The need to improve the quality of health care is well documented. Despite decades of efforts, patients continue to suffer preventable harm, often from the omission of recommended medical therapies. To remedy this problem, organizations such as The Joint Commission have developed performance measures to monitor the extent to which patients receive evidence-based therapies. Performance measures that evaluate the care patients received are commonly called process measures, whereas measures that evaluate the results achieved are commonly called outcome measures. Process measures can help hospitals focus their improvement efforts on one or more steps that lead to a particular outcome. Although better performance on process measures does not always translate into better outcomes—and Berenson, Pronovost, and Krumholtz, among others, encourage a move toward outcome measures—many patients still do not receive recommended therapies.

To spur further improvement and reduce preventable harm, in 2010 The Joint Commission designated a subset of their core process measures as “accountability” measures. Accountability measures meet four criteria—they are based on a strong foundation of research; accurately capture if the evidence-based care was delivered; address a process closely tied to improved outcomes; and Berenson, Pronovost, and Krumholtz, among others, encourage a move toward outcome measures—many patients still do not receive recommended therapies.

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comes; and have adherence results with few, if any, unintended consequences. In September 2011 The Joint Commission launched its Top Performer on Key Quality Measures® program, which recognizes accredited hospitals that attain excellence on accountability measure performance. The program is based on data reported about evidence-based clinical processes shown to be the best treatments for certain conditions, including heart attack, heart failure, pneumonia, surgical care, children’s asthma, inpatient psychiatric services, stroke, venous thromboembolism, and immunization. The recognition, which occurs in the fall of each year, coincides with the publication of The Joint Commission’s Improving America’s Hospitals annual report. The Joint Commission has set an ambitious goal for the program—namely, that at least 95% of patients must receive the recommended therapies for the accountability measures. Each hospital achieving this degree of reliability is recognized as a Top Performer by The Joint Commission. In 2012, 620—mostly small hospitals and community hospitals and a few academic medical centers (AMCs)—received this recognition (for performance data reported for 2011). In 2011, with the creation of the Armstrong Institute for Patient Safety and Quality (the Armstrong Institute), The Johns Hopkins Hospital (JHH) sought to redouble its efforts to improve quality and safety by building capacity for improvement science among its staff, advancing the science of improvement, implementing improvement programs and support systems, and creating a culture that supports learning and accountability. The Armstrong Institute, housed within the School of Medicine, coordinates the research, training, and improvement for patient safety and quality across Johns Hopkins Medicine (JHM), which entails partnering with The Johns Hopkins Health System (JHHS); the Johns Hopkins University Schools of Medicine, Public Health, Engineering, Business, Arts and Sciences, and Nursing; and the university’s Applied Physics Laboratory and Berman Institute of Bioethics. The continued goal of the Armstrong Institute is to partner with patients, their loved ones, and others to eliminate preventable harm, optimize patient outcomes and experience, and reduce healthcare waste. The Armstrong Institute includes faculty and staff from eight schools and institutes, representing 18 different disciplines.

Parallel to those efforts, after discussion with JHHS leaders, the JHM Board of Trustees committed the institution to becoming national leaders in patient safety and quality. Their first empirical goal was to ensure that patients across JHM received recommended care at least 96% of the time. They chose 96% as their goal in an attempt to achieve both The Joint Commission Top Performer award, which set a 95% measure performance goal, and the Delmarva Foundation for Medical Care’s “Excellence Award for Quality Improvement in Hospitals” (Delmarva [a Quality Improvement Organization for Maryland and the District of Columbia], which set a 96% measure performance goal. In this article, we describe the conceptual model for the JHM core measures initiative and the efforts within the JHH to achieve the Top Performer award.

Methods
The Armstrong Institute coordinated the efforts across JHM to achieve a 96% performance goal on eight targeted accountability measures and the Delmarva core measure (when describing both types of measures, we use the term core measures). Recognition as a Top Performer by The Joint Commission was based on the following three criteria: (1) the composite rate for all reported accountability measures was ≥ 95%, (2) each reported accountability measure was ≥ 95%, and (3) at least one core measure set had a composite rate ≥ 95%, and all individual measures in this set were ≥ 95%.

Setting
The JHH is a 912-bed, urban, adult and pediatric AMC—and one of six hospitals in JHHS. In calendar year 2012 there were approximately 46,000 admissions and 85,000 emergency department visits at the JHH.

Conceptual Model
To realize the JHM board’s goal, Armstrong Institute staff developed a conceptual model to address the challenges that accompany quality and safety efforts, such as unclear goals, limited capacity to conduct the work, and little feedback on performance. The four-part sequential conceptual model entailed (1) clarifying and communicating the goals and measures across all levels of the organization; (2) building capacity using Lean Sigma (as a principle to improve reliability), education, and clinical communities; (3) transparently reporting and ensuring accountability for performance; and (4) developing a sustainability process (Table 1, page 533).

1. Clarifying and Communicating Goals. In December 2011 JHHS presidents and the JHM Patient Safety and Quality Board Committee (a subcommittee of the full JHM board) committed to performing at or above 96% on the core measures. In March 2012 the JHM Board of Trustees, the JHM Patient Safety and Quality Board Committee, and each of the individual JHHS hospital boards approved the goal to achieve 96% on all core measures. The chairman of the JHM Patient Safety and Quality Board Committee and the director of the Armstrong Institute
sent a memorandum to all hospital presidents and their boards of trustees, as well all hospital leaders and department chairs, making the 96% goal clear and communicating that the Armstrong Institute would support improvement efforts and that there would be transparency and accountability around performance, including a structured review process to ensure that the goal was achieved. A similar message was sent to all JHHS staff (Appendix 1, available in online article).

2. Building Capacity Using Lean Sigma, Education, and Clinical Communities.

Gap Analyses. After the 96% goal was set, Armstrong Institute staff completed a gap analysis of JHHS’s performance on core measures for calendar year 2011 to help focus and prioritize the improvement efforts. At each hospital, we evaluated every measure whenever performance was < 96% for any month. For example, the gap analysis enabled us to identify beta-blocker and urinary catheter removal as two core measures for this improvement initiative. Aggregate performance on the beta-blocker measure for the five JHHS hospitals was 95%—that is, below the target goal of ≥ 96%. Even though JHHS performance on urinary catheter removal was 97%, we targeted this measure because two of the five hospitals were below the ≥ 96% goal for 9 of 12 months in 2011. Moreover, this measure is linked to pay-for-performance and patient outcomes. Performance on each core measure for each hospital was aggregated to produce an overall JHHS performance measure.

From this analysis, we targeted nine measures for improvement, as follows:

- PCI ≤ 90 minutes (AMI [acute myocardial infarction])
- Discharge instructions
- Blood culture in emergency department prior to initial antibiotic
- Cardiac surgery glucose control (SCIP [Surgical Care Improvement Project])
- Beta-blocker if pre, then post
- Urinary catheter removal (SCIP)
- Home management plan
- Pneumococcal vaccination
- Influenza vaccination

Although the pneumococcal vaccination and influenza vaccination measures were targeted measures in our strategic approach, we excluded them from our analysis because the measure specifications (the denominator) changed substantially between 2011 and 2012. We also considered the discharge instruction for heart failure measure sufficiently important to target, even if it was a Delmarva award measure rather than a Joint Commission accountability measure. To support learning and understanding of core measures, we held multiple education sessions for clinicians, some within specific departments and some for the entire hospital. We frequently e-mailed all staff to remind them of the importance of this initiative and reporting current performance.

The Nine Work Groups at Work. In June 2012 The Armstrong Institute and JHHS formed nine clinical work groups to address the nine measures identified in the gap analysis. Each work group was organized as a “clinical community” and con-
Sidebar 1. Beta-Blocker (SCIP) Core Measure Work Group*

The beta-blocker work group consisted of clinicians (for example, nurses, anesthesiologists) and quality improvement staff from each Johns Hopkins Health System (JHHS) hospital, and a project manager, a Lean Sigma coach, and faculty in improvement science from the Armstrong Institute. During the work group’s first meeting, on August 15, 2012, each hospital team reviewed its methods of abstracting data for the beta-blocker core measure (for example, if 100% of cases were abstracted; if only a sample was taken of knee and hip surgeries) and summarized current strategies, barriers, and challenges. The Lean Sigma coach discussed the Define-Measure-Analyze-Improve-Control (DMAIC) method and introduced the one-page Problem-Solving A3 Report (A3) Lean Sigma tool. The tool guided each hospital team in targeting modes of failure in delivering the beta-blocker in their hospital; this process continued as the work group progressed.

During subsequent biweekly meetings, hospital teams discussed interventions that increased compliance with beta-blocker use and barriers that prevented its use. Teams shared several interventions that helped increase compliance at their hospital, including the following:

- Nurse calls to remind patients to take their beta-blocker medication.
- A nurse, quality improvement staff, or other person reviews each patient case concurrent with admission to determine whether a beta-blocker was missed. One hospital team that implemented concurrent review noted that suggestions during a work group meeting prompted it to pilot a process to text providers when potential failures were identified.
- Anesthesiology department monitors perioperative beta-blocker compliance. When one hospital team shared this strategy, other work group members requested a meeting with that hospital’s anesthesiology department to learn and determine whether the surveillance process was translatable to their hospital. During the meeting, the beta-blocker core measure work group learned that anesthesiology used a pre-assessment anesthesia form to document the patient’s medications and reconcile this information with the electronic medical record (EMR). Working from the EMR, anesthesiology administered the beta-blocker intravenously if it was not given during the preoperative period. The hospital team providing the information about the anesthesiology department’s role in compliance noted that while this strategy helped performance on the beta-blocker measure, anesthesiologists could still select “no” when the EMR prompted them to indicate if the patient was on a beta-blocker, leaving the potential for failure. Through ongoing discussions, the work group agreed that engaging anesthesiology could be part of an improvement plan but that additional mistake-proofing was likely needed to better guard against failures.

The teams also shared several barriers or challenges when attempting to improve performance, including the following:

- Concerns with medication reconciliation and missing home medication lists
- Ownership of compliance with beta-blocker use, and standardization of who should administer the preoperative beta-blocker.
- Absence of documentation when a beta-blocker is not ordered

During meetings, the Lean Sigma coach continued to help each hospital team catalogue the process step at which failures were occurring and develop a list of interventions to address the failure mode at each step. Each hospital’s A3 included this analysis and displayed performance, barriers, and implemented interventions (see Figure 1, page 535—enlarged, color version available in online article—which illustrates an A3 for one JHHS hospital).

* SCIP, Surgical Care Improvement Project.
Sigma tool\textsuperscript{14,15}—to both manage projects and provide a summary report of results. Hospital teams developed an A3 for each core measure to do the following:

- Communicate the problem and key metrics and document the 96% goal (Define)
- Visually present performance on each core measure (Measure)
- Identify and prioritize root causes of failures that contribute to missed cases (Analyze)
- Outline action plans targeted at eliminating failures (Improve)
- Explore how improvements might be sustained (Control)

The work groups used a variety of other Lean Sigma tools, including swim lanes, process maps, and fishbone diagrams. The Armstrong Institute staff used the A3 tool in a three-tiered, cascading method, allowing teams to aggregate performance at the individual measure, the hospital level, and the health system level. The hospital-level A3s documented individual measures and fed this information up to the JHHS–level A3s, which documented system-level performance. Armstrong Institute staff used the system-level performance to produce reports for JHHS leaders and the JHM board, documenting attainment of the 96% goal. For example, for the beta-blocker measure (Figure 1, above), the A3 showed that performance was inconsistent across JHHS because some hospitals were below the ≤ 96% compliance rate.

All teams started auditing the beta-blocker compliance rate from the SCIP-Card-2 to track performance by month and quarter. As shown in the A3, the team identified four root causes of failures and devised and implemented five interventions to rectify them. For example, patients often did not know the beta-blocker’s function. Thus, the team added patient education on beta-blocker use to the preoperative checklist for private practice offices.

3. Transparently Reporting and Ensuring Accountability for Performance. To achieve the 96% goal, the JHM Board of Trustees committed to transparently reporting results and developing a robust accountability plan. Before this commitment was made, reporting performance on the core measures was limited to QI meetings and quarterly board meetings. JHHS also lacked a clearly articulated goal for performance (for example, 96%) and a defined accountability process for addressing performance that fell below this goal. Armstrong Institute staff recognized that to realize the 96% goal, performance had to be reviewed monthly rather than quarterly; results had to be transparently

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### A3 for Beta-Blocker Core Measure

#### Define

**Background:** The JHHS performance on SCIP-Card-2 (beta blocker, if pre-op given) is inconsistent across the health system in CY11 and CY12 with some entities performing below the target compliance rate of 96%. Literature demonstrates that patients receiving a beta blocker upon arrival with continuation throughout the perioperative period (24 hours before surgical incision through discharge from post-op) are at lower risk for post-op myocardial infarction and have decreased mortality.

**Goals:** Achieve and sustain ≥ 96% compliance on Beta Blocker SCIP measure

**Team Members:**
- CEO/Clinical Quality Leader: J.B., RN
- Quality Leader: S.R., RN
- Physician and Clinical Champion: B.M., MD
- Core Measure Abstractor: L.H., PA-C, J.A.D., RN
- Clinical Team SME’s: R.H., MBB

#### Measure

**Beta Blocker Compliance**

- Rate of Compliance Average by Quarter
- Performed Target

<table>
<thead>
<tr>
<th>Month</th>
<th>Monthly Audits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-12</td>
<td>92%</td>
</tr>
<tr>
<td>Feb-12</td>
<td>95%</td>
</tr>
<tr>
<td>Mar-12</td>
<td>96%</td>
</tr>
<tr>
<td>Apr-12</td>
<td>97%</td>
</tr>
<tr>
<td>May-12</td>
<td>98%</td>
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<td>Jun-12</td>
<td>99%</td>
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<td>Jul-12</td>
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</tr>
<tr>
<td>Nov-12</td>
<td>100%</td>
</tr>
<tr>
<td>Dec-12</td>
<td>100%</td>
</tr>
</tbody>
</table>

#### Analyze: Identifying & Prioritizing root causes of failures

- **Patient identified issues:** patients are unclear about what medications they are taking.
- **Nursing issues:** not identifying patient is on a Beta Blocker or fails to complete pre-op checklist.
- **Provider issues:** Does not order the BB post-operatively, does not document why the BB is being held.
- **Other issues:** e.g., Other missed cases. One missed case has significant impact on percentage.

#### Improve

**Educate Medical Providers:** Surgical providers have been educated on the BB Core Measures, however, our goal is to make sure all providers caring for the patient aware of the measure (attendings, consulting cardiology providers, etc.).

- This is being accomplished by discussing concerns at Peer Review Committee (Anesthesia and Medicine) and the Chair of Medical Peer Review Committee will place an article in provider newsletter.
- Follow-up letters sent to medical providers with missed measure from Chairman of Department of Medicine.
- Pharmacy does not set the “hold parameters” for BB, the providers will set them.
- Anesthesiologist will develop an order which would state “Hold BB” with a drop down menu to give a reason why. This is being finalized with CIS.
- S.R. educated Nursing Mgr at the last monthly Nursing Mgr Meeting concerning the importance of completing the pre-operative checklist.

**Initiate Concurrent Review:** Identifying the patient on BBs and ensuring that the BB are ordered post-operatively by either paging or testing provider.

**Monthly Team meetings:** Team has expanded to include Director of Patient Care, Medical Surgical Nursing.

**Peer to Peer Discussion:** With other entities, Dr. R.D. led a discussion with the other JHM entities to review the Anesthesia process concerning BB. Shared new Anesthesia pre-assessment forms and Anesthesia record.

**Revised Pre-operate List of Requirements:** will be sent to the private practice office to make sure they are educating the patients properly concerning BB preoperatively.

**Control:** Achieving High Reliability

**Improvement Verification & Future Stability:** Pending 4 months ≥ 96%
reported using a standard format; and accountability had to be ensured by creating an escalating process of performance review, progressing from the local hospital team to the full JHM board.

To make results more transparent, the Armstrong Institute, JHH QI staff, and JHHS clinical analytics created a monthly dashboard to report core measure performance for the calendar year and fiscal year to date (Figure 2, above). Hospital-level reports were generated and color coded at the ≥ 96% threshold (green) and the < 96% threshold (red) to highlight performance. The report showed monthly performance on each measure and a summary measure of each hospital’s progress toward meeting all criteria for the Top Performer award.

To improve accountability, JHHS leadership and trustees developed a formal accountability plan to structure how hospitals, hospital boards, and the JHM board reviewed performance toward this goal (Figure 3, page 537). The plan defined four successive steps of review, starting with local performance improvement staff activation and escalating up to a presentation before the JHM Patient Safety and Quality Board Committee. Each step in the plan was activated when a hospital performed below the 96% target on any given measure. Each JHHS president and his or her board reviewed and supported this accountability plan, which proceeded as follows, as necessary, from Level 1 to Level 4:

- **Level 1.** If a hospital missed the 96% target on any measure for one of the four most recent months, it activated a local performance improvement team to review the failures, identify barriers, and implement targeted interventions.

- **Level 2.** If a hospital missed the target on any measure for two months (Level 2), it presented to its local quality committee and continued to develop improvement strategies. At Level 2, the hospital president was also engaged to review performance and connect with the clinical champions of the measure to review the improvement plan.

- **Level 3.** If a hospital missed the target on any measure for three months (Level 3), it again presented to its local quality committees and local quality committee, and the hospital’s president reported to the JHM Quality, Safety and Service (QSS) Executive Council. The QSS Executive Council is composed of leadership from across JHHS, including the hospital presidents, the senior vice presidents for quality and medical affairs, and nursing leaders.

- **Level 4.** If the hospital missed the target on any measure for four months (Level 4), the hospital president reported this performance and the hospital’s improvement strategy to the JHM Patient Safety and Quality Board Committee.

  The accountable leaders, including hospital presidents for Levels 3 and 4, all used the A3 tool for all of the presentations in this accountability plan; the hospital presidents could not delegate the Level 3 and 4 presentations to their QI leaders. In addition, the hospital board included attainment of the 96% goal in the annual bonuses for Armstrong Institute leaders and for JHHS hospital presidents.

4. **Developing a Sustainability Process.** After a hospital maintained ≥ 96% compliance for four or more months on any of the individual core measures, it was eligible to enter the sustainability phase for that measure. This phase established that a hospital had completed a failure modes analysis for performing at less than the goal and had executed interventions designed to error-proof the process. After performance met the sustainability phase criteria, the hospital’s local improvement team met with the Lean Sigma Master Black Belt, the faculty improvement scientist, and the project manager to review the sustainability criteria and walk through the failure modes analysis and the executed interventions to ensure a successful transition to the sustainability phase.
Figure 3. The formal Johns Hopkins Health System accountability plan for reviewing performance on the core process measure initiative is shown. There are four steps of review (green boxes on the left), beginning with local performance improvement staff activation and escalating to a presentation before the Johns Hopkins Medicine (JHM) Patient Safety and Quality Board Committee. Each step in the plan was activated when a hospital performed below the 96% target on any given measure. The purple diamonds (center) and blue boxes (at right) describe the activities needed, the groups to confer with for support, and the horizontal chain of accountability. (Available in color in online article.)
The hospital team then followed up on any risks or concerns not yet addressed (for example, identifying a backup concurrent reviewer for a process that relied on concurrent review). After all elements of the criteria were addressed, the hospital team drafted a sustainability plan using a modified version of the A3 Lean Sigma tool. (Figure 4, above).

Sidebar 2 (page 539) describes how the JHH team increased compliance with beta-blocker use across the hospital. The completed plan was signed by clinical, quality, and executive leads for the core measure and then submitted for review to the JHM QSS Executive Council and JHM Patient Safety and Quality Board Committee.

MEASURES AND ANALYSIS

The primary performance measure was the percentage of patients at the JHH who received the recommended process of care, as defined by the specifications for each of The Joint Commission’s accountability measures. The performance for each measure was aggregated into monthly, quarterly, and annual mean performance. We performed descriptive analyses to summarize the data. As we compared performance on each measure in 2012 to performance in 2011, we also reported the percentage of measures in 2011 and 2012 that were at ≥ 96%. The percentage of measure months was calculated by multiplying the number of core measures that performed > 95% in a given month by 12 months (total potential measure months = 264). There were 10 months with missing data in 2011, which decreased the total measure months to 254, and 4 months of missing data in 2012, decreasing the total measure months to 260.

Results

In 2011, 18 (82%), versus 21 (95%) in 2012, of the core measures were ≥ 96%. Whereas 86% of the accountability measures showed an annual aggregate performance of ≥ 95% in 2011, 100% did so in 2012. The JHH was performing at ≥ 95% for all measures for 87% (220/254) of the measure months in 2011 versus 94% (245/260) of the measure months in 2012. Performance on each of the 22 accountability measures reported to The Joint Commission in 2011 and 2012 is described in Table 2 (page 540).

Figure 5 (page 541) presents the monthly performance of all nine core measures for 2011 and 2012, and Figure 6 (page 541)
Quality Measures and meet the Joint Commission criteria for significantly improve its performance on the accountability measures developing a plan for sustainability, the JHH was able to significantly improve its performance on accountability measures targeted for improvement from 2011 through the end of 2012.

Discussion
By clearly communicating goals and messages, building capacity through the core measure work groups and use of Lean Sigma methodology, creating clear transparency and accountability, and developing a plan for sustainability, the JHH was able to significantly improve its performance on the accountability measures and meet the Joint Commission criteria for Top Performer on Key Quality Measures® recognition. Our baseline performance on the core measures was greater than 90%, and many exceeded 96%, so that our marginal improvements were relatively small. Still, the board and leaders of JHM recognized that we needed to improve our accountability systems, seeking to ensure that the JHM Patient Safety and Quality Board Committee functioned with the same discipline and rigor as the board audit and finance committees. As such, the primary intent of this initiative was to develop, implement, and evaluate a framework to increase accountability. We selected performance on process measures to test this framework because these measures are both important and quickly responsive to interventions compared to most outcome measures. We plan to apply this framework to reduce several types of preventable harm, optimize patient outcomes, and improve patient satisfaction scores. Although we did not measure unintended negative consequences from this initiative, they could potentially include overall less benefit to patients by not focusing on outcomes and diverting resources from other important improvement efforts. Still, the lessons learned when implementing this accountability framework at the JHH will apply broadly and across our health system and are expected to have long-lasting impact.

This improvement work is novel and important for several reasons. Foremost, it demonstrated that large AMCs can significantly improve performance on the accountability measures. To date, few AMCs have made The Joint Commission's Top Performer list, which likely reflects several factors. First, small hospitals may care for all patient populations and may not have enough patients to report performance, while AMCs, with their larger patient populations, can report a larger number of measures, making it difficult to reach 95% on all of them. Second, AMCs are complex and often decentralized care delivery systems, making it difficult to coordinate improvement efforts and ensure accountability. For example, the QI infrastructure may not have sufficient vertical links between the AMC levels (health system, hospital, department, unit, clinician-patient) or horizontal links to support peer learning, such as through clinical communities. Third, some AMCs may choose to focus on other efforts to improve quality that they believe are important and may perceive a lack of sufficient resources to simultaneously work on multiple performance improvement efforts. Our study demonstrated that...
with focused effort and leadership, AMCs can significantly improve performance on accountability measures while pursuing other quality initiatives.

More importantly, this study adds to the field of performance improvement. The conceptual model used to achieve this goal builds on prior work, addresses prior shortcomings, and integrates efforts, creating a high-reliability system.9,17 In this study, hospital presidents and boards of trustees spent considerable time discussing, agreeing on, and clarifying the goals and how to exactly measure them. In addition, they took great care in communicating the goals to executive leadership and staff. At all board, executive, and departmental quality meetings, leaders reiterated the goals and reviewed performance in reaching the goals. Too often the goals that hospital boards set are ambiguous—the link between goals and measures are unclear—and the staff rarely understand what is expected of them.9 As a result, it is difficult for managers and staff to understand the performance expectations.

The residents played a key role in this initiative, particularly the preexisting House Staff Quality Council (HSQC) and the Armstrong Institute Resident Scholars (AIRS) program. The HSQC includes residents from all departments who meet monthly with faculty advisors to realize the goals of the Armstrong Institute, which include partnering with patients and their loved ones and others to eliminate preventable harm, optimizing patient outcomes and experience, and reducing health care waste. The AIRS program’s 12 residents each devoted 8 hours per month for 10 months to build capacity for improving patient safety and quality of care to realize the Armstrong Institute’s goals. This program included formal didactic sessions and projects with faculty mentors. Both the HSQC and the AIRS helped to educate residents and support the work group teams. In addition, the Armstrong Institute educated residents in each involved department, thereby building capacity for performance improvement across the JHH. For example, the HSQC led efforts to improve global immunization of patients at the JHH.

QI projects often fail because frontline clinicians lack the time and skills needed to conduct robust improvement efforts.18,19 In our study, local hospital clinicians and improvement staff felt ownership for improvements and, indeed, held the wisdom for

### Table 2. Johns Hopkins Hospital Performance on The Joint Commission Accountability Core Measures, 2011 and 2012*

<table>
<thead>
<tr>
<th>Joint Commission Accountability Measure</th>
<th>Overall % Performance (2011)</th>
<th>Overall % Performance (2012)</th>
<th>% Points Difference from 2011 to 2012</th>
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<tr>
<td>Aspirin at arrival</td>
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<td>0</td>
</tr>
<tr>
<td>Aspirin prescribed at discharge</td>
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<td>0</td>
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<tr>
<td>ACE inhibitor/ARB for LVSD (AMI)</td>
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<td>100</td>
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<tr>
<td>Beta-blocker at discharge</td>
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<td>Home management plan†‡</td>
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</table>

* Global immunization measures were excluded from calculations because national inpatient hospital quality measure specifications changed, which expanded the population of eligible patients from 2011 to 2012. ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; LVSD, left ventricular systolic dysfunction; AMI, acute myocardial infarction; PCI, percutaneous coronary intervention; abx, antibiotics; SCIP, Surgical Care Improvement Project.

† Accountability measures targeted for ≥ 96% goal.

‡ 2011 performance on children’s asthma care was influenced by an information technology programming issue for one month.
Percentage of Nine Core Measures with Performance ≥ 96% in 2011 and 2012, The Johns Hopkins Hospital

Figure 5. The monthly trend lines for calendar year (CY) 2011 and CY 2012 for the percentage of core measures—eight Joint Commission accountability measures and one Delmarva core measure—that performed ≥ 96% are shown. Global immunization measures were excluded from calculations because of a change in national inpatient hospital quality measure specifications, which expanded the population of patients eligible for the measure in CY 2012.


Figure 6. The trend lines for the six Joint Commission accountability measures targeted for improvement at The Johns Hopkins Hospital are shown. Quarterly performance on measures is reported for calendar year (CY) 2011 and CY 2012, along with activities of the Johns Hopkins Medicine core measure initiative in 2012. The children’s asthma care home management plan measure had an information technology programming issue for one month that skewed performance in the second quarter of 2011 to 23% compliance. Global immunization measures were excluded from calculations because of a change in national inpatient hospital quality measure specifications, which expanded the population of patients eligible for the measure in CY 2012. JHM, Johns Hopkins Medicine; PCI, percutaneous coronary intervention; AMI, acute myocardial infarction; ED, emergency department; SCIP, Surgical Care Improvement Project; CAC, Children’s Asthma Care. (Available in color in online article.)
how to improve care. They were supported by faculty and staff from the Armstrong Institute, who provided robust improvement tools, such as Lean Sigma and A3, and expertise in improvement science. Armstrong Institute staff recognized that clinical team engagement was the linchpin needed to implement effective and sustainable processes. This engagement helped ensure that core measure work groups included, among others, physicians, nurses, technicians, concurrent reviewers, clinical abstractors, information technology staff, and quality staff and leadership. Engaging this comprehensive group of participants enabled collaboration in reaching the clinical care and QI goals.

Many QI efforts have been undermined by underdeveloped accountability systems, which are characterized by a failure to clarify exactly who is accountable for what. We developed a new and explicit accountability plan with an escalating review process. This model established accountability at the board level, while continuously encouraging and supporting local innovation and improvement. This balance between interdependence and independence was important, highlighting the need to engage leadership while simultaneously supporting work at the front lines. We were initially concerned that attempts to formalize an accountability plan would meet resistance, and we were pleased after it became apparent that not only was the plan not resisted, it was supported. We attribute this support, in part, to hospital leaders’ participation in creating the accountability plan; to the Armstrong Institute for supporting the work of hospitals and teams; and to empowering local hospitals and units, who know best how to improve their processes and work within their cultures do the work. Hospital leaders agreed to use the accountability plan for future improvement efforts. Also, the hospital presidents and department directors welcomed having the accountability focused where care was delivered.

Too often, improvement efforts are not sustained; the effort stops and performance reverts to baseline. A key component of our conceptual model was a sustainability plan for each core measure, although time will tell whether the plans proved effective. We believe that this integrated conceptual model can be applied to other performance measures. For example, we are currently applying this model to improve performance on patient satisfaction scores, emergency department wait times, and health care–associated infections.

In supporting improvement at the local level, we learned the value of collaborating with clinical teams through clinical communities when strategizing around improvement work. In the beta-blocker work group, for example, it was a hospital team that suggested using concurrent review to identify patients on beta-blockers—which improved provider awareness and ordering of postoperative beta-blockers and was adopted by the other hospital teams in the group. As demonstrated through other studies, understanding clinical priorities and work-flow requirements is essential to process improvement. For this study, physicians, nurses, technicians, clinical abstractors, information technology staff, quality staff, and JHHS leadership participated in core measure work groups and described the work flow and priorities in their areas.

Another key aspect of this conceptual model was its interconnectedness, in which, as in a fractal, which has repeating similar or identical shapes in various sizes that connect to form the whole object, groups are linked horizontally and vertically throughout the health system. The board reports focused on overall attainment of the goal. Leaders and work groups used the Lean Sigma A3 tool to communicate performance and present quality leadership when the accountability plan was activated. The A3 tool was used to communicate failure modes, best practices, and lessons learned in the core measure work groups and to create the foundation for the sustainability plan. By using a common communication tool, we tied individual work groups to hospital performance and to health system performance, ultimately enabling the board to evaluate performance and be accountable. Each aspect of the model worked together with the other strategic elements, which helped support systemwide implementation and acceptance.

LIMITATIONS

This study has several limitations. First, we cannot establish a causal relationship between the intervention and improvement because our study design was pre-post and not a randomized controlled trial. Second, the study was conducted at one large AMC; whether it can generalize to other hospitals is unknown. However, the model has been applied to four other hospitals within JHHHS, all of which achieved significant improvements. This initiative demonstrates the value that an AMC can bring to an academic health system and to other hospitals. The approach we implemented can be broadly applied in other health systems if they have leadership commitment, clinician engagement, and staff with the required improvement skills. Third, we do not have any follow-up data that would help us determine whether the results seen to date will be sustained.

REFLECTIONS AND NEXT STEPS

We developed the conceptual model to overcome the common reasons why large improvement projects fail. Projects often fail because the goals and measures for those goals are unclear, the entire organization (particularly frontline clinicians) does not
know about the goals and measures, the intervention and accountability for achieving the goals lies with health system–level experts rather than with local clinicians and managers, the frontline clinicians have insufficient resources (staff time and expertise in Robust Process Improvement\textsuperscript{TM14} methods and improvement science) to realize the goal, and the leaders do not create a robust accountability process.

Commitment of the board of trustees, senior executives, and clinical directors is essential to implementing this model. We commonly hear that leadership commitment is important without anyone clearly articulating what behaviors board members and senior leaders should embrace. Our model defined those behaviors. The chairman of our board of trustees, who worked closely with the senior vice president of patient safety and quality and the hospital presidents to implement the model, drove the goal of 96% compliance. Progress toward the goal was an agenda item at every board meeting.

It is also essential that the organization have staff with the appropriate technical skills to lead Robust Process Improvement.\textsuperscript{14} The technical components were led by Lean Sigma Master Black Belts, physicians with advanced degrees in outcomes research and improvement science, and staff with project management skills. To be effective, these projects must get the adaptive work (leadership and culture change) and technical work (methods, interventions, evaluations) right and have strong project management. Neither one alone is sufficient.

Not only was this model effective, it was widely embraced and supported by the entire organization—from board members, to senior leaders, to frontline clinicians. We believe that widespread buy-in occurred because many of these stakeholders helped create the model, the model balanced independence and interdependence, the model supported local innovation and accountability with centralized measurement and methods support, and the model involved executives and clinicians alike in the process rather than dictating it.

We are further developing the model in several important ways. First, we are working to establish a “fractal infrastructure”—consisting of team members or other persons with skills and resources who are connected in the work of patient safety and QI across JHHS. We are defining the time, skills, and resources needed at every level, including the unit, department, hospital, and health system. In addition, we are creating structures to support peer learning and influence social norms. For example, each JHHS hospital is creating a structure wherein department quality leaders meet and review performance and share learning. Departmental quality leaders create structures for unit-level leaders to do the same. We have also created clinical communities, in which we link common entities (for example, ICUs, hospitalists) and product lines (heart failure) across JHHS. These communities, with the support of Armstrong Institute staff, should help achieve the Institute’s mission to eliminate preventable harm, optimize patient outcomes and experience, and improve health care efficiency.

After the fractal infrastructure is complete, we believe that it will facilitate use of the conceptual model to implement other goals. Armstrong Institute staff will still provide technical expertise, leadership, and project management, yet will also be able to more easily engage hospital leaders, hospital leaders can engage department leaders, just as department leaders can engage unit leaders in improving patient safety and quality. We believe that this disciplined and organized improvement infrastructure is analogous to how many organizations manage financial goals. Health care has yet to broadly apply this approach to realize patient safety and quality goals. As this article demonstrates, achievement of these goals can result when a health care organization applies this conceptual model and infrastructure.

**Conclusion**

By using a comprehensive conceptual model, The Johns Hopkins Hospital was able to significantly improve performance on the Joint Commission accountability measures and achieve high reliability and Top Performer recognition. The model’s effectiveness depended on local implementation in the context of support from leaders—from the Armstrong Institute up to the board of trustees. We will continue to apply this model to core measures and will expand the model to other performance measures across our health system.\textsuperscript{1}

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In recent years, we have been documenting our progress in patient safety and quality using core measures ranging from prompt administration of aspirin to heart attack patients to the proper care of children suffering from asthma. In the past, we sought to “meet or exceed” the state average on more than 30 of these measures that we report to the Centers for Medicare & Medicaid Services.

In a sense, these measures are like a report card for hospitals. While Bs and Cs may be sufficient for some, we can—and should—do better.

To ensure our goals match the character and history of this great organization and its people, the Board of Trustees committee that oversees the Armstrong Institute of Patient Safety and Quality—which includes trustees and leaders from across Johns Hopkins Medicine—took a bold step forward. Their mandate: The Johns Hopkins Health System will achieve the performance score required in patient safety and quality of care measures to demonstrate national leadership. We must, they decided, be truly excellent in these core measures if we are to be true national leaders.

In their vote, they acknowledged what we already know: We are not satisfied with being “average or above average.” We are Johns Hopkins. Excellence is our tradition and our future.

Our new goal will be to ensure that we score at least 96 percent in all the core measures. This means that in all of our hospitals, for each of the measures, we do the right thing at least 96 percent of the time.

What does this look like? To meet our goals, we really must set our sights on reaching 100 percent compliance. That means that every patient who walks in the door having a heart attack is given an aspirin upon arrival, is counseled about smoking cessation, and is prescribed a statin when discharged, as appropriate. Every time. It means that we provide every patient, every time, with appropriate vaccinations and antibiotics before having surgery. It means we follow best practices, every time, when treating every patient suffering from asthma. Not just because a 96 percent score is a laudable goal, and not just because we should be capable of achieving it, but because our patients deserve it.

But achieving this goal will take more than aspiration.

■ It will take transparency: We will need to share and make available the data that show our performance, our progress, our problems, and where we need to focus. In coming months, we will widely distribute unit-level performance data on core measures and hand hygiene via broadcast e-mail.

■ It will take defining what behaviors need to change and providing the staff across our organization with the help and support they need to make those changes. Managers, for instance, will receive toolkits guiding them on how to leverage their data for improvement in their units and departments.

■ And it will take clear lines of accountability at every level, from local units to hospitals to the entire Johns Hopkins Health System.

It will take all of us—faculty and private practice physicians, nurses and administrators, CEOs and staff, academic and community hospitals—to make this happen. By working together, we will systematically improve patient care processes and outcomes. Look for more information on this critical initiative in the coming weeks and months. Our new commitment to raising standards for the quality of care we deliver honors our noble history and sets us on a path to continue to lead in the years ahead.
Figure 1. As shown in this A3, the hospital team identified four root causes of failures for the beta-blocker measure and devised and implemented five interventions to rectify them.
Figure 3. The formal Johns Hopkins Health System accountability plan for reviewing performance on the core process measure initiative is shown. There are four steps of review (green boxes on the left), beginning with local performance improvement staff activation and escalating to a presentation before the Johns Hopkins Medicine (JHM) Quality and Safety Board Committee. Each step in the plan was activated when a hospital performed below the 96% target on any given measure. The purple diamonds (center) and blue boxes (at right) describe the activities needed, the groups to confer with for support, and the horizontal chain of accountability.

* Process measures reporting period is 1 month. Outcome measures reporting period is quarterly.
The hospital team, using a modified version of the A3, drafted a sustainability plan for the beta-blocker measure.
The trend lines for the six Joint Commission accountability measures targeted for improvement at The Johns Hopkins Hospital are shown. Quarterly performance on measures is reported for calendar year (CY) 2011 and CY 2012, along with activities of the Johns Hopkins Medicine core measure initiative in 2012. The children’s asthma care home management plan measure had an information technology programming issue for one month that skewed performance in the second quarter of 2011 to 23% compliance. Global immunization measures were excluded from calculations because of a change in national inpatient hospital quality measure specifications, which expanded the population of patients eligible for the measure in CY 2012. JHM, Johns Hopkins Medicine; PCI, percutaneous coronary intervention; AMI, acute myocardial infarction; ED, emergency department; SCIP, Surgical Care Improvement Project; CAC, Children’s Asthma Care.