

The Cost of Harm and Savings Through Safety: Using Simulated Patients for Leadership Decision Support

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Objectives: The ultimate objective of this program is to provide an approach to understanding and communicating health-care harm and cost to compel health-care provider leadership teams to vote “yes” to investments in patient safety initiatives, with the confidence that clinical, financial, and operational performance will be improved by such programs.

Methods: Through a coordinated combination of literature evaluations, careful mapping of high impact scenarios using simulated patients and consensus review of clinical, operational, and financial factors, we confirmed value in such approaches to decision support information for hospital leadership teams to invest in patient safety projects.

Results: The study resulted in the following preliminary findings:

- Communication between hospital quality and finance departments can be much improved by direct collaborative relationships through regular meetings to help both clarify direct costs, indirect costs, and the savings of waste and harm to patients by avoidance of infections.
- Governance leaders and the professional administrative leaders should consider establishing the structures and systems necessary to act on risks and hazards as they evolve to deploy resources to areas of harm and risk.
- Quality and Infection Control Professionals can best wage their war on healthcare waste and harm by keeping abreast of the latest literature regarding the latest measures, standards, and safe practices for healthcare-acquired infections and hospital-acquired conditions.
- Regular reviews of patients with health-care-associated infections, with direct attention to the attributable cost of treatment and how financial waste and harm to patients may be avoided, may provide hospital leaders with new insights for improvement.
- If hospitals developed their own risk scenarios to determine impact of harm and waste from hospital-acquired conditions in addition to impact scenarios for specific processes through technology and process innovations, they would have more clear guidance for improvement efforts.
- Tools such as impact calculators, performance models, and simulated patient trajectories are no more tied to the reality of running a hospital or treating a patient as jet simulator metrics are to taking a real flight with real weather and real aircraft—they provide a view to enhance decision making but do NOT provide the answers.

Conclusions: The final result of this project was to demonstrate a prototype leadership decision-support investment model approach that addresses clinical, operational, and financial performance for typical hospitals.

Key Words: National Quality Forum Safe Practices, risk, cost, waste, care path, medical economics, health-care engineering

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INDUSTRY IN CRISIS

All health-care supplier, provider, and purchaser stakeholders are realizing that our industry is in crisis and heading into an era of significant unpredictability. In the past, if providers had patient volume, they could count on revenue through “quality blind purchasing;” so by cost cutting, they could survive. There has been no check and balance for cost, waste, or quality. Most believe that we are entering a new era of chaos and unprecedented unpredictability.

Health-care-associated infections (HAIs) affect an estimated 5% of hospitalized patients and represent one of the leading causes of illness and death in the United States—with billions of dollars wasted on many that can be avoided.¹ For instance, surgical site infections (SSIs) were estimated in one study to increase length of stay by an average of 9.7 days and increase cost by an average of \$20,842 per admission.² Another study reported a range of increased cost because of SSI between \$11,874 and \$34,640 per patient in 2007 US dollars.³ Central line-associated blood stream infections kill an estimated 31,000 people per year in America, nearly as many deaths as breast cancer. The cost of such infections can range from more than 12,000 to more than 50,000 US dollars.⁴ Studies have shown that many such infections can be eliminated, especially when senior leaders declare that their target is zero such infections.⁵

In the words of Kaplan and Porter in their Harvard Business Review article, *The Big Idea: How to Solve the Cost Crisis in Health Care*, “Much of the rapid escalation in health care costs can be attributed to the fact that providers have an almost complete lack of understanding of how much it costs to deliver patient care. Thus they lack the knowledge necessary to improve resource utilization, reduce delays, and eliminate activities that don’t improve outcomes.”⁶ We agree; however, we believe that the other 2 stakeholders (suppliers to providers and purchasers) who buy care have even less understanding of cost and savings that can be generated by safety initiatives. Suppliers of products, services, and technologies who sell to providers and the health-care payers and purchasers of health-care services are further away from the care action and the reality of the practical economics.

Finally, many believe that more than 50% of the total health-care expenditures is waste, with one-third because of behavioral issues, one-third because of clinical inefficiencies, and one-third because of operational inefficiencies. Patient-safety issues are a major component of this waste.^{7,8} Yet there are simple strategies that can be undertaken to understand the cost of harm, savings through safety, and leverage points for innovation as we face the unpredictable waters ahead. The purpose of this article is to introduce concepts and a program undertaken by national collaborators that will generate complementary and more analytic papers addressing health services engineering.

THE FUTURE—GUARANTEED CHAOS AND DOING MORE WITH LESS

In their new book, *Great by Choice*, Jim Collins and Morton Hansen have undertaken a matched pair analysis approach

to studying companies as Collins historically has carried out in *Built to Last* and *Good to Great* to describe what they call “10-xers,” those enterprises that have exhibited certain distinct traits making them uniquely different as high performers in the current era of uncertainty.^{9–11} They open *Great by Choice* with the story of another matched pair—that of Roald Amundsen and Captain Robert Falcon Scott, who were in a race to the South Pole. They compare the stories of these 2 explorers to illustrate the traits of great organizations that thrive in chaos: “fanatical discipline, productive paranoia, and empiric creativity.” Amundsen mapped the processes throughout his journey and identified risks and costly inefficiencies to develop risk reduction buffers and optimization levers for every stage in his journey and learned the dynamics of what he might face ... external factors that would impact his progress. Scott faced the same weather and conditions but did not display the same traits of behavior; and in his journals, he expressed his “bad luck” and difficulties in terms of the forces seemingly outside of his control that led to his failure and, ultimately, his death.

It is clear that major cuts in revenue are bearing down on our industry and that one of the levers for rapid cost and waste reduction is tying payment to improved safety outcomes and implementation.¹² In support of Kaplan and Porter’s recommendations, we believe that patient trajectories can be mapped and—albeit with significant effort—we can identify new opportunities to improve clinical and financial factors. Our industry must understand and refrain from allowing “normalcy bias” to cloud our thinking about the risk of dramatic cuts in payment for health care. This is the phenomenon of being unable to deal with something one has never experienced. The normalcy bias, or normality bias, refers to a mental state people enter when facing a disaster. It causes people to underestimate both the possibility of a disaster occurring and its possible effects. This can lead to failure to adequately prepare for dramatic adverse events. The assumption that is made in the case of the normalcy bias is that because something has never occurred, then it never will occur. People also tend to interpret warnings in the most optimistic way possible, seizing on any ambiguities to infer a less serious situation.¹³ In a positive light, we believe that financial pressures will allow us to overcome inertia and learn much more about how we can make good decisions about investment in patient safety efforts and reduce the waste in both “dark green cash” dollars we outlay and “light green capacity” dollars that we can repurpose to serve patients in better ways.

THE GREENLIGHT PROGRAM CONCEPT

The Safety Challenge

A major barrier to adoption of patient safety solutions is the lack of financially responsible decision-support information. The external forces of reduced revenue per unit of care, an aging population of patients, and increasing complexity are increasing risk and cost.¹⁴ The Greenlight Program¹⁵ uses models and generates example forecasts that hospital leadership teams can use to understand how to develop their own decision support strategies they will need to confidently “greenlight” investments in patient safety. The term *greenlight*, taken from a green traffic light giving permission to proceed also is a term used in the movie business referring to the formal funding of a motion picture project, thereby allowing it to move forward into production.^{16,17}

Aims

Simply put, finance and operations leaders are typically the deciding votes on leadership teams for investment in safety and

improvement projects. The Greenlight program was developed to provide what safety and performance improvement teams need to win the “greenlight vote” of key decision makers, based on their own information complimented by national numbers and point estimates from the literature. The vision is to grow communities of practice within the TMIT National Research Test Bed¹⁸ that can continuously contribute to our understanding of clinical, operational, and financial factors that are important to investing in the best innovations in leadership, practices, and technologies that will convert waste to value and harm to healing by direct actions leaders can take.

Research Topics

The Greenlight Program addresses the majority of avoidable adverse events targeted by the National Quality Forum Safe Practices for Better Healthcare, Serious Reportable Events, and other high impact areas.^{19–21} Such areas of optimization include imaging, surgery, and health information technology adoption such as computerized physician order entry, and these can benefit most hospitals, clinics, and health-care organizations.²² Hospital-acquired conditions (HACs) are high-priority topics that have been addressed as the first areas of focus, including HAIs.^{17,23,24} The Centers for Medicare and Medicaid has launched its program called “The Partnership for Patients,” which is focused on reducing all cause of harm by 40% in 3 years and reduction of readmissions to hospital by 20% in the same 3-year period.^{12,25} There is significant overlap between a goal of preventing HACs and those of the Partnership, and the conditions being targeted by both can be avoided by adopting the National Quality Forum Safe Practices for Better Healthcare,²² which is a major focus area of the Greenlight Program.

Greenlight First Focus—Health-care-Associated Infections

The first area of focus by the Greenlight National Collaborative group was on HAIs with emphasis on SSIs, central line-associated bloodstream infections (CLABSI), catheter-associated urinary tract infections (CAUTI), and ventilator-associated pneumonia (VAP) with secondary focus on methicillin-resistant *Staphylococcus aureus* (MRSA) infections, and *Clostridium difficile* (CDI) infections. Impact calculators and simulated patient trajectories have offered significant learnings to collaborators about their own clinical, operational, and financial processes.²⁶

Collaborative Teams Composition

The national initiative included stakeholders from the supplier, provider, and purchasing sectors, which are woven together as a community of practice across the TMIT National Research Test Bed.¹⁸ The participants included the following:

Subject Matter Experts

Clinical, operational, and financial experts, specific to the focus areas from academic, frontline, and industry sectors, were tasked to provide their insights from the literature as well as their own practices to compliment the academic view with the frontline practice view from multiple regions of the country. Expert teams were asked to address “point estimate” sources for givens, assumptions, and variables that could be used to compliment simulated patient trajectory models discussed later. Because partial funding of the program was from a supplier company that sells products targeting infection prevention as noted in our disclosures, the point estimate group provided their findings without any input changes or modifications to their work before

providing them to the collaborators. Their findings will be published in future papers with the method and rationale provided in their work.

Collaborating and Source Content Organizations

National membership societies of caregivers, specialty groups, quality organizations, and the published findings of global organizations such as the World Health Organization were and are continually consulted or collaborate on the work. For example, one impact calculator was developed with and for the Association for Professionals in Infection Control (APIC), using a nationally aggregated database.²⁷

Faculty Hospital Organizations

A number of organizations play a variety of roles, such as providing expert opinion, data correlation, and raw data submission from multiple regions across America.

Public and Government Sources of Information

Government sources of information and collaborators include the Centers for Disease Control, the Office of the National Coordinator of Health Information Technology in the Department of Health and Human Services, the Agency for Healthcare Research and Quality, and certain elements of the Centers for Medicare and Medicaid. For instance, a global webinar was held at the National Press Club in Washington, DC, on October 28, 2010, with representatives from multiple agencies to provide updates to the TMIT National Test Bed and national audiences, with transcripts of the proceedings made available to the national community.²⁶

Suppliers

Some funding to TMIT came from suppliers such as CareFusion; however, to prevent any perceived or potential for real conflict of interest, a complete firewall was established between the suppliers and the collaborators—with absolutely no contact between them. Furthermore, no funding other than reimbursement of certain out-of-pocket expenses was directly provided to the collaborators—they received the benefits of exhaustive analysis of their data, and they only received direct reimbursement for travel to meetings. Suppliers who provided funding were the beneficiaries of the outputs of the program, and these suppliers were not allowed to have any access to the raw source data or any knowledge of the origins of the data. The collaborators were protected by clear data sharing agreements that were strictly adhered to by the Greenlight staff. Suppliers provided input information regarding products, services, and technologies on an as-needed basis. Conversely, no supplier data were provided to any collaborators in any way. The provider collaborators were made aware of the funded work as all were also involved in a documentary sponsored by a supplier funder, with full disclosure and properly labeled media that resulted. The documentary was approved for and became part of the continuing health-care education programs of Discovery CME, the Association for peri-Operative Registered Nurses, and has been deployed nationally with streaming versions available on the internet.²⁸

Purchasers

Certain purchasers of health care were consulted to assist in access to data about utilization of services and technologies by providers; however, they were limited to the same strict confidentiality and conflict guidelines that limited suppliers.

TMIT-APIC Calculator

Published literature has supported the macro-level argument that preventable HAIs place an enormous financial burden on U.S. health care.^{1,29–35} However, significant gaps exist in available literature such as reliable and usable information on how costs are impacted by avoidance of particular HAIs-SSI, CLABSI, CAUTI, VAP, MRSA, and CDI. Variables such as hospital size, teaching status, payer mix, and geographic location are difficult to sort out and apply to one's own hospital. Therefore, a former calculator, based on published literature, developed by APIC—mentioned earlier—was updated, and a new calculator called the TMIT-APIC calculator also was developed, relying on inpatient discharge data from 1056 hospitals in 42 states, taken from Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project National Inpatient Sample. A mathematical, nonlinear regression model was used to derive the attributable costs from these data sets. The calculator reliability was evaluated to determine if it produced estimations representative of actual costs for the sample set of hospitals in the Greenlight Program.

As a result of using and testing against data sets provided by Greenlight Project collaborating hospitals, sound index numbers were established to use in predicting attributable HAI-associated costs for various hospitals and their relative profile characteristics.

The TMIT-APIC calculator provides attributable costs and additional length of stay resulting from HAIs, which can be adjusted based on specific hospital characteristics. Cost estimation results of the six HAIs are presented graphically, allowing for easy comparison of the costs, compared side-by-side, amplifying the capacity to examine the HAI problem and to discuss solutions for mitigating such costs. The calculator is a practical, flexible tool, which can be used in a manner that is tailored to the needs of the organization and the user of the tool. The technical details of the design and development of this tool will be provided in a complementary paper.

This TMIT-APIC calculator previously described is a first-generation 1.0 model. The use of simulated patients and care trajectories, described below, generates more detailed content and is incorporated into second-generation 2.0 and third-generation 3.0 models, allowing collaborative hospitals to use their own numbers, modify simulated patient care paths, run scenarios to provide decision support to leaders to enable them to convert avoidable waste because of adverse events to value, and make the case for converting harm to healing of the patients they serve.

A NEW STRATEGIC VIEW—FIND THE COST FLOOR

The traditional approach of performance analytics is to assemble all data from all patients and to have analysts draw conclusions from the patterns that are developed. The Greenlight approach is one that has been used in developing and optimizing innovations. Because one of our aims is to develop decision-support information to help finance and operations executives make the decision to invest in innovations in patient safety, the fidelity of the modeling needs to be at the level required for those decisions. As such, identifying the clear floor of benefits provides an underestimate of the full cost benefits of avoided adverse events. Clearly, a detailed analysis of all patients of an organization is the typical academic approach to problems; however, the goal of this approach is to produce a study. The goal of our work is to produce good decisions regarding interventions. By clearly identifying the floor of benefit that may

be delivered to a population by preventing HAIs, we can often provide enough information to earn the “greenlight vote” to initiate a project for implementation of an initiative for the whole organization because the intervention benefit pays for itself just with the simple population of patients without comorbidities.

The Greenlight approach uses simulated patients representing high-volume/high-impact, low-volume/high-impact, and low-volume/high-impact scenarios identified by practicing physicians with the support of their own organization data and complemented by evidence-based point estimates derived from the literature, and the consensus of experts. Most importantly, simulated patients and their care trajectories do not include comorbidities that drive up cost but offer tremendous complexity.

The steps that were followed in its development include the following:

- Extensive literature searches were performed by extremely qualified patient safety analysts.
- The evidence was graded using an evidence-based medicine approach by a world-class multidisciplinary team.
- Typical impact-scenario mapping of care processes for common presentations and trajectories were undertaken by front-line and academic centers from multiple regions of the country.
- Index hospital segments representing the following categories were studied including: small rural hospitals of 75 beds, medium-sized hospitals of 275 beds, large hospitals of 350 to 500 beds, which included teaching centers.
- Care paths were designed to reflect the high-impact/high-volume clinical area representing 80% of the patient mix. These were maintained at a high-level review of the process and purposely ignored comorbidities and other complicating factors unrelated to the area of interest (Fig. 1).
- Subject matter experts (clinicians with relevant experience in surgical and infectious disease) developed the care paths with the help of other clinical staff (nurses and infectious disease preventionists).
- The draft care paths were shared among groups for review, feedback, and validated by a broad representation of other clinical staff from those organizations. Any changes were submitted back to the original developer of the care path for approval.
- Once the care paths were completed, patient scenarios were developed to determine the financial impact.

SIMULATED PATIENT TRAJECTORIES

Patient scenarios were derived from care paths and reflected the potential trajectories associated with the complications, workup, and treatment. For HAIs, the patient was followed through discharge from hospital, and the patient scenarios were developed in the following manner:

1. Hospitals ranging from 50 beds to more than 1000 beds per physical facility, and clinicians, finance executives, and operations leaders from corporate organizations representing more than 150 hospitals in more than 20 states across America were chosen as hospital collaborators.
2. Because of the great geographic distances among the collaborating hospitals and heavy workload of practicing physicians, the work was generated by more than 1000 Web-enabled collaborative teleconferences projecting direct visualization of the work, many hundreds of teleconferences, and numerous onsite meetings at collaborating hospitals. Texas Medical Institute of Technology provided thousands of person-hours of work through a support staff of 20 with daily services including engineering support of clinicians, informatics experts, infection prevention experts, and business analysts. Much of the work was carried out on weekends to be available to practicing clinicians. Each collaborator had teams that were composed of clinical, operational, and financial leaders from frontline caregivers to officers of multi-billion-dollar organizations.
3. The expert pool that was engaged in the program was more than 100 of the 500 TMIT Test Bed experts. The HAI experts and hospital collaborators participated in many of the internet meetings and teleconferences.
4. Using the care paths reflecting high-impact/high-volume patients, we applied typical real-life patients’ profiles and developed a history and diagnosis representative of the treatment process. This was completed by the same clinicians who were involved in the development of the care path, using both personal experience and review of de-identified patient records in very high volume organizations.
5. A list of the related current procedural terminology and diagnostic-related group (DRG) codes associated with the treatment process³⁶ for that specific patient was identified using clinical and administrative experts. The inventory of the codes was compiled and distributed to run against the cost accounting system.

DEEP INCISIONAL SURGICAL-SITE INFECTIONS - COLORECTAL EXAMPLE

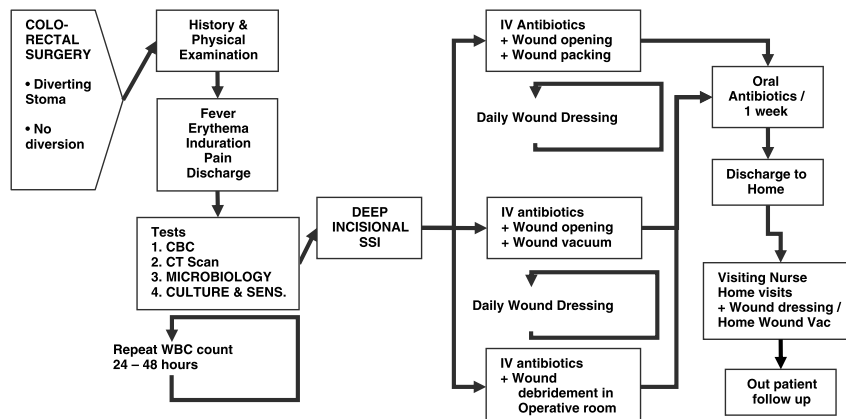


FIGURE 1. Deep incisional SSIs-colorectal example.

6. Cost data were then aggregated for each of the tests and procedures and applied to every scenario to obtain a combined cost for the treatment of the patient through the episode of care.
7. Finally, a matrix reflecting the percentage of patients falling into each scenario was developed based on subject matter expertise and actual aggregated data.

POINT ESTIMATES—GIVENS, ASSUMPTIONS, AND VARIABLES

- Simulated patient trajectories reflect the real-life scenarios that physicians and administrators face every day, and when these trajectories can be tied to real cost, harm, waste, and quality data, then decisions can be inspired by reality instead of lifeless spreadsheets of aggregated data that are inherently distrusted by clinicians when they are not anchored in work processes the clinicians perform every day in the care of patients.
- By complementing aggregated data from national databases with point estimate impact factors from peer-reviewed literature with such reality-based care trajectories that have been uncomplicated by comorbidities that overwhelm even the most astute analyst, we can develop good rationale, well-enough articulated for decisions regarding resource allocation to the same fidelity that senior finance and operations executives are used to making every day.
- By providing a floor of harm and floor of cost, with the likely case being even stronger for investment once comorbidities are included, we win the trust of executives who are used to overestimation and underdelivery.
- The givens, assumptions, and variables that are developed for leadership teams give them the opportunity to run scenarios over time as external forces change during this time of chaos.

PRELIMINARY FINDINGS

The early deliverable for our Greenlight HAI work focused on an objective to provide the floor impact for HAI waste and harm in terms of length of stay and cost from targeted patient scenarios that address SSI, CLABSI, VAP, CAUTI, MRSA, and CDI. In a separate track with a world-class team of patient experts, an analysis of specific interventions was requested to be mined and qualified from the literature. Following the methods previously described, we developed a total of 30 care paths, resulting in 55 different trajectory limbs that demonstrate the various common routes a patient without comorbidities would take in typical care.

There were 36 SSI trajectories that were classified in the common breakdown used by surgeons of superficial, deep incisional, and organ/space infections³⁷:

- 10 colorectal trajectories for surgical-site infections from procedures including colectomies, small bowel resections, sigmoid resections, and procto-colectomy. Diagnosis-related groups evaluated include DRGs 146, 147, 148, and 149.³⁸
- 10 cardiovascular trajectories for mediastinal SSIs from CABG procedure. The DRGs evaluated include DRGs 106, 107, and 109.
- 12 orthopedic trajectories for knee and hip, replacement procedures, and laminectomy. DRGs included 210, 211, and 212
- Four neurologic trajectories for SSI from craniotomy procedures—DRGs evaluated include DRG 1, 2, 531, and 532.
- The balance of the trajectories was derived using aggregated infection data and determining the high-impact/high-volume DRGs. These included three trajectories for CLABSI (1 uncomplicated and 2 complicated), 7 for CAUTI (2 uncomplicated,

3 complicated, and 2 complex), 2 for VAPs (1 uncomplicated and 1 complicated), 4 MRSA (2 uncomplicated and 2 complicated), and 3 CDI (1 uncomplicated, 1 complicated, and 1 complex).

These were developed by an iterative process with key physicians practicing in very high volume environments. Alternative limbs were generated with extensive analysis of cost and process mapping. The number of alternative limbs ranged from 1 to 4 per care path.

More comprehensive studies will be published on the future; however, our early findings included the following:

- Consistent findings with the TMIT-APIC model (we call this model 1.0). Larger organizations tended to have higher costs; this could be due to additional overhead allocations and operational structure. This was evident in the case of patient-room and intensive care unit (ICU) room costs, where small rural hospital costs were half of those at teaching centers, and the comprehensive community center ICU-room cost was 30% lower than that at an academic center.
- Activity-based accounting methods are not consistent in allocating indirect costs—for example, across organizations. For instance, some organizations would allocate research and development (R&D) costs to individual activities, thus masking real costs and the variable impact of HAI avoidance. To have the most clarity, we concentrated on direct costs, with the recognition that indirect costs were important and should be considered by providers of care after they understand direct costs.
- The cost for HAIs using patient trajectory methodology is significantly lower (on average, 50%) than what is typically seen in the published literature. This might be explained by the fact that we used direct costs. When indirect costs are included in an analysis, the cost forecasts come closer to published data.
- One consistent finding is that infection control departments rarely have a direct ongoing data sharing collaboration with finance departments and frequently have not undertaken studies of their actual cost of HAIs (outside of a funded study).
- Few organizations have an integrated information technology system that allows the infection prevention department to have easy access to financial data. The reasons for this finding spanned a number of issues including legacy system limitations, privacy and security, or lack of interest and desire. All hampered the infection control professionals' ability to make sound cost-benefit calculations regarding prevention techniques or interventions.

COSTS

Intensive care unit and patient room costs were a large contributor to the overall cost to treat HAIs. For the superficial and deep wound SSIs and uncomplicated HAIs necessitating additional length of stay, room cost could account for 80% of the direct cost. Even in the case of organ/space SSIs and complicated HAIs, the room cost could account for 50% of the overall direct cost.

Operating room cost accounting was very inconsistent across organizations with no common guidelines. For instance, some organizations used a “cost per minute” process based on level type of procedure, some used both time and acuity of the case as variables, some included certain anesthesia costs in the procedure cost, and others did not.

Pharmaceutical costs were relatively consistent across collaborators (this included product cost, sourcing, and handling); there were significant differences in generic versus branded drugs

where cost per dose could be 50 to 80 times more expensive for the same treatment.

Laboratory costs for both the procedures and tests were in the same range across organizations.

Certain complications from HAIs may be much less expensive than previously thought. For instance, mediastinal infections are thought to cost as much as or more than \$100,000; however, the attributable cost to some medical centers was less than \$30,000. Costs of SSIs also were found to be lower than expected. Future papers by our surgical colleague collaborators will be published on these topics.

Superficial SSIs were very inexpensive to treat, and few require additional patient length of stay, although they account for 40% of the volume of SSIs.

- Costs of CAUTIs were higher than are typically published for the complicated and complex trajectories, likely because of the clinical support required to keep the patient in ICU or extending their stay in the hospital because of fever. Actual treatment cost was not the larger contributor.
- Costs of certain diagnostic testing procedures were lower than most physicians perceive, such as the direct cost for computed tomography procedures that might be assigned a cost of \$100 with a charge that could exceed \$1000. Again, future studies will be published with clinical leaders of collaborating organizations.

PRELIMINARY RECOMMENDATIONS

Much more detailed recommendations for hospitals will be generated in future papers; however, some of our early recommendations include the following:

- Quality leaders and departments establish direct collaborative relationships with counterparts in finance departments with regular meetings to help both clarify direct costs, indirect costs, and the savings of waste and harm to patients by avoidance of infections. See the National Quality Forum (NQF) Safe Practices for Better Healthcare Report 2010 Safe Practice 4: Identification and Mitigation of Risks and Hazards for guidance on how linkages can be created.^{22,39}
- Governance leaders and the professional administrative leaders need to consider establishing the structures and systems necessary to act on risks and hazards identified through the process defined above in Safe Practice 4.³⁹ See NQF Safe Practice 1 for details as to how the concepts of awareness, accountability, ability, and action can be applied to the performance gaps in HAIs.^{40,41}
- Quality and infection control professionals should keep up on the latest literature regarding the latest measures, standards, and safe practices for HAIs. The literature is constantly evolving; Centers for Disease Control guidelines will evolve, the safe practices have a certain shelf life that will be driven by research studies as they come out, and new studies will drive change. Even extensive compendia such as the Compendium of Strategies to Prevent Healthcare-Associated Infections in Acute Care Hospitals, published by the Society of Healthcare Epidemiology of America and the Infectious Diseases Society of America in partnership with APIC, the American Hospital Association, and The Joint Commission, have a certain longevity.³⁵
- Consider performing regular reviews of patients with HAIs to determine the attributable cost of treatment and how financial waste and harm to patients may be avoided—that is, the fully loaded avoidable care burden.
- Develop your own risk scenarios to determine impact of reimbursement withholdings from HACs as well as your

own impact scenarios on specific process and technology interventions.

- Always remember that impact calculators, performance models, and simulated patient trajectories are just a new way of thinking. The numbers they generate are no more tied to the reality of running your hospital or treating your patients as jet simulator numbers are for a pilot practicing a flight—he or she would not rely on them to fly his next flight nor should he or she. Such tools help you sharpen your knowledge and skills; however, they are not “plug numbers” for your business case or to make automatic decisions about patients or innovation purchases. Use your numbers and your own clinicians to make your decisions, complimented by their interpretation of the latest best literature, measures, practices, and standards.

The Resulting Performance Models

Our leadership decision-support investment models address clinical, operational, and financial performance for typical hospitals. They provide structure and flexibility: the structure to address specific patient safety gaps, while providing the flexibility of givens, assumptions, and variables to adjust forecasts for hospitals' unique situations. The ultimate objective is to provide what is necessary for CFOs and finance teams to vote “yes” to a Greenlight investment in patient safety initiatives, with the confidence in the ROI and financial impact of those programs. In the long term, “CFO-validated factors” will be made public in peer-reviewed papers with input from leading CFOs.

NEW HORIZONS AND NEXT STEPS

As the Greenlight Community of Practice matures over the years ahead, we will have a clearer view of the relationships between cost, quality, value, speed, trust, waste, and both attributable and avoidable harm.

Complimentary articles will address the method for identifying point estimates for givens, assumptions, and variables that may be considered for decision support along care path trajectories. As previously noted, we have always recommended that providers make their own decisions as to how our models and calculators be applied—we have provided them as a guide to how an organization must think about their decisions to invest in patient safety. The output numbers generated are intended to provide an example as to how one might consider developing models with ones own data with input from their own clinicians.

We will be writing articles from the CFO point of view as to how quality leaders can develop the business case necessary to get the Greenlight vote of their CFO's. Specific articles will address the cost of harm and savings through safety of certain HACs as well. As we have said in the past, patient safety leaders may become thought of as “Chief Revenue Preservation Officers” as value-based purchasing initiatives start tying payment to quality by targeting HACs and HAIs.⁴²

The methodologies will be applied to transitions in care and all cause harm areas addressed in the NQF Safe Practices mentioned above and applied to the predisposing conditions and environments that lead to events described in the NQF 2011 Serious Reportable Events.²¹ They also will be applied to the issues regarding radiation safety and use of imaging procedures in 2011.

THE VOYAGE AHEAD

We, as an industry, are embarking on a chaotic voyage to an unknown destination in uncertain seas taking an unclear course.

Suppliers will move from “feature sales to value solutions,” providers will make the leap from “volume-centered care to value-centered care,” and purchasers move from “discount-based purchasing to value-based purchasing.”

To succeed in this whole new world, we will have to exhibit new behaviors and traits. Perhaps, in the words of Collins and Hansen, our leaders may have to develop fanatical discipline, productive paranoia, and empiric creativity and animate these traits with Collins’s Level 5 leadership ambition¹⁰ for a cause greater than our own short-term prosperity.

To survive, we will all have to convert harm to healing and waste to value. This will require new decision support tools that allow us to make clear decisions about the risk to our patients and risk to our organizations. As we consider the doom and gloom predictions of those who believe that our current health-care economic crisis and unfunded liabilities spell unavoidable disaster, we must listen to a more positive counterpoint. Andrew Menard, accomplished author and innovation expert, reminds us of the “Malthus Fallacy.” Thomas Malthus, a very influential economist in the 1800s, predicted that human population growth would be constrained by the limited ability of arable land to produce food. He predicted that famine and misery would prevail, and he was wrong. Menard applies this to health care when he states: “While the dire predictions flowing from trends in healthcare utilization and cost are helpful wake up calls, we should not underestimate the ability of creative individuals and groups to respond to the ‘crisis’ with innovative approaches to solve these problems. For hundreds of years, human society has demonstrated again and again that productivity improvements don’t just ‘bend the curve’ of past trends; they shift the entire curve, simultaneously delivering higher quality and lower costs” (oral communication, October 25, 2011).

As you finish reading this paper, we remind you to consider the stories of Amundsen and Scott. Amundsen ran scenarios and trajectories that modeled external and internal risk, won the race, and finished on the day he forecasted with resources to spare. Scott lost not only the race but even his life—he was found frozen solid, huddled with colleagues who bet their lives on his decisions in a tent just 3 miles from his destination. Who will you be?

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