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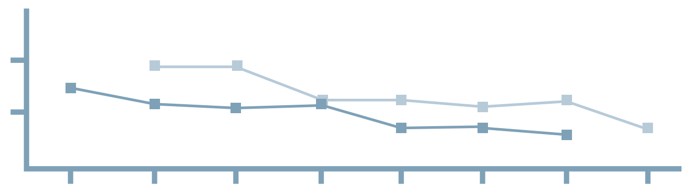

Innovation Series 2005

Reducing Hospital Mortality Rates (Part 2)

8

We have developed IHI's Innovation Series white papers to further our mission of improving the quality and value of health care. The ideas and findings in these white papers represent innovative work by organizations affiliated with IHI. Our white papers are designed to share with readers the problems IHI is working to address; the ideas, changes, and methods we are developing and testing to help organizations make breakthrough improvements; and early results where they exist.

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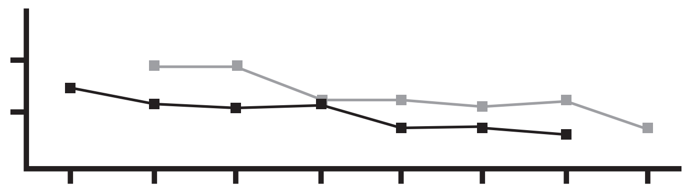

Innovation Series 2005

Reducing Hospital Mortality Rates (Part 2)

Note: This is IHI's second white paper reporting on our innovation work in the area of reducing mortality rates. The white paper describing our earlier work in this area, entitled *Move Your Dot™: Measuring, Evaluating, and Reducing Hospital Mortality Rates*, is available on IHI.org at www.ihi.org/IHI/Products/WhitePapers/.

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Executive Summary

Mortality rates in US hospitals vary widely when calculated in a standardized way. Systematic analysis of hospital deaths can reveal some of the reasons for this variation. When hospital deaths are categorized according to the level and type of care, patterns emerge that can highlight system defects.

In 2002, a pilot group of eight hospitals — six from the US and two from the UK — began working with the Institute for Healthcare Improvement (IHI) to analyze inpatient mortality, and to test IHI's hypothesis that a combination of evidence-based interventions can reduce mortality rates. Each hospital implemented strategies proven to reduce mortality, including, but not limited to, Multidisciplinary Rounds, Rapid Response Teams, and the Ventilator Bundle (a group of interventions designed to improve care of patients on ventilators). Use of these strategies reduces the number of "code calls" per thousand discharges and the incidence of ventilator-associated pneumonia.

Early data on the impact of these interventions on overall mortality are encouraging. Two pilot hospitals have experienced particularly impressive reductions in raw mortality rates from 2003 to 2004, the one-year period after interventions were introduced.

Introduction

Health care in the US is known to be highly variable in quality.[1] One particularly troubling manifestation of this problem is the wide range of mortality rates in US hospitals.

The alarming truth for patients in US hospitals is that their likelihood of dying is highly correlated with their choice of hospital. Analysis by the Institute for Healthcare Improvement (IHI) using hospital standardized mortality ratios (HSMRs) has shown that a substantial variation in care/quality of care exists among US hospitals. (An HSMR is a performance metric based on mortality data which adjusts for multiple variables — at the patient level, hospital level, and region level — that affect mortality.[2] These adjustments allow quality-of-care comparisons to be made between hospitals.) US hospitals' HSMRs varied greatly: Excluding outliers, HSMRs still ranged from 65 to 149. In other words, a patient's chance of dying could range from roughly 65 percent of the hypothetical average to 149 percent of the average based on which hospital they chose — more than a two-fold difference. The HSMR is an important system-level quality indicator, and is an essential tool for hospitals seeking to understand and reduce serious adverse outcomes of inpatient care.

As part of its effort to foster improvement in health care systems, IHI developed an analytical approach for understanding hospital mortality rates, described in detail in an IHI Innovation Series white paper entitled *Move Your Dot: Measuring, Evaluating, and Reducing Hospital Mortality Rates*, available at www.ihi.org/IHI/Products/WhitePapers/MoveYourDotMeasuringEvaluatingand ReducingHospitalMortalityRates.htm. IHI believes that mortality can be consistently reduced through the use of a combination of evidence-based interventions. A number of hospitals working with IHI have been testing this theory, and the preliminary results generally are encouraging. These early results, coupled with work by other IHI collaborative quality improvement initiatives, evidence from the literature, and a growing sense of urgency to improve patient safety and health care outcomes, led IHI to launch a national campaign to reduce mortality in December 2004. The *100,000 Lives Campaign* has enlisted more than 2,200 hospitals across the United States in a commitment to implement changes in care that have been proven to prevent avoidable deaths.

In addition to using Rapid Response Teams and employing the Ventilator Bundle, described in this paper, the *100,000 Lives Campaign* also encourages and coaches hospitals to implement the following interventions:

- Deliver reliable, evidence-based care for acute myocardial infarction
- Prevent adverse drug events
- Prevent central line infections
- Prevent surgical site infections

Background

During 2002 IHI helped set the stage for measuring and reducing mortality by supporting the work of Sir Brian Jarman, Emeritus Professor of Primary Health Care at Imperial College School of Medicine in London, UK.[3] Developer of the Jarman Index, a measure of the relationship between indicators of socio-economic status and health outcomes, Jarman spent 2002 working as a Senior Fellow in Residence at IHI.

During that time, Jarman developed the hospital standardized mortality ratio (HSMR) methodology for US hospitals, which has proven to be a robust metric for mortality. (For technical details on how HSMRs are calculated, see IHI's white paper entitled *Move Your Dot: Measuring, Evaluating, and Reducing Hospital Mortality Rates.*) Jarman's original work in this area was done for British hospitals.[4] Jarman's work showed that improvements in quality of care resulted in a concomitant reduction in HSMR.

Based on this finding, in 2002 IHI invited the approximately 90 hospitals in its IMPACT network to investigate their mortality rates. IHI provided each hospital with its HSMR, along with guidance on how to identify the appropriateness of the level of care for the last 50 patients who died in the hospital. The tool for this analysis is the 2x2 Matrix, shown in Figure 1.

Figure 1. 2x2 Matrix

		ICU Admission	
		Yes	**No**
Comfort Care Only	**Yes**	1	2
	No	3	4

Source: Institute for Healthcare Improvement

Using this tool, trained reviewers categorized patients who died during their hospitalizations, according to the following four categories upon admission:

Box 1: Admitted to an intensive care unit for comfort care only

Box 2: Admitted to a non-intensive care unit (for example, a medical/surgical floor) for comfort care only

Box 3: Admitted to an intensive care unit for active treatment

Box 4: Admitted to a non-intensive care unit for active treatment

Special attention was paid to the medical records of patients categorized in Box 4 — those who, on admission, were admitted to a non-intensive care unit for active treatment but who died. Several common themes related to unexpected and potentially preventable mortality emerged from review of these charts, including planning failures; poor handoffs; lack of communication and teamwork; suboptimal risk assessments and/or delays in diagnosis; and incidences in which patients were harmed, known as adverse events. For example, at one hospital, staff saw patterns indicating that some deaths occurred because of a failure to respond early enough to changes in patients' conditions. There are generally three reasons for this type of failure: failure to recognize the change in the patient's condition; failure to effectively communicate concerns about the change; and failure to respond in a timely and appropriate manner to concerns that are communicated.

The ability to predict hospitals' HSMRs was initially explored in an effort to identify and understand the key factors that contribute to a lower HSMR. IHI faculty developed a theory, based primarily on strong evidence from the literature, that the presence or absence of the following three characteristics would affect a hospital's HSMR:

1. Implementation of best practices from the medical literature that correlate with a reduction in mortality;

2. Adoption of system supports (such as reminders and standardization) used in high-reliability organizations; and

3. Identification and differential treatment of high-risk patients.

To test this theory, IHI conducted a series of site visits and telephone interviews with 12 hospitals with low and high HSMRs to determine the presence of these characteristics. Discussions with these hospitals were facilitated by presenting diverse scenarios designed to highlight issues of hierarchy, communication, front-line support, and failure to rescue. Additional characteristics related to mortality cited in the literature were explored, including standardization of high-risk medications, RN-to-patient ratios, presence and use of hospitalists, presence and use of intensivists (i.e., physicians who specialize in the care and treatment of patients in intensive care), and presence of pharmacists on clinical units. Although this work did not yield a robust rule for predicting an individual hospital's HSMR, it did inform and refine subsequent pilot testing of evidence-based interventions designed to reduce mortality in eight new pilot sites.

Innovation Begins

The eight new pilot hospitals — six from the US and two from the UK — selected to test approaches to reducing mortality had a mix of high and low HSMRs, expressed the interest, willingness, and ability to actively engage in rapid testing of change ideas, and had a history of successful improvement work. All eight hospitals worked collaboratively to test and implement change ideas that had the potential to reduce mortality in each of the four boxes of the 2x2 Matrix. They also continued to develop methods for analyzing their own in-hospital deaths to identify additional specific opportunities for improvement within their facilities.

Fifty consecutive patients who had died in each pilot hospital were categorized according to the 2x2 Matrix by a trained reviewer (often a nurse). The reviewer then performed a more comprehensive analysis of the charts of patients who were not expected to die (Boxes 3 and 4), using IHI's Global Trigger Tool.[5] The Trigger Tool provides a structured framework to identify elements of the patient's overall care experience — not just care related to medication or surgery, for example — that might be considered an adverse event. Adverse events are viewed from the patient's perspective; the Global Trigger Tool defines an adverse event as "harm to a patient from the viewpoint of the patient." The tool further guides reviewers to determine whether the "harm" in question is part of the natural progression of the disease process or a complication of the treatment related to the disease process. While these decisions will at times be difficult and subjective, preliminary experience with the use of the Trigger Tool has found the process to be reasonably sensitive and specific.

Physicians then reviewed the subset of charts with possible adverse events to confirm the reviewers' classification and discern specific potential system problems related to mortality, such as miscommunication, failure to rescue, or delays in diagnosis.

Results of the review and classification of 50 consecutive in-hospital deaths among the eight pilot hospitals are shown in Figure 2.

Figure 2. Results of Mortality Review in Eight Pilot Sites

Comfort Care Only	ICU Admission: Yes	ICU Admission: No
Yes	1 US: 3% UK: 1%	2 US: 13% UK: 42%
No	3 US: 35% UK: 8%	4 US: 49% UK: 48%

Source: Institute for Healthcare Improvement

Change Ideas and Measures

IHI faculty recommended change ideas and measures for each box based on major themes for all patients, rather than changes specific to any single diagnosis. Although there is opportunity to improve care for specific disease states such as congestive heart failure or pneumonia, decreasing mortality significantly for the entire hospital population requires a focus on larger systemic issues. Thus, a standardized approach is common to the change ideas for each of the four boxes.

The *primary outcome measure* for evaluating the success of the project was the percentage change in raw (crude unadjusted) mortality rate over a 12-month period from 2003 to 2004. Hospital teams measured their improvement in real time using actual monthly mortality rates. A secondary, but important, intermediate global measure was the monthly code call rate, defined as the number of code calls per 1,000 discharges. Hospitals also tracked the percentage of code calls that occurred outside the ICU. The goal was to drive the number of failure-to-rescue code calls down to as close to zero as possible.

It is important to note that preventing mortality is not a realistic goal for Boxes 1 and 2. Rather, the goals for these boxes should be to place patients in the most appropriate setting, and to ensure as much comfort and dignity as possible throughout the dying process. This paper will focus on evidence-based interventions to reduce mortality rates for patients who are categorized in Boxes 3 and 4.

Focus on Patients in Box 3

Box 3: Patients admitted to an intensive care unit for active treatment, who die during their hospitalization

Primary Types of Failure: Failure to plan, failure to communicate, failure to rescue

Opportunity for Improvement: Patient deaths in this category reflect a need for more reliable care in the ICU

Changes: Changes in this category focus on improving communication and using evidence-based care processes known to reduce infection and improve outcomes:

- **Create and use multidisciplinary teams to care for patients.** Clear and effective communication is important in all health care settings and is particularly imperative in the intensive care unit. Ineffective communication can result in an increased length of stay, increase in adverse events, and decreased patient, family, and provider satisfaction.[6,7,8,9,10,11] Improving communication among caregivers through an effective multidisciplinary rounding process combined with the use of a Daily Goals Sheet has resulted in an increased understanding by the care team of specific patient requirements and a decrease in overall length of stay in the ICU.[12]

  A multidisciplinary team consists of physicians, nurses, pharmacists, therapists, and others who provide care collaboratively for an ICU patient. This group of providers conducts patient rounds together, sharing knowledge, observations, and expertise both among themselves and with patients and families as desired, and makes decisions jointly with patients on appropriate goals.[13,14,15]

- **Use shared Daily Goals Sheets.** A Daily Goals Sheet is a structured form used to communicate a patient's goals, posted where providers, the patient, family members, and other visitors can easily see it.[16] This serves as a useful way for everyone to work together toward appropriate clinical goals.

- **Maintain optimal glucose control.** Careful glucose control among ICU patients has been shown to make a significant improvement in the outcomes of patients.[17,18,19,20,21,22,23] Better control can be achieved through a standardized use of IV insulin infusion protocols for elevated glucose.

- **Implement the "Ventilator Bundle."** This group of four scientifically grounded care components, executed reliably in patients on mechanical ventilation for which they are appropriate, can significantly improve the care of the ventilated patient. The four components are:[24,25,26,27,28]

  - Elevate the head of the bed to between 30 and 45 degrees, which reduces the frequency and risk of nosocomial pneumonia compared to a supine position.

- Interrupt sedative drug infusions daily (often referred to as a "sedation vacation"), which decreases the duration of mechanical ventilation and length of stay (LOS) in the ICU; and assess readiness to extubate daily.
- Administer peptic ulcer disease (PUD) prophylaxis to reduce the risk of upper gastrointestinal bleeding.
- Administer thromboprophylaxis to prevent deep venous thrombosis (DVT).

- **Use intensivists.** The use of intensivists has been shown to reduce ICU length of stay and mortality.[29] Moving to a model in which all ICU patients are under the care of a critical care specialist improves care and outcomes.[30]

Measures:

- Percent of patients categorized in Box 3 who die during their hospitalization
- Percent compliance with the entire Ventilator Bundle for mechanically ventilated patients
- Percent of patients with completed Daily Goals Sheets
- Ventilator-associated pneumonia rate per 1,000 ventilator days in the ICU
- Percent of patients seen by multidisciplinary rounding team
- Percent of patients in the ICU whose blood sugar results fall in the range of 60-150

Focus on Patients in Box 4

Box 4: Patients admitted to a non-intensive care unit for active treatment, who die during their hospitalization

Primary Types of Failure: Failure to plan, failure to communicate, failure to rescue

Opportunity for Improvement: Improving care and reducing mortality for this category of patients represents perhaps the greatest challenge. Key issues center around recognition, risk assessment, and communication of symptoms that might indicate deteriorating health, and the response to those indicators.

Changes:

- **Standardize care team communications with SBAR.** SBAR — Situation-Background-Assessment-Recommendations — is a standardized model for providers to communicate about patients in non-ICU settings.[31,32,33] For example, when a nurse calls a physician using this technique, she or he describes the situation (e.g., the patient is short of breath); the patient's background (e.g., the patient has a history of COPD); the assessment (e.g., I think this patient is deteriorating); and the recommendation (e.g., I think you should see the patient now).

- **Implement Rapid Response Teams.** Failing to rescue patients before a critical event is a significant problem. Studies of charts of patients who have experienced a code call — i.e., "code blue," "crash call" (UK), cardiopulmonary arrest — reveal missed opportunities to intervene in the 24 hours prior to the arrest.[34,35,36]

  Studies have shown that using a medical emergency response team — a small group of experienced clinicians available to assist in assessing and responding to patients with deteriorating conditions — can be an effective way to rescue patients.[37,38,39,40,41,42,43] These Rapid Response Teams (RRTs) — typically composed of a critical care nurse, a respiratory therapist, and/or a physician — are on-call 24/7 to consult on any patient. Nurses are given a list of criteria to guide them in the use of the RRT. The criteria include acute changes in heart rate, systolic blood pressure, respiratory rate, oxygen saturation, level of consciousness, urinary output, or a staff member is simply worried that the patient is declining.

  When called, the RRT assists the front-line nurses by assessing the patient's condition, making any necessary interventions, and recommending further actions that should be taken. Once the RRT sees the patient and gathers information, the attending physician is informed of the patient's condition and included in the process of care.

- **Develop a hospitalist program.** Use of hospitalists (i.e., physicians who oversee the care of emergency or critical care patients admitted to the hospital) has been shown to reduce hospital length of stay as well as ICU length of stay.[44,45]

Measures:

- Percent of patients categorized in Box 4 who die during their hospitalization
- Monthly code call rate (per 1,000 discharges)
- Percent of code calls outside the ICU
- Percent of patients with code calls discharged alive
- Utilization of Rapid Response Team: Weekly number of calls to RRT

Implementing Three Key Changes to Reduce Mortality

Following are examples of how three key change concepts — Multidisciplinary Rounds, the Ventilator Bundle, and Rapid Response Teams — were implemented in three hospitals working with IHI.

Multidisciplinary Rounds: OSF St. Anthony Medical Center

OSF St. Anthony Medical Center is a 254-bed tertiary care facility located in Rockford, Illinois, USA. With a Level I Regional Trauma Center, OSF St. Anthony's had more than 29,000 visits to its emergency department in 2004; the 38-bed ICU treated 2,640 patients.

OSF staff agreed to try multidisciplinary rounding in the ICU to test the impact on quality of care and patient safety. ICU Multidisciplinary Rounds were used to accomplish the following:

- Advance the plan of care by reviewing the patient's current status, progress toward goals, and response to interventions;
- Identify possible gaps in care, prevent unnecessary delays, and reduce the number of inappropriate days in the ICU and in the total hospital stay;
- Begin multidisciplinary planning for discharge upon admission to the ICU, including identifying the anticipated length of stay;
- Anticipate and plan for changes and reduce/prevent predictable complications; and
- Encourage family participation in the plan of care and improve family support and decision making, including end-of-life care, if needed.

The process at OSF begins by setting specific times for Multidisciplinary Rounds and posting them in the intensive care unit. In addition to physicians and nurses, representatives from quality/care management, social services, nutrition, respiratory therapy, physical therapy, and pharmacy are asked to participate.

The Quality/Care Management Coordinator convenes the team participants and ensures that rounds start on time. He or she also helps expedite the flow of rounds from bedside to bedside and encourages communication among all participants, using the most recent Daily Goals Sheet for each patient to facilitate the discussions. The recommendations of all group members are documented on the Multidisciplinary Rounds Sheet.

The patient's most recent Daily Goals Sheet is discussed during rounds to ensure a systematic review of all clinical parameters, early identification of changes, new problems, and safety risks.

The team evaluates the overall plan of care and makes recommendations to advance care, including continuing with the current plan of care or initiating a new treatment, intervention, or preventive measure(s). The Quality/Care Management Coordinator makes an entry in the physician's progress notes if applicable.

Following testing and implementation in the ICU, the use of Multidisciplinary Rounds was spread to the medical/oncology unit, involving the family as appropriate. Staff nurses identified patients, other than ventilator patients, who they thought would benefit from Multidisciplinary Rounds.

Ventilator Bundle: Virginia Mason Medical Center

At Virginia Mason Medical Center, a large health system based in Seattle, Washington, USA, ICU staff use the Ventilator Bundle.[46] Evidence shows that the group of four components in the Ventilator Bundle, combined with the use of Multidisciplinary Rounds, can significantly improve care and outcomes for patients on ventilators. All four components must be implemented to maximize benefits for patients, including reducing the incidence of ventilator-associated pneumonia (VAP).

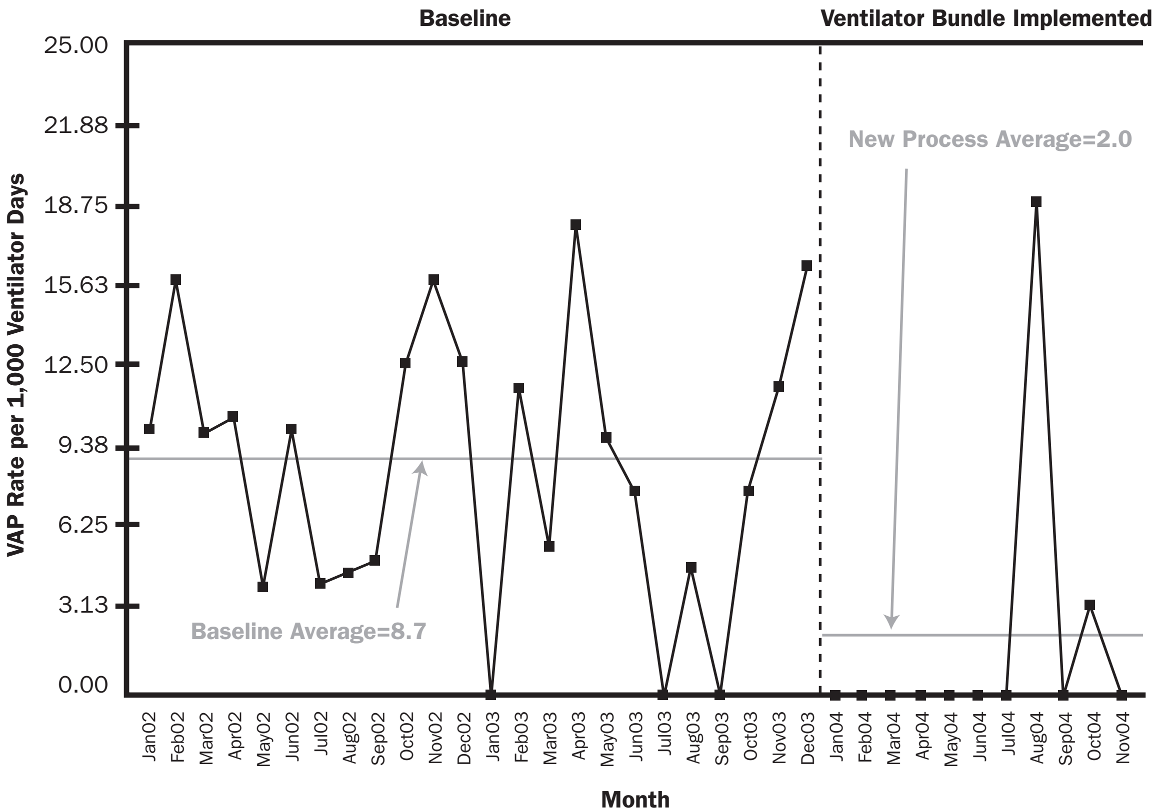
The following four care components of the Ventilator Bundle were tested by the pilot and innovation teams:

1. Elevation of the head of the bed to between 30 and 45 degrees
2. Deep venous thrombosis (DVT) prophylaxis
3. Peptic ulcer disease (PUD) prophylaxis
4. Daily "sedation vacation" and daily assessment of readiness to extubate

Multidisciplinary Rounds help support the use of the Ventilator Bundle, because all providers are focused on the same set of care practices, which they review as they round on each ventilator patient. Simple reminders — for example, one site placed bright red tape at the 30-degree mark on each bed — also help.

Figure 3 shows reductions in the VAP rate after implementation of the bundle. (Note that the baseline, or "before" data, reflect one element — elevated beds — that was already in use.)

Figure 3. Ventilator-Associated Pneumonia Rate per 1,000 Ventilator Days, Virginia Mason Medical Center, Seattle, Washington



Rapid Response Teams: Borgess Medical Center

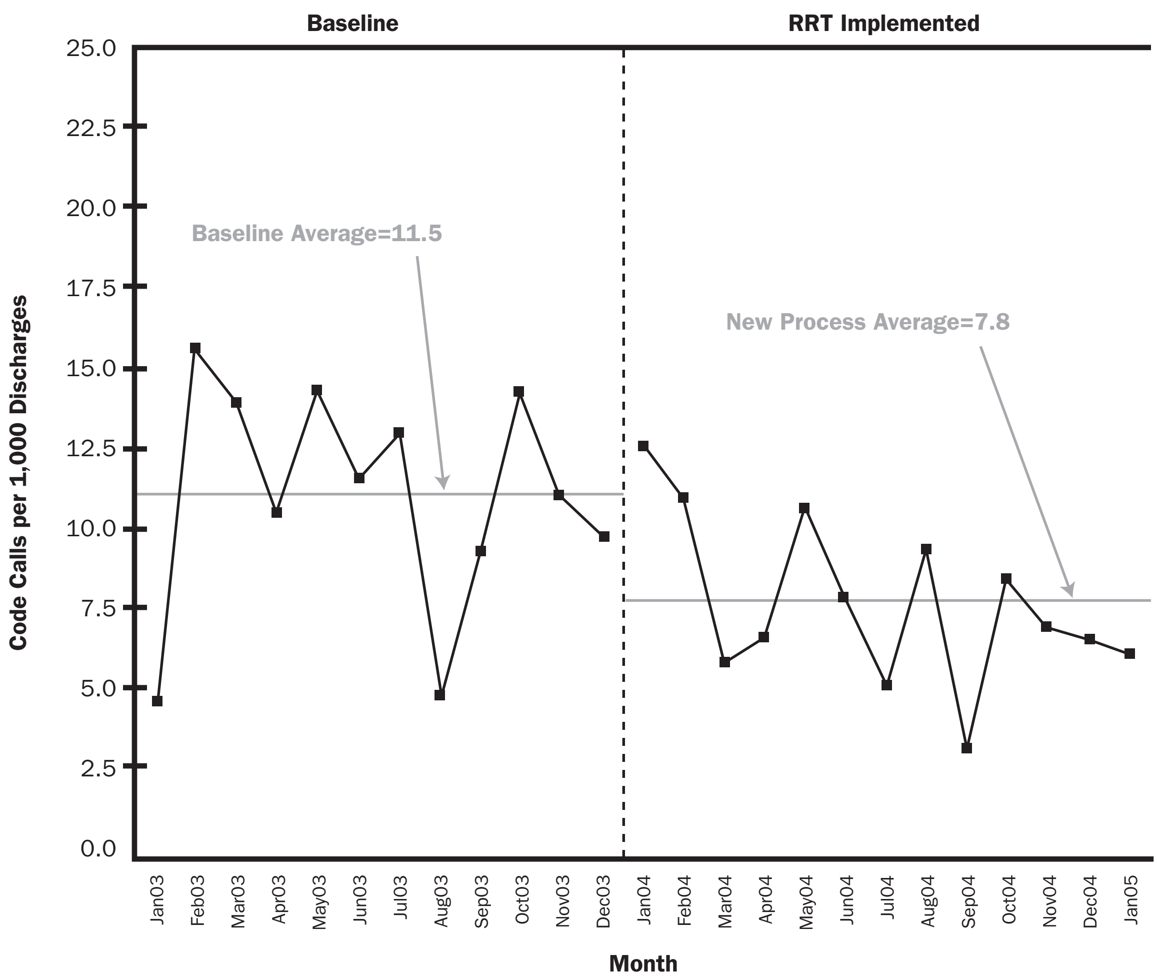
Borgess Medical Center in Kalamazoo, Michigan, USA, part of the Ascension Health System (and Ascension's "alpha site" for testing changes to reduce mortality), evaluated and introduced a Rapid Response Team (RRT). The team consists of an experienced critical care-trained nurse (from the nursing resource team, a pool of critical care-trained nurses deployed in different capacities as needed throughout the hospital), a respiratory therapist, and a senior resident on the intensive care medicine service. A RRT is on-call throughout the hospital, on all shifts, and typically responds to calls within five minutes.

Floor nurses receive ongoing education regarding the appropriate use of the RRT. Nurses are encouraged to call the RRT whenever they feel a patient should be seen quickly to prevent deterioration in the patient's condition that could lead to a code call, and then to immediately alert the patient's attending physician. During the patient visit, the RRT works closely with the bedside nurse, bringing additional analytical skills and the ability to see the patient's issues in a broader context. If the attending is not immediately available to see the patient, the resident on the team makes necessary treatment decisions.

About half the patients visited by the Borgess RRT are moved to a higher level of care, either a monitored bed or the intensive care unit. Those who aren't moved are treated on the unit. With a typical daily census between 250 and 260, Borgess averages slightly less than 25 RRT calls per month.

The introduction of a RRT at Borgess has resulted in a decrease in the number of code calls per 1,000 discharges (Figure 4).

Figure 4. Code Calls per 1,000 Discharges, Borgess Medical Center, Kalamazoo, Michigan



Results: Putting It All Together to Reduce Mortality

Early data from the pilot innovation site hospitals suggest that reliable implementation of these interventions can reduce mortality. Figure 5 shows the raw mortality rates and HSMRs from 1997 to 2004 for five of the eight pilot sites for which these data were available. Note that the HSMR closely mirrors the raw mortality rate in these hospitals over time, suggesting that the raw mortality rate provides a reasonable real-time proxy for the HSMR, which typically is not available from national data sources for at least a year. The graphs show the percent difference between 2003 and 2004, since this was the pre-determined primary outcome measure. Decreased raw mortality rates were observed from 2003 to 2004 at Tallahassee Memorial Hospital, Borgess Medical Center, and Missouri Baptist, while no improvement was seen in the other sites. The two sites with the most impressive gains from 2003 to 2004 — Borgess and Tallahassee Memorial — have experienced a decline in mortality over longer periods. Borgess Medical Center has been engaged in quality improvement work with IHI since 2000, and Tallahassee Memorial Hospital began its initial work on mortality reduction immediately after obtaining its HSMR in late 2002.

At Tallahassee Memorial Hospital in Tallahassee, Florida, USA, a 770-bed acute care and extended care hospital that is part of Tallahassee Memorial HealthCare, use of SBAR, Multidisciplinary Rounds, and Rapid Response Teams was associated with a 13 percent decrease in the raw mortality rate between 2003 and 2004.

In addition, condition-specific mortality at Tallahassee Memorial dropped between 2002 and 2004:

- 53 percent reduction in death from acute myocardial infarction (AMI)
- 62 percent reduction in death from heart failure
- 41 percent reduction in death from stroke
- 46 percent reduction in death from pneumonia

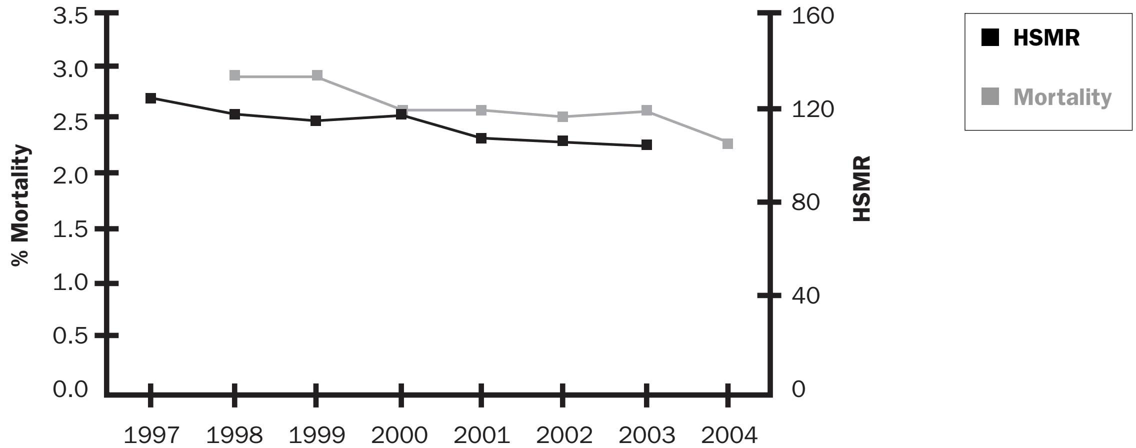
Borgess Medical Center implemented Multidisciplinary Rounds in the ICU with Daily Goals Sheets, as well as the Ventilator Bundle with the added element of tight glycemic control. RRTs are available to all medical/surgical units. The raw mortality rate at Borgess dropped by 17 percent between 2003 and 2004.

These longitudinal raw mortality data should be interpreted with caution, particularly with respect to a cause-effect relationship between mortality rate and collaboration with IHI or the implementation of any particular suite of interventions. Nonetheless, the mortality reductions observed in some institutions are impressive.

Figure 5. HSMRs and Raw Mortality Rates in Five Pilot Hospitals

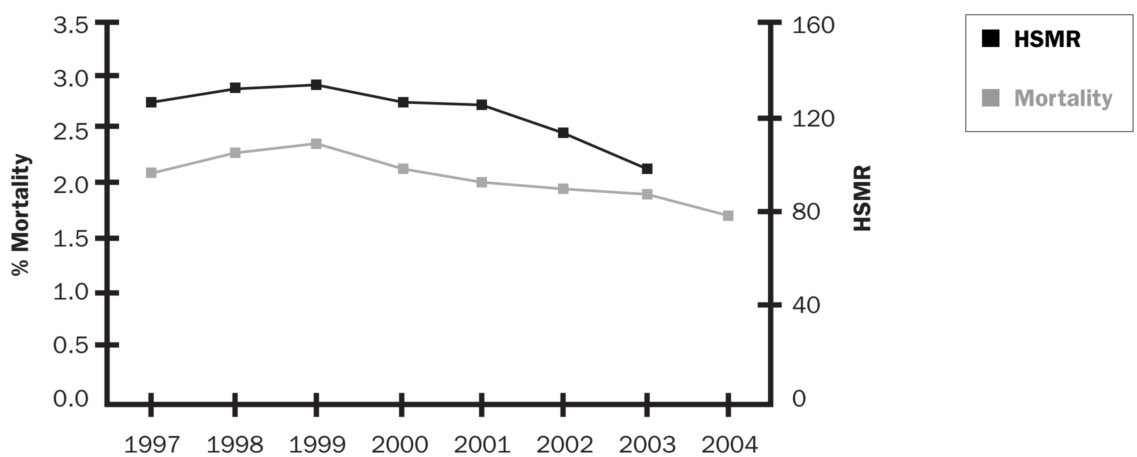
Borgess Medical Center Raw Mortality Rate vs. HSMR

1997–2003 actual HSMR; 1998–2004 raw mortality
17% decrease in raw mortality rate 2003–2004



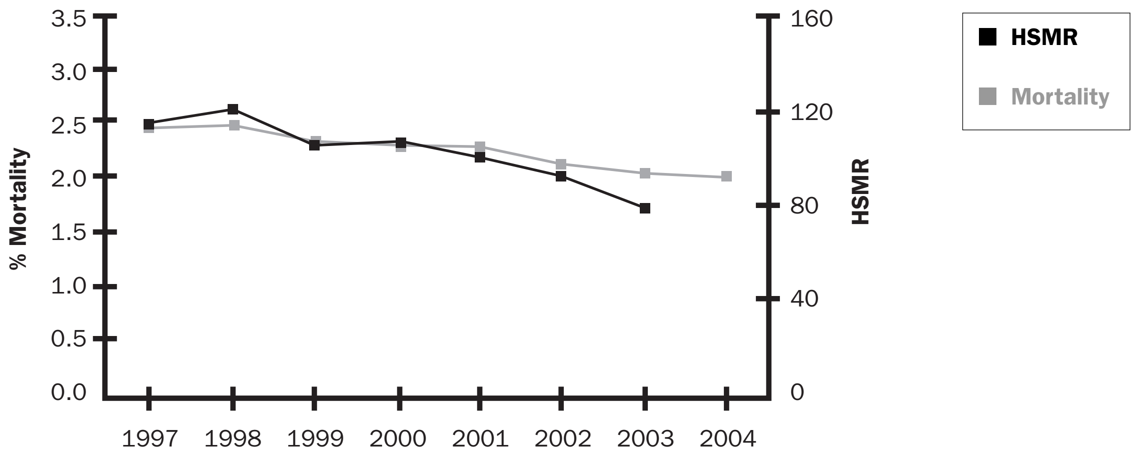
Tallahassee Memorial Hospital Raw Mortality Rate vs. HSMR

1997–2003 actual HSMR; 1997–2004 raw mortality
13% decrease in raw mortality rate 2003–2004



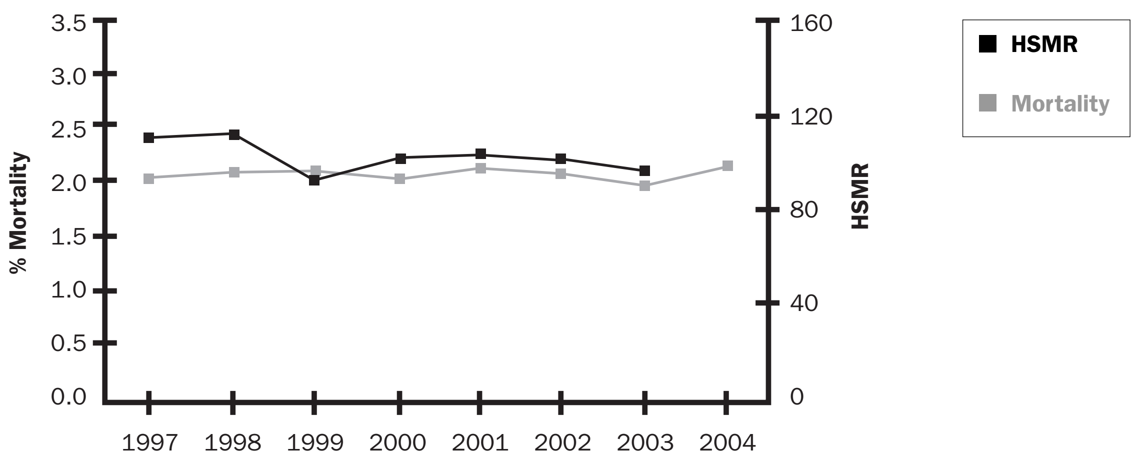
Missouri Baptist Medical Center Raw Mortality Rate vs. HSMR

1997–2003 actual HSMR; 1997–2004 raw mortality
2% decrease in raw mortality rate 2003–2004



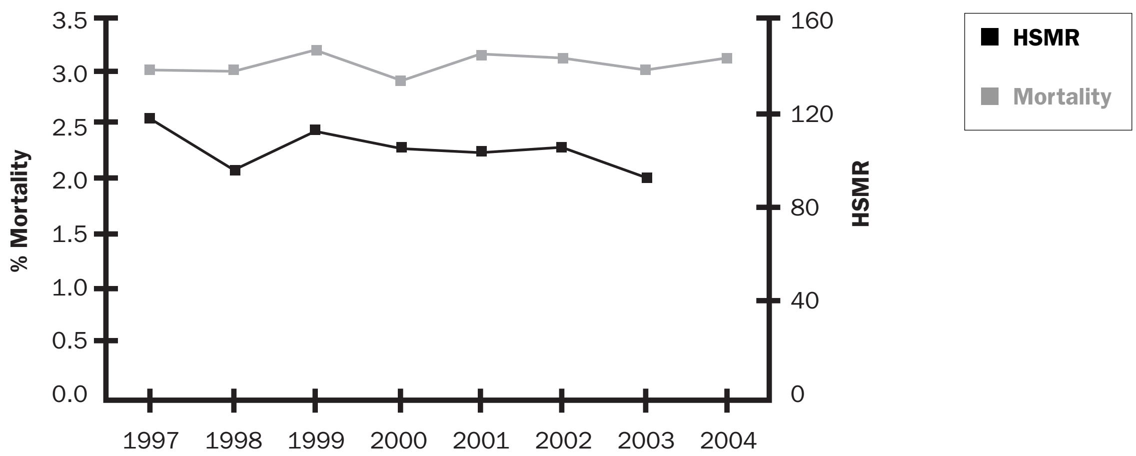
Miami Valley Hospital Raw Mortality Rate vs. HSMR

1997–2003 actual HSMR; 1997–2004 raw mortality



OSF St. Anthony Medical Center Raw Mortality Rate vs. HSMR

1997–2003 actual HSMR; 1997–2004 raw mortality



Conclusion

Reducing hospital mortality requires new models of care that emphasize planning, communication, teamwork, and evidence-based practice. Categorizing and analyzing inpatient deaths is an important first step in understanding the contributing factors to hospital mortality, and can provide important baseline data against which to compare mortality rates after interventions are implemented.

Work in this area by the IHI Innovation Community on Reducing Hospital Mortality Rates suggests that the care models described in this paper hold the promise of reducing needless hospital deaths.

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[46] Virginia Mason, although not one of the pilot test sites referred to in this paper, joined this test subsequently and has done some particularly impressive work on VAP.

More Resources

More resources on the following topics are available at www.ihi.org:

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