quality and Safety Strategies. For fiscal year (FY) 2012 (July 2011–June 2012), the Big Dot Quality and Safety measures were as follows:

- "Clinical Excellence," which includes CMS [Centers for Medicare & Medicaid Services]/Joint Commission core measures[7]; a Surgical Safety Checklist (Appendix 2, available in online article), modeled after the World Health Organization checklist[8]; and hand hygiene compliance, as represented by participation in the Joint Commission Center for Transforming Healthcare hand hygiene project.[9]
- "Do No Harm," which includes Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicators (PSIs)[10] and CMS Hospital-Acquired Conditions (HACs; including central line–associated bloodstream infection [CLABSI], ventilator-associated pneumonia [VAP], catheter-associated urinary tract infection, and surgical site infection).[11]
- "Saving Lives," as measured by the Serious Safety Event (SSE) rate. SSEs are harm events caused by injury or error not related to the natural or expected course of a patient's illness or underlying condition. SSEs encompass all possible harm, not just those defined by infections, safety indicators, and HACs. SSEs, along with "Good Catches" (pages 255–256) and Close Call Events, are described in Appendix 3 (available in online article). The SSE rate is expressed as the number of events per 10,000 adjusted patient-days.[12]

Big Dot strategies are attached to actions consistent with the MHHS vision and mission. Outcomes are tied to goals, and performance improvement is developed and executed as close to the bedside as possible. Results are then reported up through the MHHS systemwide transparent reporting process, as represented in Monthly Operating Review (MOR) reports and meetings. The MOR report serves as a self-assessment framework for facilities, guides strategic actions, and encourages organizational learning. At each meeting, facility executives and senior system executives communicate, analyze, and act on the MOR report. The system chief medical officer [M.M.S.], system chief operating officer, and other senior system executives and facility leaders analyze and form action plans for each and every variance throughout the entire system. The MOR meeting makes operational leadership accountable for quality and patient safety results and requires that hospital leaders master an understanding of clinical and transformative processes. MOR meetings enable facility and system leadership to share information, collaborate on solutions, and benchmark each hospital's progress.

Monthly outcomes are compared to goals set at 100% quality measure performance and 0% preventable harm. It is important to recognize that the MOR process and meeting do not occur in isolation. Within each facility, similar meetings are held at the department and service-line levels to review and prepare the results that make up the facility MOR report and to make plans for improvement.

The MHHS board reviews and actively discusses the MOR quality and safety results on a quarterly basis at the System

Quality Committee of the board, which is chaired by a medical staff physician. The MHHS reporting process promotes transparency, compresses the vertical distance between bedside and board, and empowers decision makers at all levels.

Robust Process Improvement™ with High-Reliability Interventions

MHHS is a geographically and demographically diverse system. Each facility's culture, structure, and location affect the performance improvement process in significant ways. Therefore, MHHS uses a uniform approach to performance improvement called RPI, which includes Six Sigma, Lean, and change management, to solve difficult safety and quality problems.[13] Experts closest to the bedside lead performance improvement processes that promote integration and standardization across the system. RPI projects culminate with the implementation of high-reliability interventions. RPI methodology supports transparency of information vertically across the organization, allows our staff to access data and conduct "just-in-time" two-provider ("double") checks, supports informed decision making, and enhances solution design.

Cultural Establishment, Sustainment, and Evolution

To establish a high-reliability culture, MHHS uses a systemwide education program called Breakthroughs in Patient Safety (BIPS). To achieve and sustain performance improvement gains, employees are continuously reminded of high-reliability techniques and nationally recognized actions to prevent patient harm and support quality care. For instance, there is BIPS signage in every patient room, on thousands of alcohol gel dispensers, and in many hallways and lobbies. The BIPS wall placard in patient rooms instructs patients and families to ensure that all caregivers and visitors wash their hands on entry and leaving as well as how to call the rapid response team directly.

To commemorate significant zero-harm milestones and to reinforce our cultural evolution, in 2011 MMHS established a new High Reliability Certified Zero Award to celebrate a hospital's effective prevention of harm events and adverse outcomes for 12 or more consecutive months. The awards are called "certified" because they are based on the results reported to CMS, the state, and The Joint Commission. Certified Zero Awards were established for most health care–associated infections, Patient Safety Indicators, and HACs. Two HACs—blood incompatibility and air embolus—were never in the Certified Zero program because none had occurred anywhere in the system since 2006.

Results

Selected High-Reliability Interventions and Best Practices

The nine acute care hospitals provide multiple opportunities to integrate high-reliability interventions and best practices across the MHHS.

Hospital-Acquired Infections. In 2007 MHHS began an RPI project to eliminate hospital-acquired infections (HAIs). Several improvement phases focused on assuring reliable adherence to infection prevention bundles for ventilator care and central line catheter insertion, care, and maintenance. A task force of more than 50 multidisciplinary stakeholders from all system hospitals, including leaders, infection preventionists, bedside care providers, and physicians, was convened. Creating a collaborative of experts, frontline users, and operational leaders was a critical tactic. Inclusivity allowed process step alignment and formalization of an accountable systemwide team for HAI prevention. As a result of the task force discussion, accountability was shifted from the infection preventionists to the clinical and administrative leaders in each hospital responsible for physician and employee performance.

Making local leaders accountable for results drove the process forward. HAIs decreased rapidly. Each phase of bundle implementation reduced infections by a statistically significant amount. However, most hospital HAI rates did not reach zero. A second and crucial phase of the RPI process was partnering with the Center for Transforming Healthcare in its inaugural project to establish reliable hand hygiene behaviors,[9] which improved MHHS's average hand hygiene compliance rate from a baseline of 44% to 92% currently, with compliance in some hospitals as high as 99%. Soon after the achievement of hand hygiene compliance of > 85% at all 12 MHHS hospitals, the average rate of CLABSIs and VAPs decreased to essentially zero. For FY 2012 in MHHS hospitals, zero was by far the most common monthly "number" of VAPs and CLABSIs reported (Appendix 4, available in online article).

Computerized Decision Support (CDS) Alerts. Another high-reliability intervention was suggested by the clinicians on the MHHS System Quality and Patient Safety Council (SQPSC), which is led by physicians, clinical leaders, and operational system leaders and reports to the board of directors. In April 2006 the SQPSC endorsed the use of CDS alerts to avoid potential errors in patient care. When a CDS alert causes clinicians to cancel or modify a potentially deleterious order or action for at least a 24-hour period, it is tabulated as a "Good Catch" (Appendix 3). Following this innovation, a Clinical Decision Support Committee was formed to set priorities for

how and when to develop and implement CDS interventions throughout the health care system. Some recommendations originate from the overall safety strategy, while others originate from frontline staff who see opportunities to improve care. Good Catches now occur about 1,000 times per month across the 12 MHHS hospitals. The CDS reliability strategy is strengthened by the implementation of 700 computerized evidence-based system order sets, which were designed by teams of 450 physicians, along with nurses, pharmacists, therapists, and case managers.

Electronic Health Record and Practice Guidelines. Another embodiment of high-reliability technology is the MHHS electronic health record (EHR), which helps improve clinical care in multiple ways. In ambulatory care, primary care physicians, including physicians in training, use a laptop computer when they examine patients. The MHHS ambulatory EHR alerts the physician if a patient isn't up to date with tests or treatments recommended by MMHS practice guidelines.

MEDSAFE. An internally developed, proprietary high-reliability intervention, MEDSAFE increases process reliability at the point of medication administration. It provides an electronic double check by comparing medication bar code information against a verified physician's order at the patient's bedside.[14] For 2011 MHHS placed among the 6.1% of hospitals nationwide at Stage 5 of EHR implementation, closed-loop bar code medication administration.[15] (By the first quarter of 2013, 16.3% of hospitals were at this stage). MEDSAFE aligns MHHS with The Joint Commission's 2013 National Patient Safety Goals to improve the accuracy of patient identification (Goal 1), the effectiveness of communication among caregivers (Goal 2), and the safety of using medications (Goal 3).[16] Bedside MEDSAFE alerts occur when the medication scanned is not consistent with physician orders, including wrong patient, wrong medication, wrong medication form, wrong route, wrong time, wrong dose, and even recent laboratory results not consistent with administering the medication. On average, MEDSAFE produces more than 25,000 alerts per year, increasing the safety of the medication administration process. Of the more than a million medication doses per month, in some months, zero serious medications errors have occurred.

Use of Real-Time Ultrasound Guidance for Central Line Insertion. By February 2011 MHHS Southeast Hospital, one of MHHS's busier community hospitals, had gone a year since its last iatrogenic pneumothorax (PSI-06).[10] Its physicians had adopted the evidence-based safety technique of using real-time ultrasound guidance for central line insertion in more than 95% of the cases. As of August 2012 this high-reliability intervention was in implementation across the system, with increasingly excellent results, with three of the nine hospitals, including Southeast, reporting usage rates of 100% (Appendix 5, available in online article).

Other Serious Safety Events. MHHS has focused on the operating room to reduce SSEs such as accidental punctures or lacerations (APL-PSI-15) and eliminate retention of foreign bodies at surgery (RFB-PSI-05).[10] These PSIs are reported directly to leadership, operating room staff, and physicians as part of the accountability process. Each variance classified as an SSE is subjected to our medical staff peer review system. In addition, many SSEs undergo extensive root cause analysis, with a focus on preventability of the event. As part of MHHS's systematic high-reliability process, radio frequency identification (RFID)-tagged sponges are used for all open surgical procedures. In addition to routine sponge counts, all open-surgical patients are scanned with an RFID detection wand before the incision is closed. This process has led to the detection and removal of sponges that might have been retained because the sponge count was thought to be "correct." This is an example of a resilient high reliability process with multiple opportunities for a "Good Catch." Physicians and operating room staff also use the MHHS Surgical Safety Checklist (Appendix 2). Compliance with the checklist process is audited and reported as part of each hospital's MOR.

Certified Zero Awards Results

Since April 2011, when the Certified Zero program started, a total of 92 Certified Zero Awards have been presented to MHHS hospitals—including, for example, 8 awards for ICU central line infections, 20 for ventilator pneumonias, 1 for central line infections anywhere in the hospital, 19 for foreign bodies, 12 for iatrogenic pneumothorax, and 16 for pressure ulcers Stage III or IV.

Discussion

MHHS's leadership is committed to providing the highest-quality and safest care in operationally and financially efficient ways, which, we believe, will remain key to success in the health care industry.[17] MHHS's size and diversity require a disciplined approach to performance improvement and systemwide achievement of measurable success. Scale and scope present significant challenges to the successful implementation and sustainment of reliable systemwide initiatives.

High-reliability cultural expectations were established through a standardized, organizationwide educational initiative. The high-reliability culture is then reinforced and integrat-

ed across the system by continually educating staff and leadership and publicly recognizing high-reliability performance. The most significant cultural change at MHHS has been the expectation for achievement of 100% compliance with evidence-based quality measures and 0% incidence of patient harm. Achieving HRO principles and our stringent goals necessitates an enhanced quality of attention in our employees.[18] Mindfulness—"a rich awareness of discriminatory detail"—enables individuals to detect subtle variations in complex situations in ways that promote continuous improvement.[4(p. 32)] Structural alignment and transparency promote quick adaptation, reflecting the fact that all levels of staff have reporting lines that are easy to trace to the top and back down to the experts—the providers at the bedside.[19] A clear accountability chain provides each management level—managers, directors, and leadership—meaningful and measurable accountability for the levels below. The MOR process also adds a layer of resilience to the organization by granting leadership an additional opportunity to influence oversight and direction.

Conclusion

MHHS has a responsibility to continuously improve its performance. Even when it reaches zero—as, for example, with transfusion reactions for many years—the challenge is to forever sustain perfect performance. That's high reliability. We must never stop improving. We must never lose attention to detail. We must never become complacent. After all, it's what we would want for ourselves, our family, and our friends and neighbors. At MHHS, it's what we want for our patients as well. J

Online-Only Content

See the online version of this article for

Appendix 1. The Memorial Hermann Health System Organizational Structure

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Appendix 3. Scheme of Event Level of Harm

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Appendix 5. Use Rates for Ultrasound-Guided Central Line Insertion at the Nine Memorial Hermann Health System Hospitals, August 2012

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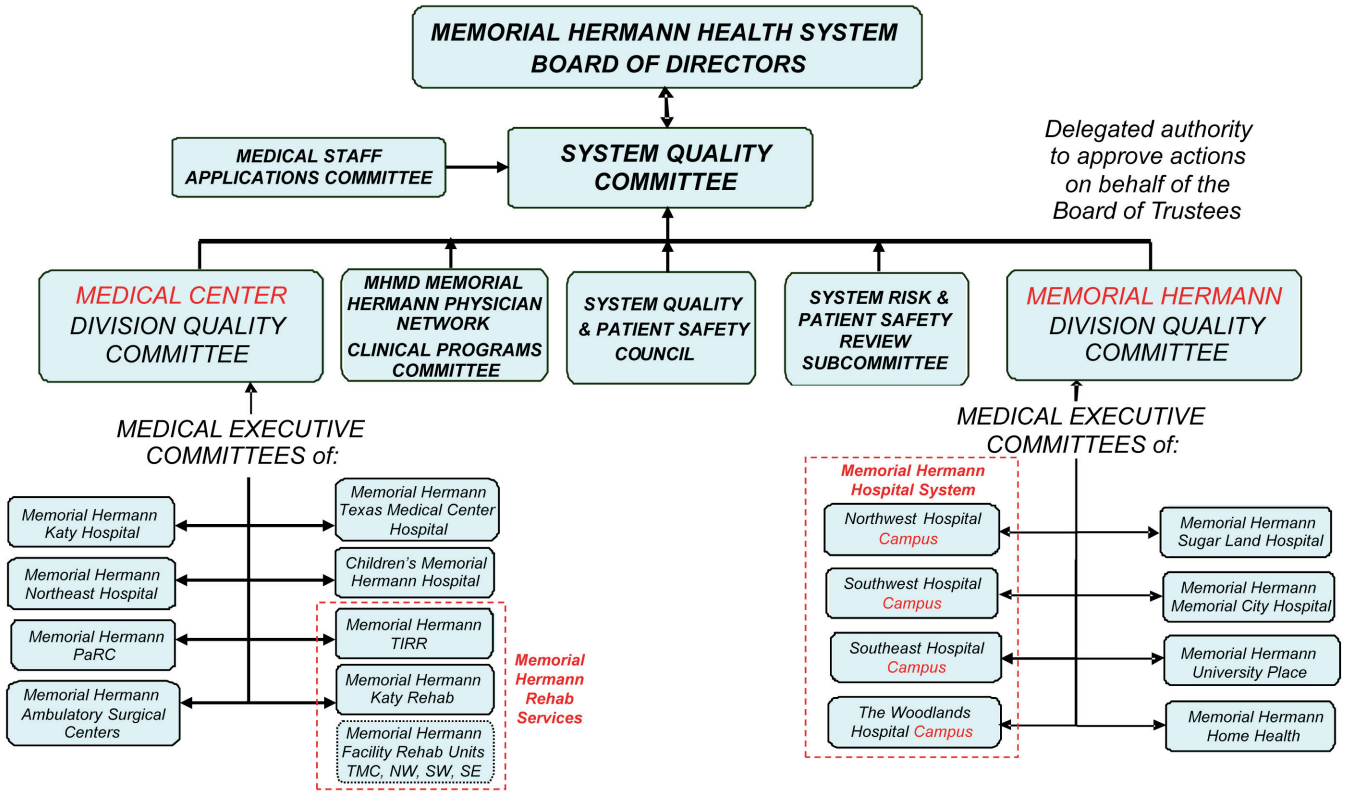
Appendix 1. The Memorial Hermann Health System Organizational Structure*



** PaRC, Prevention and Recover Center; TIRR, Texas Institute for Rehabilitation and Research; TMC, Texas Medical Center; NW, Northwest; SW, Southwest; SE, Southeast.*

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Appendix 2. Memorial Hermann Health System Surgical Safety Checklist*

MEMORIAL HERMANN

Surgical Safety Checklist

BRIEFING: PRIOR TO INDUCTION, CIRCULATING NURSE AND ANESTHESIA PROVIDER FOR THE CASE ARE PRESENT

- ☐ Confirm patient ID, site, consent and procedure
- ☐ Confirm correct implants present (if applicable)
- ☐ Ensure site is marked
- ☐ Check anesthesia equipment and medication
- ☐ Assess any difficult airway or aspiration risk
- ☐ Note any patient allergies
- ☐ Confirm blood availability if necessary
- ☐ VTE prophylaxis, warming blanket and beta blocker confirmed (if applicable)

BEFORE SKIN INCISION: TIMEOUT ALL TEAM MEMBERS PRESENT, PATIENT DRAPED, PRIOR TO INCISION

- ☐ Confirm all team members have identified themselves (can be done prior to draping)
- ☐ Confirm patient name and procedure, and visualize incision site/marking (if applicable)
- ☐ Administer appropriate antibiotics
- ☐ Confirm correct implants
- ☐ Address team member patient-specific concerns
- ☐ Determine anticipated case length
- ☐ Determine anticipated risk of blood loss
- ☐ Confirm sterility indicator
- ☐ Ensure essential imaging is displayed

DEBRIEFING: PERFORMED AT END OF PROCEDURE BUT PRIOR TO SURGEON LEAVING

- ☐ Nurse verbally confirms:
  - ☐ Name of procedure and post-op diagnosis
  - ☐ Completion of instrument, sponge and needle count prior to closing
  - ☐ Specimen labeling
  - ☐ Failed equipment out of service with proper labeling and reporting
- ☐ Determine any concerns to relay to immediate post-op caregiver

Based on the WHO Surgical Safety Checklist, URL: //www.who.int/patientsafety/safesurgery/en

OPERATION BREAKTHROUGH PATIENT SAFETY BEST OF THE BEST

MEMORIAL HERMANN

** ID, identification; VTE, venous thromboembolism. Based on the WHO Surgical Checklist. http://www.who.int/patientsafety/safesurgery/en/. © World Health Organization 2009. All rights reserved.*

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Appendix 3. Scheme of Event Level of Harm*

SAFETY EVENT CLASS	LEVEL OF HARM	CODE	DESCRIPTION
SERIOUS SAFETY EVENT	Death	SSE1	Death due to injury or error, not related to the natural or expected course of the patient's illness or underlying condition.
	Severe Permanent Harm	SSE2	Detectable harm due to injury or error, causing great discomfort, injury and/or distress (including permanent loss of organ function), not related to the natural or expected course of the patient's illness or underlying condition.
	Moderate Permanent Harm	SSE3	Detectable harm due to injury or error, greater than minimal harm but less than severe harm (e.g. chronic renal insufficiency post acute renal failure), not related to the natural or expected course of the patient's illness or underlying condition.
	Severe Temporary Harm	SSE4	Detectable harm due to injury or error, lasting for a limited time only, resulting in no permanent injury, yet causing great discomfort, injury and/or distress (e.g. additional procedure, surgery or resuscitation), not related to the natural or expected course of the patient's illness or underlying condition.
	Moderate Temporary Harm	SSE5	Detectable harm due to injury or error, lasting for a limited time only, resulting in no permanent injury and is greater than minimal harm, but less than severe harm (e.g. does not require additional surgery, procedure or resuscitation measure), not related to the natural or expected course of the patient's illness or underlying condition.
CLOSE CALL EVENT	Minimal Permanent Harm	PSE1	Detectable harm due to injury or error, not expecting change in clinical status and is minimal in severity (e.g. scar from laceration), not related to the natural or expected course of the patient's illness or underlying condition.
	Minimal Temporary Harm	PSE2	Detectable harm due to injury or error, lasting for a limited time only, resulting in no permanent injury and is minimal in severity; requires little or no intervention, not related to the natural or expected course of the patient's illness or underlying condition.
	No Detectable Harm	PSE3	Not able to discover or ascertain the existence, presence or fact of harm due to injury or error, but harm may exist; insufficient information available or unable to determine any harm
	No Harm	PSE4	The absence of harm due to injury or error, with sufficient information available to determine that no harm occurred (i.e. "got lucky")
GOOD CATCH	Event "almost happened"	NME1	Error, injury or condition was caught by an error detection barrier (i.e. "the system worked")
	Adverse-to-Quality Condition	NME2	Requires remediation but not an apparent or root cause analysis process

** SSE, Serious Safety Event; PSE, Patient Safety Event; NME, Near Miss Event. Adapted with permission from Healthcare Performance Improvement (HPI), LLC, Virginia Beach, VA.*

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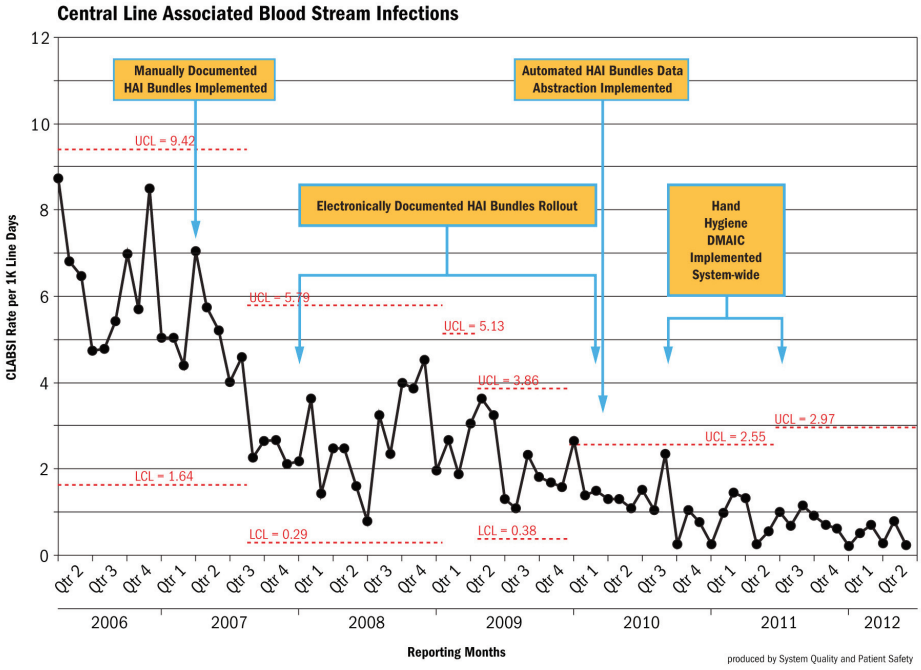
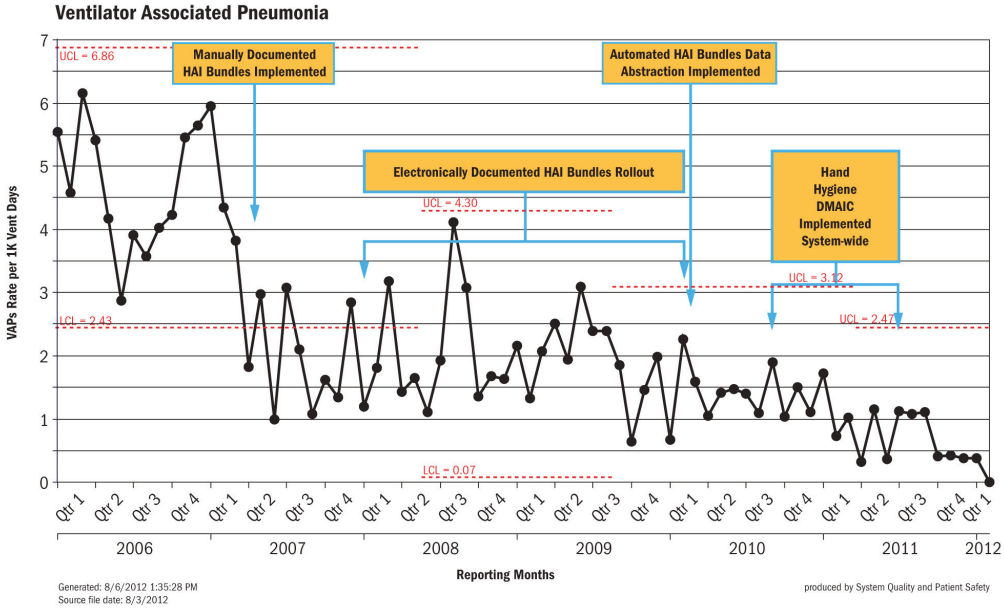
Appendix 4. Memorial Hermann Adult ICU Central Line–Associated Bloodstream Infection (CLABSI; top) and System Adult Ventilator-Associated Pneumonia (VAP) Rates, 2006–2012*





** HAI, health care–associated infection; DMAIC, Define, Measure, Analyze, Improve, Control; UCL, upper control limit; LCL, lower control limit; Qtr, quarter.*

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Appendix 5. Use Rates for Ultrasound-Guided Central Line Insertion at the Nine Memorial Hermann Health System Hospitals, August 2012

Facility	Grand Total	Usage Rate
Hermann Hospital – Acute	212	83.49%
Katy Hospital – Acute	11	100.00%
Memorial City Hospital – Acute	20	90.00%
Northeast Hospital – Acute	56	94.64%
Northwest Hospital – Acute	74	97.30%
Southeast Hospital – Acute	30	100.00%
Southwest Hospital – Acute	74	98.65%
Sugar Land – Acute	1	100.00%
The Woodlands – Acute	44	75.00%
Grand Total	**522**	**89.66%**