Institute for Healthcare Improvement

WHITE PAPER

Achieving Hospital-wide Patient Flow

The Right Care, in the Right Place, at the Right Time

AN IHI RESOURCE

20 University Road, Cambridge, MA 02138 • ihi.org

How to Cite This Paper: Rutherford PA, Provost LP, Kotagal UR, Luther K, Anderson A. *Achieving Hospital-wide Patient Flow*. IHI White Paper. Cambridge, Massachusetts: Institute for Healthcare Improvement; 2017. (Available at www.ihi.org)

AUTHORS:

Patricia A. Rutherford, RN, MS: *Vice President, IHI*

Lloyd P. Provost, MS: *Statistician and Senior Improvement Advisor, Associates in Process Improvement*

Uma R. Kotagal, MBBS, MSc: *Executive Leader, Population and Community Health, Cincinnati Children's Hospital Medical Center; IHI Senior Fellow*

Katharine Luther, RN, MPM: *Director of Quality, UTHealth McGovern Medical School*

Alex Anderson: *Research Associate, Innovation, IHI*

Acknowledgements:

The authors would like to thank IHI's Hospital Flow Professional Development Program faculty and participants who helped create and refine the framework, strategies, and improvement ideas described in this white paper. We appreciate the pioneering efforts to improve hospital flow of Carol Haraden, PhD, Kirk Jensen, MD, MBA, Eugene Litvak, PhD, Tom Nolan, PhD, Roger Resar, MD, and organizations participating in IHI's IMPACT Network and Pursuing Perfection initiative. Special thanks to Frederick C. Ryckman, MD, Denise White, Christine White, MD, MAT, and their colleagues at Cincinnati Children's Hospital Medical Center for their exemplary work to achieve hospital-wide patient flow and for offering insights that have continuously improved the framework. Thanks also to Maureen Bisognano, Tejal K. Gandhi, MD, MPH, Don Goldmann, MD, Vinod K. Sahney, PhD, and Jeffrey D. Selberg for their thorough review and thoughtful recommendations for the paper. We also thank Jane Roessner and Val Weber of IHI for their support in developing and editing this white paper.

Contents

Foreword

My visits with hospital leaders around the world make it clear that patient flow in hospitals is a large, and growing, challenge to providing high-quality care. Waits and delays are not only disrespectful to patients, they are potentially harmful. When patients experience delays in treatment or are boarded in emergency rooms, in hallways, or in units not specialized for their care, outcomes are worse and costs are higher.

Our failure to see the burden we're putting on patients can keep us locked into inaccurate and potentially paralyzing ways of thinking about flow. Our inability to more effectively design and manage processes also wears on clinicians and staff — decreasing their efficiency and productivity, contributing to burnout, and decreasing job satisfaction.

This IHI White Paper shares strategies, promising change ideas, and resources to help leaders and improvement teams take on the challenge of achieving hospital-wide patient flow. An extraordinary team at IHI has researched this topic, tested and refined theories, and assembled key resources to help health care organizations improve flow, no matter where they are on this important journey.

Maureen Bisognano
President Emerita and Senior Fellow
Institute for Healthcare Improvement

Executive Summary

While health care systems are making progress toward more value-based, person-centric care practices, the majority of hospitals are experiencing significant operational and financial stress. Costs continue to escalate, while reimbursements are waning. Even though there is an oversupply of hospital beds in the US, emergency department and inpatient bed capacity fail to meet daily patient demand in many hospitals, particularly in large academic medical centers.[1]

Diversions, long waits, and delays in the emergency department (ED) are a hospital-wide issue, not solely an ED operations issue. Delays are often the result of ED beds being occupied by patients waiting for admission to the hospital. Larger hospital-wide issues include mismatches in bed and staff capacity and demand for various clinical services; inefficient processes for transferring patients among units and for discharging patients; long waits for transferring patients to skilled nursing and long-term care settings; and patients with mental health conditions occupying hospital beds due to inadequate mental health facilities in the community. Lack of inpatient capacity also results in delayed or canceled surgical procedures, patients being "boarded" in the post-anesthesia care unit, and patients being cared for in "off-service" units. Disparities in timely access to and progression of care for underserved patient populations is an additional issue that must be understood and addressed.

Failing to achieve hospital-wide patient flow — the right care, in the right place, at the right time — puts patients at risk for suboptimal care and potential harm. It also increases the burden on clinicians and hospital staff and can accelerate burnout. Yet, while many understand the problem, they often lack the comprehensive strategies to address it. Optimizing hospital flow, and ultimately improving outcomes and the experience of care for patients, requires an appreciation of the hospital as an interconnected, interdependent *system* of care. It also requires strong leadership; in fact, the role of executive leaders is critical for success. The executive oversight team committed to achieving system-wide flow must prioritize four things: carefully craft and communicate a long-term aim and its rationale; put in place structures to execute on system-wide improvement, shifting the focus from localized initiatives to hospital-wide results; be ready to resolve the tough dilemmas on a timely basis; and focus on a few important initiatives to demonstrate organizational capability, then expand the scope to hospital-wide flow initiatives.

This white paper — the culmination of approximately two decades of the Institute for Healthcare Improvement's research, innovation, and learning about hospital-wide patient flow — guides leaders and quality improvement teams through an in-depth examination of a systems view of patient flow, theories for improvement, and high-leverage strategies and interventions to improve hospital-wide patient flow. IHI's recommended approach is based on these principles:

- The integration of various approaches (e.g., quality improvement, Lean management, operational engineering, complex systems analysis, operations research) to achieve hospital-wide patient flow.
- The utilization of advanced data analytics to reduce artificial variation in elective surgical scheduling, forecast patient demand patterns, and match capacity and demand.
- A focus on reducing demand, with change ideas to reduce hospital utilization by relocating care to less costly and, in many cases, higher-quality care; and on shaping demand by expansion of operating room scheduling system capabilities to predict and plan for patients who need intensive care and care in other inpatient units.

- A system-wide approach to patient flow, with a few "simple rules" to govern complex systems. Simple rules are design principles to guide system-wide improvement (e.g., no delay greater than two hours in patient progression, based on clinical readiness, from clinical areas/units throughout the hospital; available capacity on each unit or clinical area at the beginning of each day).
- A learning system that utilizes the science of improvement to understand and prioritize solutions to mitigate "flow failures."

Background

Achieving hospital-wide patient flow, and ultimately improving outcomes and the experience of care for patients, requires an appreciation for the entire system of care. A hospital is an interconnected, interdependent system; improvements in one department affect the operations of other departments. In a 2003 white paper, the Institute for Healthcare Improvement (IHI) explained, "Understanding patient flow requires looking at the entire hospital system of care, not just in isolated units. Reducing variation in flow has been shown to improve overall patient flow. Providing patients with timely access to appropriate care is an essential element of high-quality care, because *when* care is provided is often as important as *what* care is provided."[2]

Complex theories and approaches to improving flow that have matured in other industries and academic disciplines have been adapted to the context of health care systems.[3] Some examples from other industries include Lean manufacturing and Toyota Production System, operational management, and the use of advanced data analytics. The pioneering efforts of Eugene Litvak and his colleagues described the importance of developing systems to address variation in scheduling of elective surgical procedures, and to separate the flows of planned surgical cases from unexpected or emergent cases.[4] Both methodologies have demonstrated a significant impact on hospital flow.[5,6] While eliminating artificial variability in elective surgical scheduling has been shown to make dramatic improvements in patient flow, cultural barriers have thwarted widespread adoption of this method. Other efforts have focused on administrative oversight systems, primarily matching available staffing and bed capacity to demand for patient care.

Following on the work of the IMPACT Flow Community (2004 to 2009), IHI continued to collaborate with expert faculty to promote specific strategies to improve hospital flow. Real-time demand capacity (RTDC) management, a method piloted at the University of Pittsburgh Medical Center,[7] aims to improve hospital-wide patient flow through better prediction and planning each day, identifying capacity and demand mismatches, and initiating specific improvement projects to address obstacles to efficient patient flow.

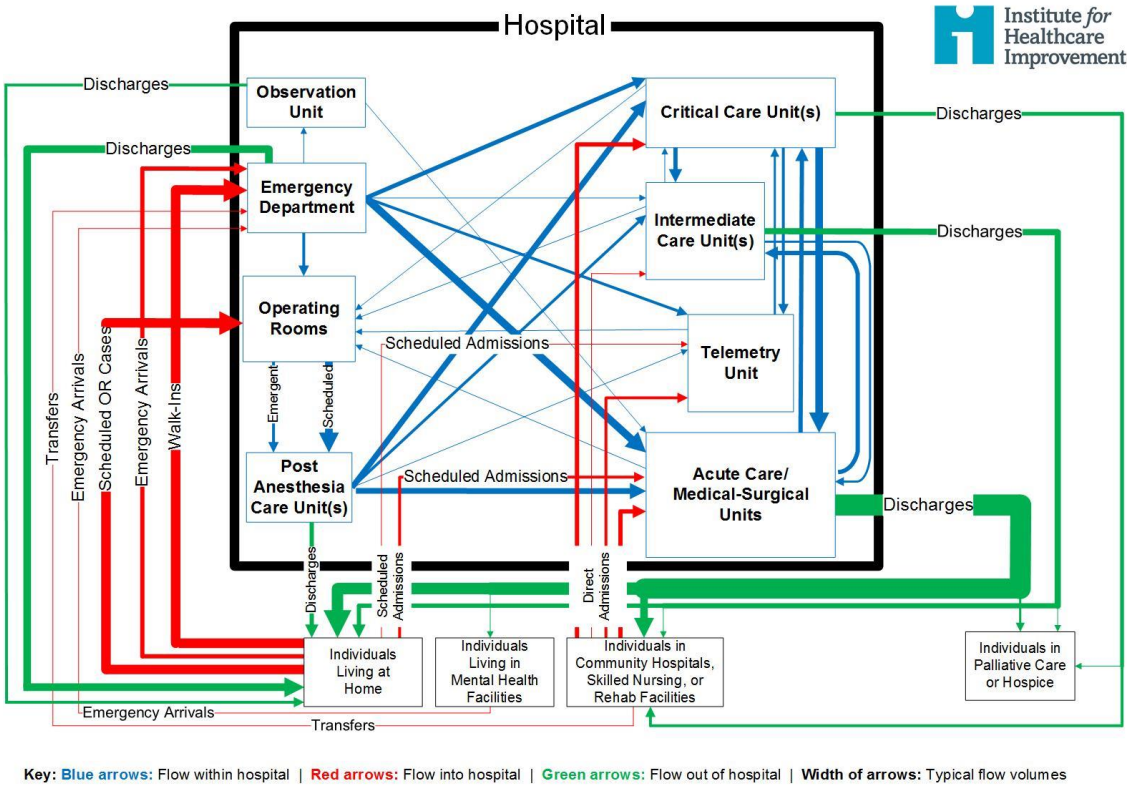
In the past two years, IHI's Innovation team has intensified its focus on learning about persistent challenges and breakthrough strategies to achieve hospital-wide patient flow. These efforts include extensive literature reviews, expert interviews with leading hospital administrators and point-of-care staff, site visits to exemplar organizations, and development of training opportunities to spread this learning. This 2017 IHI White Paper is a culmination of approximately two decades of IHI's research, innovation, and learning about hospital-wide patient flow.

A Systems View of Hospital-wide Patient Flow

Making meaningful and sustainable changes to hospital operations, including patient flow, requires recognizing the interdependent nature of every facet of the hospital. Understanding hospital-wide patient flow requires looking at the whole system of care, not just individual patient care units or subgroups of patients. A system is an interdependent group of items, people, or processes working together toward a common purpose.[8,9] Systems thinking means viewing the organization as dynamic, adaptive to the needs of patients, and comprising interdependent people, departments, equipment, facilities, processes, and products, all working toward a common purpose. Optimization of a system requires orchestrating the efforts of all components of the system toward achieving the stated purpose.[10]

To appreciate this interdependence, a conceptual diagram or "system map" helps to visualize the key components of the system and the important linkages among them. Figure 1 is a system map of patient flow in a typical hospital, depicting the interactions within the hospital and beyond it. Within the largest "Hospital" box in the figure, the smaller boxes represent typical hospital units, and the blue arrows show the flow of patients among these units. The figure also depicts care settings outside of the hospital, with red arrows showing the flow of patients into the hospital and green arrows showing flow out of the hospital to these settings. The width of the arrows indicates typical flow volume; the wider the arrow, the greater the volume. Figure 1 clearly illustrates that hospital patient flow is a highly interdependent system: changes to flow in one unit affect many other parts of the system. See Appendix A for a full-page version of Figure 1.

Figure 1. System Map: Patient Flow in the Hospital

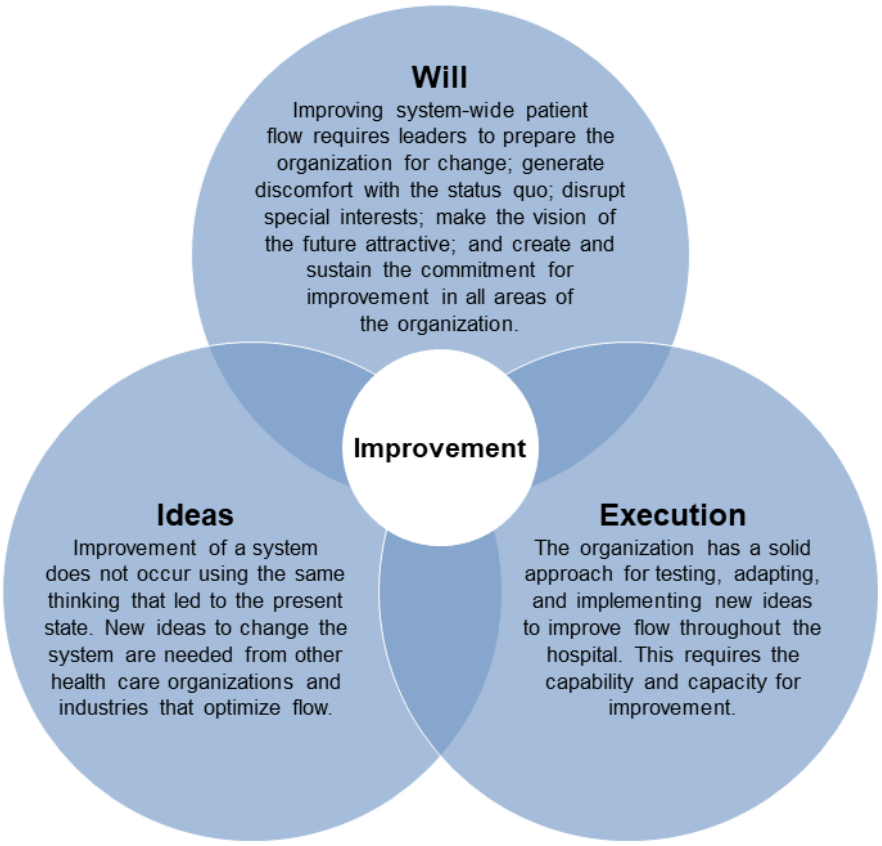


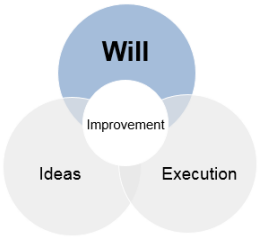
Some key systems principles can be observed in this figure:

- **If each part of a system, considered separately, is made to operate as efficiently as possible, the performance of the system as a whole will be suboptimized.**[11] Improvements on one unit could create problems, even chaos, in another part of the hospital. For example, when EDs improve efficiency and increase throughput, there is a need to accelerate the transfer of patients from the ED to inpatient units. However, if inpatient beds are unavailable when needed, patients are often placed in hallways and on "off-service" units. So, improving flow must be orchestrated at the system (hospital) level. This principle suggests that understanding flow throughout the hospital requires measures at the organization, department, and unit levels (discussed in more detail later in the paper). A system map helps identify the processes in each unit and the impact that changes in one unit may have on other areas of the system.[12]
- **There are two types of changes in a system: first-order and second-order changes.**[13] First-order changes (e.g., problem solving, staffing allocations, bed allocations) are needed to keep the system running day-to-day at the current level of performance. Second-order changes (e.g., improvement projects, capital projects) are required to move to new levels of performance.
- **Every system has a current constraint or bottleneck.** Identifying the major constraints in the system and then developing changes to address or remove them will have the greatest impact on the performance of the system.[14]
- **Understanding variation is key to achieving optimum flow.** Common cause variation is the natural or expected variation inherent in a process. Special cause variation arises because of specific circumstances that are not inherent in the process.[15] Displaying flow measures using control charts enables teams to distinguish between special cause and common cause variation. When a system is stable (i.e., only has common cause variation), organizations can then use queuing theory to plan for balancing capacity and demand.[16]
- **Every system is perfectly designed to get the results it gets.**[17] If we want better results, we need to change the system.

IHI's three essential elements for any system-level improvement — Will, Ideas, and Execution (see Figure 2) — provide a strategic framework for achieving hospital-wide patient flow.[18] According to this framework, the improvement of any system requires the *will* to improve the system, *ideas* about how to make the system perform better, and a plan to make it real — *execution*. We use these three elements as the overall structure for the sections that follow.

Figure 2. System-Level Improvement Requires Will, Ideas, and Execution





Building Will for Improving Hospital-wide Patient Flow

Taking a system-level approach to improving hospital flow requires building will throughout the organization, from the highest levels of leadership to point-of-care managers and staff. This section presents five strategies for building will:

- Make Delivering the Right Care, in the Right Place, at the Right Time a Strategic Priority
- Align Medical Staff and Hospital Executives to Achieve Improved Flow
- Adopt Value-Based Care Models to Support Improved Flow
- Demonstrate That Improved Flow Has a Positive Return on Investment
- Connect the Work of Departments and Units to Hospital-wide Flow Strategies

Make Delivering the Right Care, in the Right Place, at the Right Time a Strategic Priority

The operational challenges inherent in our highly complex health care systems often mean that patients do not receive the right care, in the right place, at the right time. This leads to suboptimal care and is certainly wasteful; it is also potentially harmful to patients. Harm as a result of poor patient flow manifests itself in many ways — an anxious ED patient waiting in pain to be admitted to a hospital bed that is unavailable; delays in initiating treatments or procedures for an acutely ill patient because of waiting times for transfer to the appropriate service or hospital unit; a patient, boarded in a medical-surgical bed instead of an ICU or specialty-unit bed due to overcrowding, receiving less than optimal care because of the respective skills sets of each unit's care teams.

When viewed from the perspective of a system-wide approach to improving flow, these patient experiences are clear examples of waste and potential harm. Yet, our health care systems and the existing incentives often create conditions for this type of care to exist. As Don Berwick, IHI President Emeritus and Senior Fellow, notes: "Flow is every bit as consequential for the health of our systems and the wellbeing of our patients" and deserves the same strategic prioritization as safety.[19] Without addressing flow as a strategic priority, clinicians and hospital staff are left to fix flow failures on an ad-hoc, reactive basis — repeatedly addressing the same problems and flow failures without addressing recurring system constraints and inefficiencies.[20]

Achieving system-wide hospital flow requires strong leadership; in fact, the role of executive leaders is critical for success. The executive oversight team for this work must prioritize four things: carefully craft and communicate a long-term aim and its rationale; put in place structures to execute on system-wide improvement, shifting the focus from localized initiatives to hospital-wide results; be ready to resolve the tough dilemmas on a timely basis; and focus on a few important initiatives to demonstrate organizational capability, then expand the scope to hospital-wide flow initiatives.

Align Medical Staff and Hospital Executives to Achieve Improved Flow

The relationship between senior leaders, who set organizational priorities, and medical staff and other care providers, who implement changes at the point of care, is integral to the success of a system-wide effort to improve flow. Some hospitals use financial incentives for improved performance. However, a more promising approach is for hospital executives, physicians, and care providers to implement strategies to overcome barriers and adopt changes to improve hospital-wide patient flow. For example, Virginia Mason Hospital and Medical Center has a compact with physicians and other care providers that outlines what each party can expect from the other. The compact creates space for honest conversations and setting expectations about strategic priorities and approaches to achieve Virginia Mason's mission.[21] The incentive for improvement stems from involving the people who will be most affected by the changes. Honest discussions, with clear data analysis, about the needs of both the organization and clinicians surfaces barriers to desired performance and creates a path forward to real improvement.

A well-crafted aim statement and a shared vision for achieving hospital-wide patient flow is critically important, but perhaps not sufficient. These developments may not be adequate to mitigate the influence of special interests (e.g., those of surgeons, ED physicians, hospitalists) that are not oriented to the needs of the whole organization. Hospital executives need the authority to

mitigate the influences of special interests in order to align efforts to achieve new levels of performance for hospital-wide patient flow.

Adopt Value-Based Care Models to Support Improved Flow

As hospitals move toward more integration across the system of care, or toward value-based care models like accountable care organizations (ACOs), there are increased incentives to deliver the right care, in the right place, at the right time. Timely access to care providers and community services, a proactive approach to care management and coordination, and collaborations among health care providers across the continuum of care to best meet the needs of patient populations often reduce patients' need for acute care services and hospitalizations.

For example, when patients rely on emergency departments for low-acuity visits, high-cost resources are used inefficiently and inappropriately, and continuity of care across providers becomes more difficult. ACOs or other value-based models of care are in a unique position to work with patients to ensure they receive care in the most appropriate setting based on their health needs. Full implementation of this type of system of care requires a dramatic improvement in providing patients with timely access to providers, particularly for patients with chronic illnesses; extended clinic hours; open slots for urgent care visits; phone contact with care providers for clinical advice and guidance; access to medications and refills; and contact between ED physicians and clinic staff to ensure adequate and timely outpatient follow-up for those who do seek care in the ED. In a two-year study comparing patients who joined an ACO between 2012 and 2013 with patients in traditional health system models, the ACO patients visited EDs 3.6 percent less often than their non-ACO counterparts and were less likely to utilize the ED for conditions that could be better treated in outpatient settings.[22]

Demonstrate That Improved Flow Has a Positive Return on Investment

Realizing a return on investment (ROI) for flow improvements will vary based on hospitals' payment models and local contexts. The selection and timing of specific flow improvement initiatives should take this into consideration. In both value-based and fee-for-service payment systems, a positive return on investment is attainable. In predominantly fee-for-service environments, the two major drivers for increasing ROI are eliminating diversions and improving efficiencies, leading to increased capacity and throughput. Cost savings in value-based payment models are realized by reducing the following: patient length of stay; complications; and avoidable ED visits, hospitalizations, and readmissions. In both payment models, improved patient satisfaction scores will likely lead to patient loyalty and increases in market share.

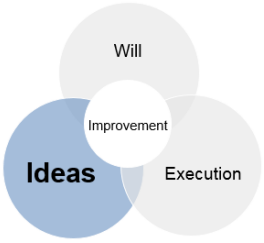
While average hospital occupancy rates in the US stay close to 65 to 67 percent, due to significant fluctuations in demand (i.e., predictable increases in patient demand related to seasonal events) hospitals often find themselves at or above 100 percent occupancy. With a system-wide approach to improving flow, hospitals can more effectively manage these fluctuations and thereby reduce costs and retain more revenue within the hospital system.[23]

Connect the Work of Departments and Units to Hospital-wide Flow Strategies

Implementing and sustaining improvements in hospital-wide flow requires alignment, cooperation, and coordination between hospital units and departments. Without effective

executive oversight and collaboration, teams operate in isolation from one another and the aggregated impact of their efforts is limited. In many cases, this isolation leads to duplicative work, rework, or work that runs counter to overall goals to improve hospital-wide patient flow.

Before embarking on a coordinated, system-wide approach to improving flow, leaders need to recognize the work already undertaken by various teams, celebrating and highlighting their successes, while also acknowledging the systemic nature of ongoing flow challenges. Hospital leaders must present a vision of flow as a system-wide issue with cross-departmental improvement opportunities, so that every team and every individual understands the connection between their work and overall improvement for the hospital. To facilitate this, it helps to create a unified system of measures used throughout the hospital, including all units and clinical services, such as operating rooms. Visual displays of data and improvements related to the work (e.g., patients waiting in the ED, admissions and discharges pending, critical test backlog) allow for real-time situational awareness for all caregivers. This helps create an environment in which each team has a direct line of sight to the overall efforts of the organization to improve flow, which increases buy-in to the effort.[24]



High-Leverage Change Ideas for Improving Hospital-wide Patient Flow

To reduce delays and waiting times and improve patient flow throughout the hospital, there are three key approaches for optimizing the system: shape or reduce demand, match capacity and demand, and redesign the system.[25] Below is an overview of the three approaches.

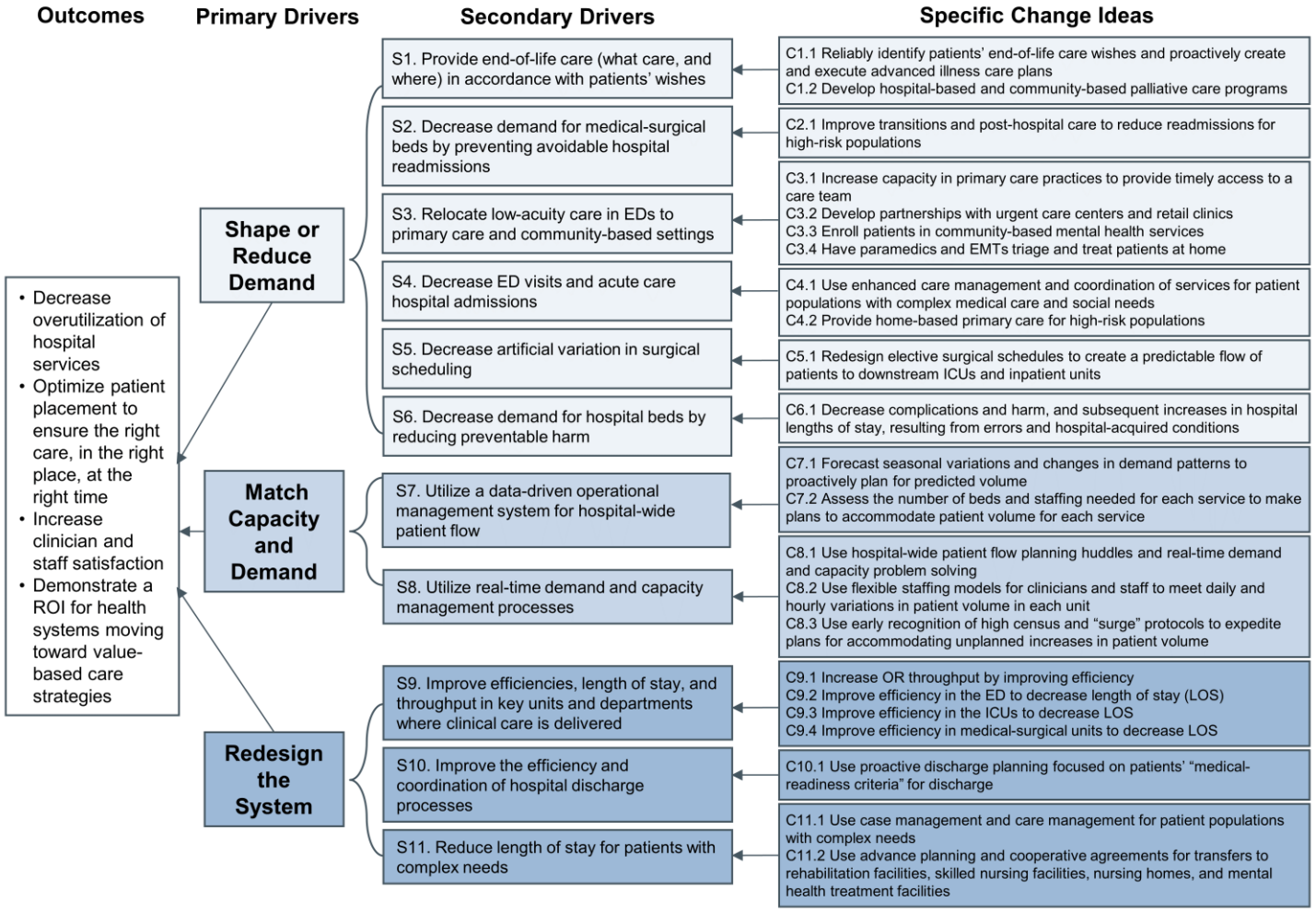
- **Shape or Reduce Demand:** Instead of adding capacity to hospital departments or units to meet patient demand, waits and delays in patient flow throughout a hospital stay can be reduced by shaping or reducing demand. Examples include:
    - Reduce patient demand due to ineffective or defective care (e.g., reduce hospital-acquired conditions, such as infections, to reduce avoidable bed days);
    - Provide needed care outside the hospital (e.g., extend hours in primary care, provide palliative care for patients with advanced illness in accordance with their wishes); and
    - Smooth or level-load elective clinical services (e.g., smooth elective surgical schedules, eliminating artificial peaks and valleys in patient demand for post-operative care in various ICUs and patient care units).
- **Match Capacity and Demand:** Both demand for care and capacity to deliver care can vary by month, day, shift, and hour. Often, changes can be made to better align system capacity with demand. Some examples of matching capacity and demand include:
    - Add or reduce capacity to meet month-to-month variation in patient demand (e.g., create seasonal "swing" units to add or reduce bed capacity during anticipated surges or declines in seasonal demand); and
    - Schedule or adapt capacity to meet day-to-day or hour-to-hour variation in demand (e.g., use data analysis to determine patterns of patient demand and create staffing patterns for ED physicians and nurses to match the demand).
- **Redesign the System:** Creating efficiencies throughout the system can increase capacity without adding resources. Redesign efforts involve changing processes, redesigning work for

constrained resources (e.g., units and staffing), managing constraints, doing tasks in parallel, eliminating steps, and synchronizing tasks. Examples of redesigning the system include:

- Do tasks in parallel: Implement a process for direct rooming and bedside registrations in the ED;
- Change processes to create efficiencies: Discharge patients when they meet clinical readiness criteria, thereby reducing discharge delays; and
- Redesign work for constrained resources: Create separate process flows for distinct types of patient demand; for example, use separately designated OR suites for elective surgical cases and emergent surgeries based on patient demand patterns, thereby increasing throughput and reducing OR delays.

The driver diagram in Figure 3 depicts (from left to right): the desired outcomes for achieving hospital-wide patient flow; the three primary drivers for improving flow; the secondary drivers for each primary driver (denoted by the letter "S" in the figure and text below); and the specific change ideas for each secondary driver (denoted by the letter "C" in the figure and text below). See Appendix B for a full-page view of Figure 3. See Appendix C for detailed descriptions of the specific change ideas for each secondary driver.

Figure 3. Driver Diagram for Achieving Hospital-wide Patient Flow



Shape or Reduce Demand

Achieving hospital-wide patient flow cannot be solved within the hospital walls alone. To improve overall flow of patients throughout the hospital, hospital leaders need to work in partnership with primary care practices, urgent care centers, specialty practices, mental health services, community-based care services, skilled nursing facilities, and nursing homes and other long-term care facilities. Decreasing overutilization of hospital services and relocating care to lower-intensity sites of care, while improving outcomes, is one high-leverage strategy for improving value by providing the right care, in the right place, at the right time.

S1. Provide end-of-life care (what care, and where) in accordance with patients' wishes.

Most patients in ICUs receive intensive expert clinical care to stabilize or reverse acute conditions, and when they are clinically ready patients are transferred to other patient care units within the hospital. However, between 15 and 20 percent of all deaths in the United States occur in the ICU.[26] Some patients choose to exhaust all available medical efforts to extend life, and these patients may eventually die in the ICU. Others with advanced illnesses prefer to avoid acute care hospitalizations and intensive care treatments, even at the risk of a shorter life. Patients should engage in proactive planning for advanced illness care in collaboration with clinical teams in primary and specialty care, and/or with hospitalist teams. Frequently, care provided in ICUs could be provided in other settings that are better aligned with the patient's wishes — at home, in a palliative care unit, or in hospice.[27] Each individual's care should be aligned with his or her values and goals for care at the end of life, and in some cases advanced illness care planning may reduce unwanted hospitalizations.[28,29,30]

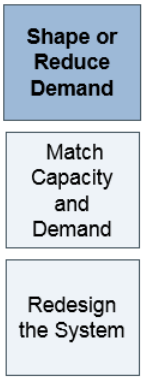
Specific Change Ideas:

- C1.1 Reliably identify patients' end-of-life care wishes and proactively create and execute advanced illness care plans.
- C1.2 Develop hospital-based and community-based palliative care programs.

S2. Decrease demand for medical-surgical beds by preventing avoidable hospital readmissions.

Potentially preventable rehospitalizations are prevalent and costly events that are burdensome for patients and their families and frustrating for providers, often putting a strain on hospital resources.[31] In most cases, hospitalization is necessary and appropriate. However, a substantial fraction of all hospitalizations are patients returning to the hospital soon after their previous inpatient stay. Preventable readmissions also offer a lens to view patients' experiences of care at a critical time of vulnerability. Many patients return to the hospital for treatment of acute exacerbations of chronic conditions or because of a poor recovery after leaving the hospital.[32] Evidence suggests that the rate of avoidable readmissions can be reduced by improving core discharge planning and transition processes out of the hospital; improving transitions and care coordination at the interfaces between care settings; and enhancing coaching, education, and support for patient self-management.[33,34]

In recent years, avoidable readmissions came under the scrutiny of US policymakers as an opportunity to improve care while reducing health care spending.[35] Efforts supported by the Centers for Medicare & Medicaid Services and mandated by the Affordable Care Act showed early progress in reducing readmissions that has since slowed down.[36] Care is fragmented and patients



are caught in episodic care processes driven by the incentives of fee-for-service reimbursement rather than receiving integrated, coordinated care. US health care policy and payment changes, in addition to coordinated care improvement efforts, have resulted in reductions in the 30-day readmission rate by as much as 40 to 85 percent for certain patient populations.[37] Additionally, evidence shows that reductions in 30-day readmissions also have a small, but statistically correlated reduction in 30-day mortality after discharge.[38] Notable care transition interventions include the Care Transitions Model,[39] Bridging Nursing Support/Transitional Care Model,[40] Project RED,[41] Project BOOST,[42] GRACE Model,[43] and the STate Action on Avoidable Rehospitalizations initiative.[44]

Specific Change Idea:

- C2.1 Improve transitions and post-hospital care to reduce readmissions for high-risk populations.

S3. Relocate low-acuity care in EDs to primary care and community-based settings.

Hospital emergency departments serve as the most accessible health care site for individuals with emergent health care needs. For urgent medical needs, the ED is the most appropriate place to receive care. However, many visits to the ED are for low-acuity, non-urgent care needs. While it is difficult to determine the rate of non-urgent ED visits, estimates range between 8 and 62 percent, with an average of 37 percent.[45] Individuals rely on the ED for non-emergent conditions for many reasons: lack of or delayed access to primary care, specialty care, or mental health care; lack of familiarity with other options for care; availability of care 24 hours a day, 7 days a week; and belief that the ED provides the best care. Minimizing low-acuity visits to the ED by implementing comprehensive health care system strategies to provide care and community services for individuals' low-acuity health care needs is an effective patient-centered strategy — improving the quality and continuity of care, while decreasing unnecessary ED use.

Specific Change Ideas:

- C3.1 Increase capacity in primary care practices to provide timely access to a care team.
- C3.2 Develop partnerships with urgent care centers and retail clinics.
- C3.3 Enroll patients in community-based mental health services.
- C3.4 Have paramedics and emergency medical technicians triage and treat patients at home.

S4. Decrease ED visits and acute care hospital admissions.

Reliance on EDs and hospitals for acute care needs is on the rise across all patient populations. Overuse in these settings disrupts system-wide flow by creating unnecessary demand for emergency and hospital services. This overuse is especially important for patients with complex medical care and social needs,[46] for whom preventing ED visits and acute care hospital admissions requires a proactive approach to care management and coordination. Also, hospitals and community-based care settings can engage in proactive management for patient populations that are underserved and for those who have difficulty accessing primary care and mental health services. This requires strengthened partnerships between the various care access points in a community. Care settings should identify overlapping patient populations and their needs, understand how each care team serves these patient populations, develop shared goals, and work

Shape or Reduce Demand

Match Capacity and Demand

Redesign the System

together to best meet the populations' needs by designing a plan of action to deliver higher-quality, better coordinated care.[47]

Specific Change Ideas:

- C4.1 Use enhanced care management and coordination of services for patient populations with complex medical care and social needs.
- C4.2 Provide home-based primary care for high-risk populations.

S5. Decrease artificial variation in surgical scheduling.

The Institute for Healthcare Optimization (IHO) has developed an approach to identify, classify, and quantify different types of variability in patient flow, followed by smoothing of artificial variability. The main goal of managing flow variability is to increase patient throughput, decrease patient waiting times, reduce cost of care, and maintain or improve safety and quality.[48] The IHO Variability Methodology has a three-phase approach. Phase one focuses on balancing resources and flow of time-sensitive emergent/urgent and elective/scheduled surgical cases. Phase two focuses on smoothing elective/scheduled patient flow (with scheduled surgical cases having the biggest impact on variation in patient demand on inpatient units). The main goals of this phase are to improve quality and safety of care, decrease competition between scheduled and unscheduled flow on inpatient units, and enhance elective surgical and/or medical throughput, depending on the hospital's priorities. Phase three focuses on correctly sizing inpatient units to improve quality, safety, and throughput to better match capacity with demand on medical units, alleviate medical unit bottlenecks, and improve appropriate patient placement.

Specific Change Idea:

- C5.1 Redesign elective surgical schedules to create a predictable flow of patients to downstream ICUs and inpatient units.

S6. Decrease demand for hospital beds by reducing preventable harm.

Preventable harm in health care is a health crisis requiring a coordinated response from policymakers, stakeholders, community members, and care providers.[49] The Centers for Disease Control and Prevention lists unintentional medical errors as the third leading cause of death in the United States.[50] Preventable harm — including medication errors, diagnostic errors, hospital-acquired conditions, and central line infections — is responsible for additional medical treatment and extended hospital stays for one in 18 Canadian hospital patients.[51]

Hospital-acquired conditions (HACs), complications and harm that are a result of medical care in the hospital, are avoidable through reliable implementation of evidenced-based care practices. The Centers for Medicare & Medicaid Services (CMS) identified several preventable HACs for which CMS will not reimburse treatments and additional days in the hospital.[52] The impact of HACs on patients and hospital resources is significant. Older adults contracting healthcare-associated bloodstream infections (BSI), for example, experience a 48 percent higher mortality rate, 44 percent longer length of stay, and 46 percent higher cost compared to patients who avoid BSI.[53] Value-based payment programs penalize or withhold incentive payments if hospitals fail to prevent avoidable harm, increasing the financial incentive to reduce HACs and other harms.[54,55]

Specific Change Idea:

- C6.1 Decrease complications and harm, and subsequent increases in hospital lengths of stay, resulting from errors and hospital-acquired conditions.

Match Capacity and Demand

To reduce waits and delays in patient progression throughout the hospital, hospital operations leaders must continuously assess the status of capacity and patient demand and remedy mismatches through effective strategies. Both demand for patient care services and hospital capacity can vary by month, day, shift, and hour. Hospitals must employ complex short-term and long-term system-wide strategies to align capacity with patient demand.

S7. Utilize a data-driven operational management system for hospital-wide patient flow.

Operations management is described as the use of quantitative methods to assist hospital data analysts and operational leaders in utilizing what has been learned through data analysis to achieve the most favorable performance of hospital operations. Key operations management strategies include demand capacity management; constraint management; elimination of artificial variation and management of natural variation utilizing queuing theory; and simulation modeling to forecast future demand and depict various courses of action. These approaches form the basis of suggested strategies to improve system-wide hospital operations and patient progression throughout stages of care in the hospital.[56,57]

The use of advanced data analytics is essential for the system-wide flow improvement oversight team to assess and manage demand and capacity at the hospital-wide level and in all hospital departments and inpatient units. The aim of demand and capacity management is to predict patient demand by time of day, day of the week, and season of the year, and to design hospital operations with sufficient capacity (i.e., hospital facility space and staffing) to meet that demand. Start by answering these questions: Who is coming to the hospital? When are they coming? What are they going to need? Is our service capacity going to match predicted patient demand? What will we do if capacity doesn't match demand?[58] Matching capacity to demand leads to better service for hospitalized patients with shorter waiting times; safe and reliable care for patients in the right place and at the right time; and better utilization of resources by optimizing capacity to meet predicted demand.

Specific Change Ideas:

- C7.1 Forecast seasonal variations and changes in demand patterns to proactively plan for predicted volume.
- C7.2 Assess the number of beds and staffing needed for each service to make plans to accommodate patient volume for each service.

S8. Utilize real-time demand and capacity management processes.

Many hospitals lack the processes and structures to admit or transfer patients without delays to inpatient units throughout the hospital. Managing hospital flow is a day-to-day activity; however, this effort should be coupled with a learning system that skillfully identifies problems and develops prevention strategies to avoid future problems. The real-time demand capacity (RTDC) management approach, which is based on management principles and queuing and constraint theory, has been implemented successfully in a variety of health care organizations.[59] RTDC represents a promising approach to improve hospital-wide patient flow and can be integrated into current bed management processes. RTDC comprises four steps that are undertaken in the hospital each day: 1) predict capacity at the unit level; 2) predict demand at the unit level; 3) develop a plan to match capacity and demand at the unit level; and 4) evaluate the results of the

plans to identify barriers to patient flow that can be the focus of targeted improvement projects.[60] In addition to RTDC, flexible staffing models and capacity planning to accommodate surges in patient volume are necessary to provide agility in matching capacity and demand.[61]

Specific Change Ideas:

- C8.1 Use hospital-wide patient flow planning huddles and real-time demand and capacity problem solving.
- C8.2 Use flexible staffing models for clinicians and staff to meet daily and hourly variations in patient volume in each unit.
- C8.3 Use early recognition of high census and "surge" protocols to expedite plans for accommodating unplanned increases in patient volume.

Shape or Reduce Demand

Match Capacity and Demand

Redesign the System

Redesign the System

Demand for hospital beds often exceeds capacity, leading to delays in patient admissions and transfers between inpatient units, and cancellations of elective surgical procedures. Effective strategies must be in place for efficient use of existing bed capacity. There are numerous opportunities to improve efficiencies in care for hospitalized patients — while maintaining steadfast attention to providing safe, patient-centric, value-added hospital care — and arranging needed follow-up care after patients are discharged. To achieve efficiencies and increase value in hospital care, hospital operations leaders must employ Lean principles, constraint management, and quality improvement strategies throughout the hospital.[62,63]

S9. Improve efficiencies, length of stay, and throughput in key units and departments where clinical care is delivered.

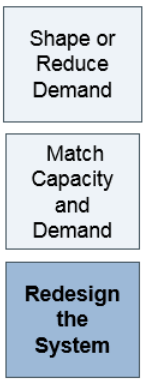
Length of stay (LOS) for hospital patients is a well-accepted indicator of hospital efficiency, a key driver of hospital costs, and affects capacity within hospitals. Shorter hospital stays are often more standardized and patient centered, enabling beds to be available more quickly and thus more patients to receive timely care. Understanding and managing constraints and bottlenecks and continuously reducing waste from processes within ORs, the ED, ICUs, and medical-surgical units are principal strategies to decrease inefficiencies, reduce LOS in key clinical units, and improve patient flow. While these improvements are essential for optimal clinical operations, it is also critically important to monitor and mitigate any unintended consequences of LOS reductions, such as readmissions to the hospital within seven days.

Specific Change Ideas:

- C9.1 Increase OR throughput by improving efficiency.
- C9.2 Improve efficiency in the ED to decrease LOS.
- C9.3 Improve efficiency in the ICUs to decrease LOS.
- C9.4 Improve efficiency in medical-surgical units to decrease LOS.

S10. Improve the efficiency and coordination of hospital discharge processes.

Bed capacity management is a critical issue facing hospitals, and inefficient discharges impact patient flow throughout the hospital. Discharging patients from the hospital is a complex process with numerous challenges. Many factors must be considered when optimizing the progression of care for each patient, to balance both quality of care and efficiency. Some common steps and care



processes that impact timely patient discharges include early comprehensive assessment of discharge needs; completion of diagnostic testing and reporting of test results; coordination and decision making among physicians, nurses, other care team providers, and patients and their family members; preparation of patients and family members for the next phase of care in the patient's home or other care setting; arrangement of home health equipment and services; securing the availability of transportation for patients returning to home; and arranging for transfer to community settings of care (e.g., skilled nursing facility, mental health treatment facility, rehabilitation center). While patients' clinical conditions, plans of care, and personal situations vary greatly, numerous activities must be coordinated and completed before patients can be safely discharged to home or the next care setting.[64]

Specific Change Idea:

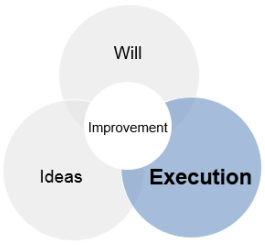
- C10.1 Use proactive discharge planning focused on patients' "medical-readiness criteria" for discharge.

S11. Reduce length of stay for patients with complex needs.

When patients with complex medical care and social needs require hospitalization for an acute condition, they often encounter a health care system that is poorly coordinated and inefficient. These patients have challenges that may include exacerbation of multiple chronic conditions, often accompanied by cognitive impairments, behavioral health issues, and a variety of unmet social needs. Underserved populations that historically have been adversely affected by discrimination or exclusion also require special attention to their complex needs. Meeting the comprehensive needs of this population through effective partnerships with community providers is essential for achieving optimal outcomes during the hospital stay. Another important dimension of care is developing comprehensive plans to meet patients' ongoing medical care and social needs after hospital discharge. Coordination of services for patients with complex needs requires proactive planning and interdisciplinary collaboration to prevent unnecessary hospital stays after the patient is clinically ready to be transitioned from the acute care hospital to home or a community care setting.[65,66,67]

Specific Change Ideas:

- C11.1 Use case management and care management for patient populations with complex needs.
- C11.2 Use advance planning and cooperative agreements for transfers to rehabilitation facilities, skilled nursing facilities, nursing homes, and mental health treatment facilities.



Execution Strategies to Achieve Hospital-wide Patient Flow

The key to execution is to plan and deploy a portfolio of improvement projects to achieve strategic goals, since no single initiative or set of unaligned projects will likely be enough to produce system-level results.[68] See Appendix D for additional guidance on getting started with efforts to improve hospital-wide patient flow, or to enhance your organization's current initiatives. This section presents four key execution strategies to achieve hospital-wide patient flow:

- Provide Oversight of System-Level Performance

- Use Hospital-wide Flow Measures to Guide Learning and Improvement to Achieve Results
- Create a System for Achieving Breakthrough Performance Improvement
- Build Quality Improvement Capability at All Levels of the Organization

Provide Oversight of System-Level Performance

System-level improvement requires executive leaders to prioritize the intended work and set expectations regarding resource allocation, operations, and results. Without "strong, effective, and persistent" executive oversight, there will be little coherence between improvement projects across individual departments and teams.[69] The necessary operational and cultural changes to achieve sustainable improvements in hospital-wide patient flow require dedicated executive leadership, including the following:

- **Declare the importance of hospital-wide patient flow.** In many hospitals, isolated teams attempt to address patient flow without leadership support at the highest level. Only the executive leadership team has the authority to establish system-wide change. Executive leaders must understand the challenges of patient flow throughout the system; articulate why improving flow is important to the hospital's operations and core mission, as well as safety and quality; and then support and guide efforts to make system-wide improvements. Every team member, from executive leaders to point-of-care staff, must understand the importance of flow in the context of delivering high-quality care.
- **Demonstrate an understanding of the realities of flow challenges in the hospital.** Effective executive leaders understand the challenges and opportunities facing their hospital systems. This requires firsthand learning about flow failures by spending time in the various hospital departments and units. Formal executive walkarounds can enhance senior leaders' working knowledge of hospital-wide, unit-level, and departmental operations, including types and frequency of patient flow and census challenges. Gaining insights into how special interests and siloed operations suboptimize flow is another critical step in understanding challenges that must be addressed in order to achieve hospital-wide patient flow.
- **Convene an executive oversight team for system-wide flow improvement.** This team should include many, if not all, of the following individuals: executive team representatives; heads of major departments across the hospital, such as surgery, medicine, and nursing; staffing and resourcing leaders; data and operations analysts; and quality improvement specialists.
- **Establish hospital-wide goals for patient flow.** The oversight team establishes the overarching goal or goals for improved flow. These goals need to be measurable, time-bound, and incorporated into the aims of improvement teams and into the flow measurement system that informs a hospital-wide learning system. When establishing hospital-wide goals, consider adapting two "simple rules for governing complex systems" for achieving hospital-wide patient flow:[70]
    - No delay greater than two hours in patient progression (based on clinical readiness) from clinical areas and units throughout the hospital (e.g., one hour from ED to ICU, two hours from PACU to surgical unit); and
    - Ensure capacity on each unit or clinical area at the beginning of each day (e.g., one or two staff on the unit, available beds on the unit at 7:00 AM).

The executive oversight team should create a hospital-wide learning system to understand failures of these simple rules and develop approaches to mitigate these failures.

- **Empower teams to make improvements and remove barriers.** Executive leaders can empower improvement teams to take on new work by providing clarity around prioritization. Improving hospital-wide flow requires teams to work in innovative ways, both within their own local teams as well as with cross-departmental teams. Executive leaders must ensure that staff have protected time and resources to engage in flow improvement work, which may require de-prioritizing other improvement projects. As teams map the current processes, existing barriers to patient flow (e.g., delays that are tied to old processes, "the way we've always done it here") will be identified. Executive leaders must ensure that teams are empowered to address these impediments, and provide support to help teams eliminate barriers.
- **Ensure learning and oversight to optimize hospital-wide flow.** The executive oversight team must meet on a regular basis to review the progress of flow improvement projects and monitor hospital-wide measures of flow (described below). Tracking and utilizing data on key flow measures throughout the hospital can help senior leaders and unit-level teams better understand areas where patient flow is, or is not, working well. Based on these results, executive leaders can help correct course or make important decisions to redirect or reinforce efforts. Executive leaders should be accountable to the organization for ongoing learning and progress toward the goals for hospital-wide patient flow.

Hospital Example: Oversight of System-Level Performance

Executive leaders at Cincinnati Children's Hospital and Medical Center used the approach described above to convene an oversight team focused on improving system-wide flow. The team included executive leaders, department leaders, operations specialists, and data analysts. The oversight team identified "entire system delay" as their primary system-level measure of patient flow, which aggregated all delays of admission, transfer, and discharge across all departments into one easily understood number.

Executive leaders ensured that hospital departments had protected time to undertake improvement and invested in developing staff's quality improvement skills. To ensure the success of flow improvement efforts, executive leaders meet regularly with the oversight team, which provides a forum for identifying and addressing barriers and challenges in a timely manner. Through their James M. Anderson Center for Health System Excellence, the hospital has built improvement capability and an operations infrastructure to support this learning system, enabling them to operate at greater than 90 percent bed occupancy rate overall.[71]

Use Hospital-wide Flow Measures to Guide Learning and Improvement to Achieve Results

Measurement is essential to understanding patient flow throughout a system. Table 1 lists recommended flow measures for the overall hospital system, as well as for specific departments and units. This table includes both process and outcome measures.

Table 1. Recommended Measures for Patient Flow in a Hospital System

Hospital-Level Measures
Average occupancy rate (monthly, day of week)
Readmissions within 1 week after discharge
Number and percentage of readmissions within 30 days after discharge
Patient experience (HCAHPS measures related to waits and delays)
Clinician and staff satisfaction related to workload (e.g., NDNQI)
Number of "off-service" patients by service (monthly, day of week)
Number or rate of healthcare-acquired conditions (e.g., falls with injury, ventilator-associated pneumonias)
Number of flow failures (defined by each service — e.g., >2-hour delay after medically ready for discharge)
Number of length of stay "outliers" (defined by each service)
Emergency Department Measures
ED diversions (number of diversions; hours per month)
Number or percentage of patients who "left without being seen"
Total number of visits per day (time of day, day of week)
Average length of stay (stratified by patients who are discharged and patients who are admitted)
Door-to-provider time
Time from decision to admit to transfer to inpatient unit (ICU, medical-surgical unit)
Time from decision for emergency surgeries to OR
Number of "ED boarders" waiting to be admitted to a hospital bed (day of week, time of day)
Percentage of ESI level 4 & 5 patients (low acuity)
Critical Care Unit Measures
Average census (monthly, day of week)
Number of available and staffed beds in the unit at 7AM
Average length of stay (LOS)
Number of "LOS outliers" per month (defined by each service)
Number of decedents spending 7 or more days in the ICU in the last 6 months of life
Number of ICU diversions due to lack of capacity (number of "off-service" patients)
Hours of core nursing overtime and temporary nursing time
Number or rate of hospital-acquired conditions (HACs)
Time from clinical readiness to transfer to medical or surgical beds

Medical-Surgical Unit Measures
Average census (monthly, day of week)
Number of available and staffed beds in the unit at 7AM
Average length of stay (LOS)
Number of "LOS outliers" per month
Hours of core nursing overtime and temporary nursing time
Number or rate of hospital-acquired conditions
Time from clinical readiness to discharge time
Number of "off-service" patients (by unit, by service)
Operating Room Measures
Number of emergency cases by day
Number of scheduled cases by day
Percentage of OR utilization (monthly, day of week)
Number of changes from schedule for elective surgical cases
Actual and scheduled start times for elective surgical cases
Hours of core nursing overtime and temporary nursing time
Number of overnight PACU patients
Time from clinical readiness to transfer from PACU to an inpatient unit

These measures help hospitals monitor overall system performance, as well as department- and unit-level performance, related to patient flow over time; plan for improvement; and manage flow in real time.

- **Planning for Improvement:** Understanding the performance of an organization at all levels requires the use of multiple measures. No single measure is adequate to inform the performance of a complex system, including hospital-wide flow. Below we discuss the use of a dashboard of the nine hospital-wide flow measures.
- **Measurement for Improvement:** Measurement and feedback are used to identify flow problems, establish baseline performance, inform and guide the progress of improvement projects, and select and test changes for improvement. Evaluating current performance through continuous monitoring of system-level measures is the key strategy to identify flow problems. This quality control function should be a part of daily operations. When performance gaps are detected in flow measures, operations can react to close these gaps (e.g., through daily flow huddles, real-time capacity and demand analysis). With ongoing monitoring of system-level flow measures, the executive oversight team can also initiate improvement projects with the objective of improving overall hospital-wide patient flow.

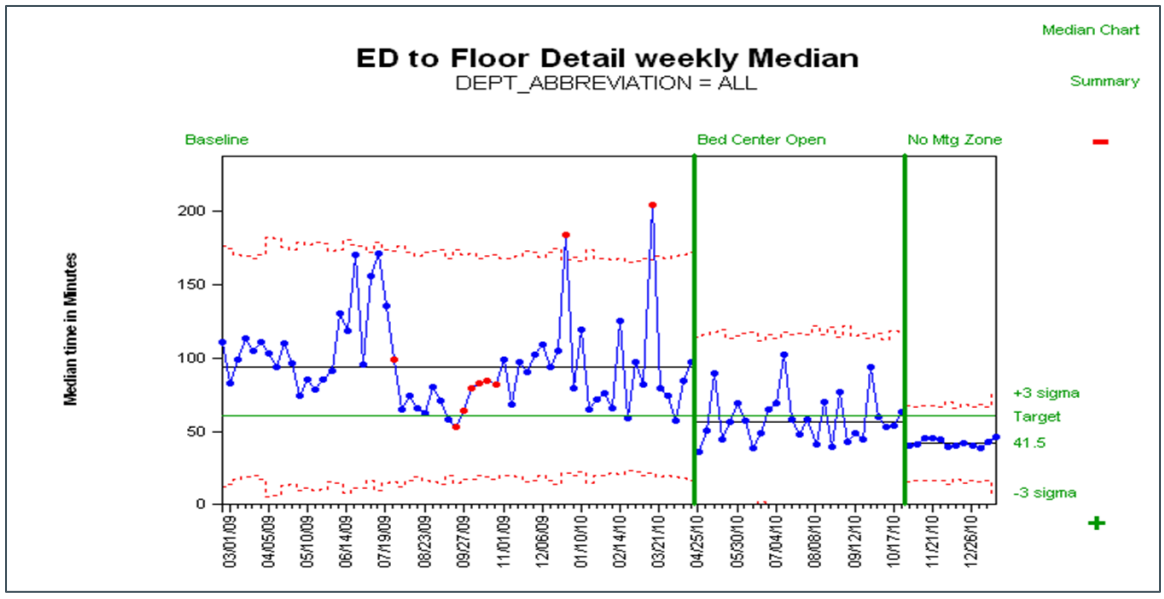
  Measurement is also used to inform and guide improvement projects at the department and unit levels. At the beginning of a QI project, the team establishes process, outcome, and balancing measures to support the improvement aim. Measurement is part of Plan-Do-Study-Act (PDSA) cycles to develop, test, and implement changes. Measures used in these small tests of change are typically specific process measures related to the change(s) being tested in

the PDSA cycle; sometimes, they are the project outcome measures stratified for the scope of the PDSA cycle. The team reports data for measures graphically on time series charts.

- **Real-Time Flow Management:** Information technology makes it possible to measure flow (capacity and demand) on a real-time basis and take actions based on these measures to maintain flow. (See additional discussion in the strategies associated with real-time capacity and demand management.)

Since flow is a dynamic concept, the presentation and analysis of flow measure data should incorporate the use of time series charts, graphical displays of data plotted over time, in the form of run charts and Shewhart control charts (a statistical tool used to distinguish between common cause and special cause variation in a measure).[72] Figure 4 is an example of a Shewhart control chart for an ED flow measure (time from decision to admit to transfer from the ED to the inpatient unit).

Figure 4. Example Shewhart Control Chart from Kaiser Permanente South Sacramento Medical Center



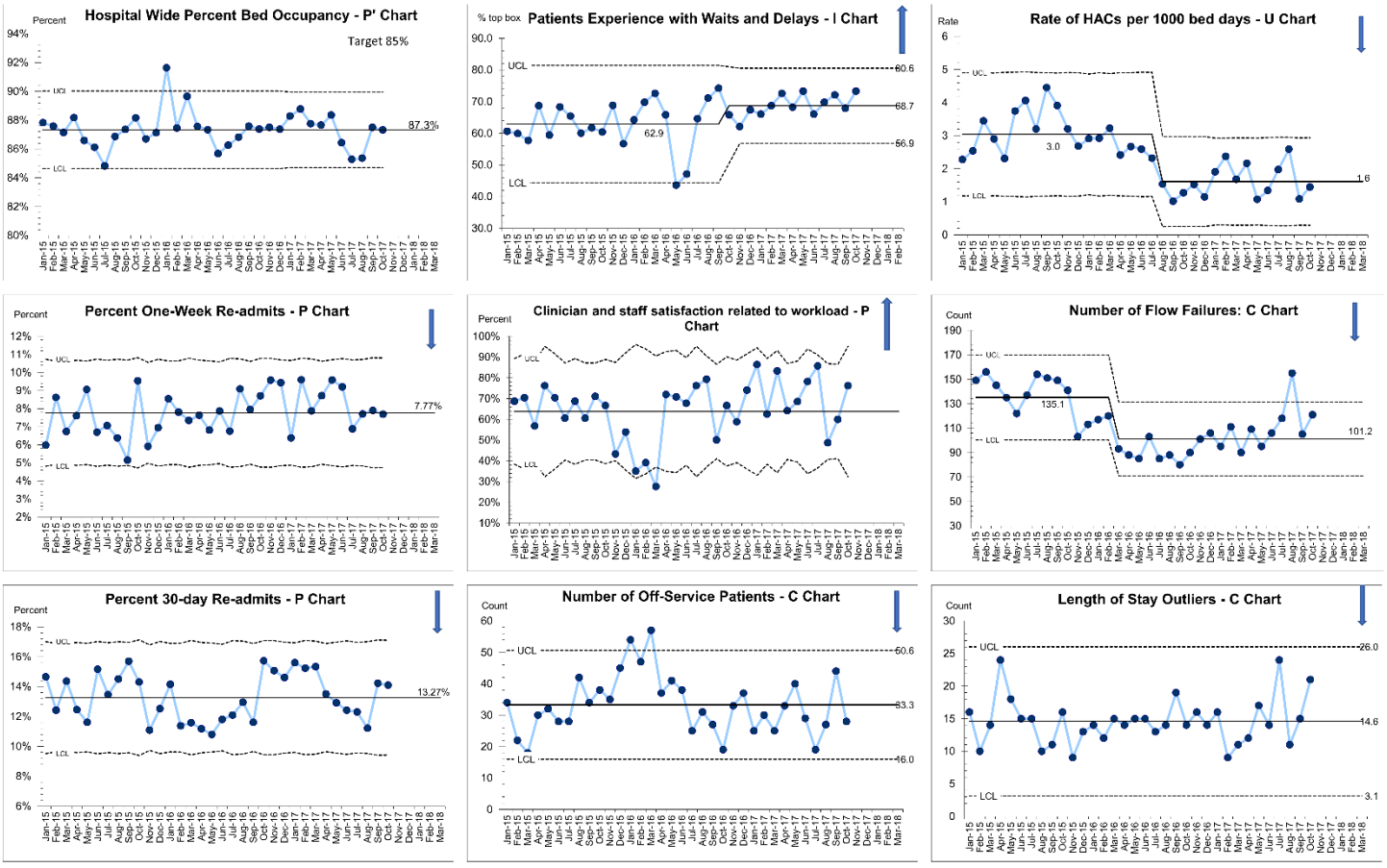
Some organizations present their dashboard of flow measures using a color-coded system: red (problems), yellow (warning), green (okay).[73] Although the focus on colors to indicate current flow performance can be useful for hospital operations, where the purpose is quick decision making and action, it can be distracting and misleading when the focus is learning and understanding the system-wide impacts. These color-coded displays may lead to making judgments relative to goals without providing a basis for making improvements against these goals.

Because of the dynamic complexity of flow, data for each measure should be tracked on an appropriate time series chart (run chart or Shewhart control chart). Displaying all time series charts on the same page presents a "dashboard" view of the performance of the entire system,[74] enabling teams to explore the interdependencies of the measures and understand the impact (both intended and unintended) of improvement initiatives.[75,76]

Figure 5 shows an example of the dashboard format for the nine hospital-level measures listed in Table 1. The dashboard format helps leaders more accurately assess the impact of changes to the

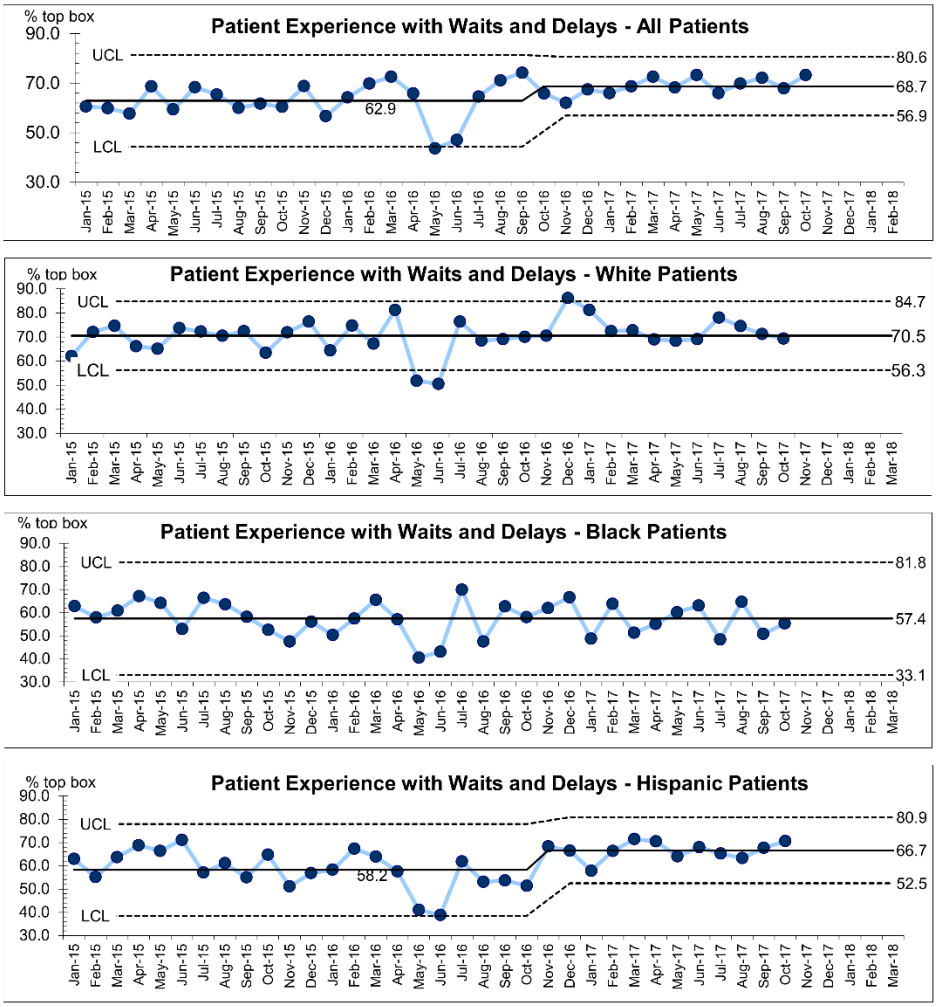
system, identify system interrelationships, appreciate both dynamic (change over time) and detail complexity, and predict future performance of each of the measures.

Figure 5. Dashboard of Time Series Charts for Nine Hospital-wide Patient Flow Measures



Stratifying these flow measures is also useful for exploring issues such as health equity. Figure 6 shows examples of stratification by racial groups on Shewhart control charts for the hospital-level patient experience measure (HCAHPS measures related to waits and delays).

Figure 6. Incorporating Learning from Data about Health Equity



Create a System for Achieving Breakthrough Performance Improvement

Execution is the action component of the Will-Ideas-Execution framework presented in the IHI White Paper on this topic and includes the four components described below.[77] No single improvement initiative or set of unaligned projects will likely be enough to produce system-level results. The execution strategy described here is aimed at producing system-level results in hospital-wide patient flow.

- **Set breakthrough performance goals for hospital-wide patient flow.** Leaders must establish flow as a system-wide strategic and operational priority, and clearly articulate the need for improved patient flow and its impact on the hospital's operations and mission. Strategic goals represent intermediate steps in achieving the aim of ensuring patients receive the right care, in the right place, at the right time. These goals should be ambitious in impact and scope so that the organization's stakeholders realize that accomplishing the goal is a substantial achievement. This focus helps reduce the tendency to set too many goals for improving hospital-wide patient flow.

- **Develop a portfolio of improvement projects to support the strategic goals.** Goals without methods for achieving them often lead to distortion of the system, unintended consequences, or unsustainable results. Redesigning the system to achieve the desired hospital-wide flow goals requires a strategically selected portfolio of improvement projects to achieve those goals. Teams (usually cross-functional and interdepartmental) lead the day-to-day improvement projects using an improvement methodology to guide their work — establishing a project aim and measures, and identifying and testing changes on a small scale before implementing them more widely to reduce the risks of unintended consequences and learn whether promising change ideas produce the predicted results. Scale-up can occur after successful implementation in pilot areas.[78] Figure 7 describes a comprehensive portfolio of projects in key clinical areas in the hospital derived from the specific change ideas depicted in the driver diagram in Figure 3 (and described in more detail in Appendix C).

Figure 7. Example of a Comprehensive Portfolio of Flow Improvement Projects

	Shape Demand	Match Capacity and Demand	Redesign the System
	Examples: Reduce bed days; reduce low-acuity ED visits; reduce day-of-week census variation	Examples: Reduce delays in moving patients to appropriate units; ensure patients are admitted to the appropriate unit	Examples: Reduce bed days, reduce length of stay; reduce waits and delays
Hospital-Level (Macro)	• Provide end-of-life care in accordance with patients' wishes • Reduce avoidable readmissions • Reduce readmissions for patients with complex needs • Reduce hospital-acquired conditions	• Data-driven operational management system for hospital-wide patient flow • Real-time capacity and demand management • Early recognition of high census and surge planning	• Single rooms • Seasonal "swing" units/beds • Service line optimization (frail elders, SNF residents, stroke patients, etc.)
Emergency Department	• Provide end-of-life care in accordance with patients' wishes • Relocate patients with low-acuity needs to community-based care settings	• Improve predictions of admissions for various units • Create staffing plans to meet predicted patient volume	• ED efficiency changes to decrease length of stay (for patients being discharged and patients being admitted) • Separate flows in the ED
Critical Care Units	• Provide end-of-life care in accordance with patients' wishes • Decrease complications and harm	• Improve real-time capacity and demand predictions • Create staffing plans to meet predicted patient volume	• Decrease length of stay (timely consults and procedures; aggressive weaning and ambulation protocols)
Medical-Surgical Units	• Provide end-of-life care in accordance with patients' wishes • Decrease complications and harm • Reduce avoidable readmissions • Create cooperative agreements with rehab facilities, SNFs, and nursing homes	• Improve real-time capacity and demand predictions • Create staffing plans to meet predicted patient volume	• Decrease length of stay for patients with complex medical care and social needs • Discharge patients when patients meet clinical readiness criteria
Operating Rooms	• Decrease artificial variation in surgical scheduling	• Improve predictions for transfers to various units • Create staffing plans to meet predicted patient volume	• OR efficiency changes to improve throughput • Separate flows for scheduled and emergency OR cases

- **Deploy resources to the projects that are appropriate for the improvement aim.** System-wide improvement projects to achieve the goals to improve flow will demand significant resources and time. The intensity of resources committed will affect the pace of progress. Improvement project teams need to include an executive sponsor to keep the team connected to organizational strategy, coordinate the efforts with other projects, ensure resource support, and assist with removing barriers. Teams need one or more technical experts, persons who know the clinical subject matter intimately and who understand the processes of care. Teams also need experts on measurement and improvement methods, depending on the needs of the project. In addition to allocating time and resources for improvement team members, organizations must also make it a priority to allocate other organizational resources to the portfolio of projects, including the following:
    - Capital for projects, such as information technology, construction, or new equipment;
    - Designated information technology services to support the needs of projects;
    - Other support services such as finance or human resources, as required; and
    - Dedicated data or operations analysts and quality improvement specialists assigned to assist teams. These analysts and improvement specialists can also serve as expediters for the hospital-wide flow improvement efforts by sharing knowledge among the various improvement teams.
- **Establish an oversight and learning system for the portfolio of improvement projects to increase the likelihood of success.** As part of strategic planning, organizations need a process for executive review of the portfolio of flow improvement projects. These reviews should occur at least monthly with the executive sponsors of the projects, and quarterly with an executive team that is responsible for execution of the overall strategic plan and the associated improvement initiatives. The best reviews function as high-level problem-solving sessions, with an unwavering commitment to make the projects and the teams successful.

Build Quality Improvement Capability at All Levels of the Organization

Deploying resources to a portfolio of flow improvement projects requires leaders, managers, clinicians, and staff with skills in quality improvement.[79] Hospital-wide flow improvement initiatives require an executive oversight team to integrate the selected portfolio of projects to achieve the hospital-wide flow goals. For individual projects, select project leaders from candidates who have training in using quality improvement methods and interest in improving system-wide flow.

The executive oversight team will have to negotiate with line managers to enable their time to work on the projects, as this work will require considerable time. Although the high levels of staffing initially required by the improvement projects (discussed above) may seem excessive or unaffordable, these projects are vital to the organization and expected to result in a substantial return on investment. The pace of the improvement projects is a deliberate choice ("how much, by when") and the resources must support that choice.

For many organizations, the issue is not how much of someone's time to allocate to a project, but rather finding and developing people in the organization who are capable of leading a project or overseeing a portfolio of projects. Organizations that successfully execute projects create development plans for individuals within the organization to become improvement team leaders,

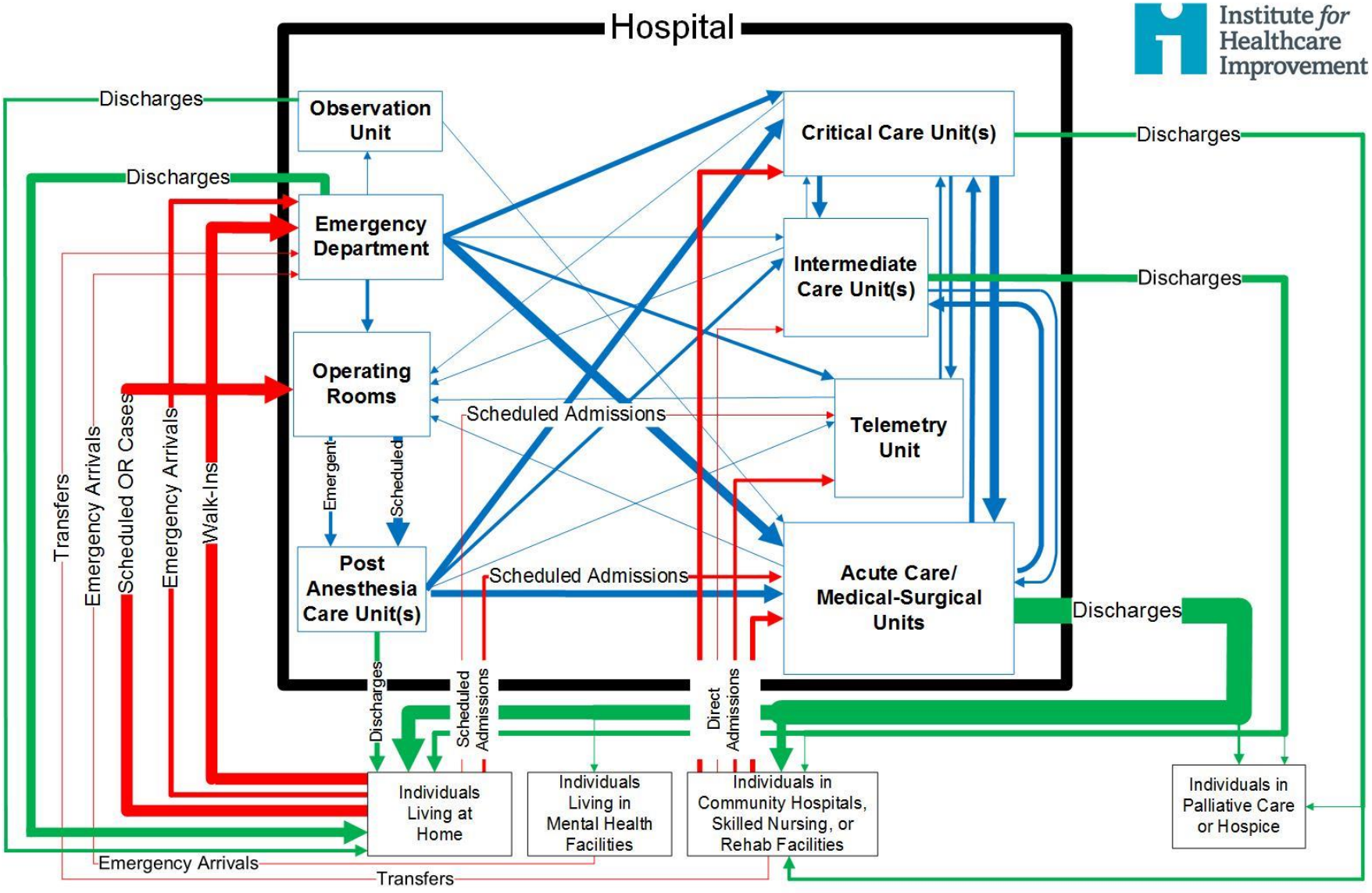
including some or all the following: increasing responsibility for larger and more complex projects; attending seminars and other formal improvement training; participating in multi-organization improvement efforts; making presentations at conferences; and writing papers for publication in peer-reviewed journals.

Training and development of improvement project leaders should take an experiential learning approach that applies improvement skills and knowledge to real projects. The organization needs to have a common framework for improvement (like the Model for Improvement) in order to leverage a common approach to training and training materials across all departments and projects.

Conclusion

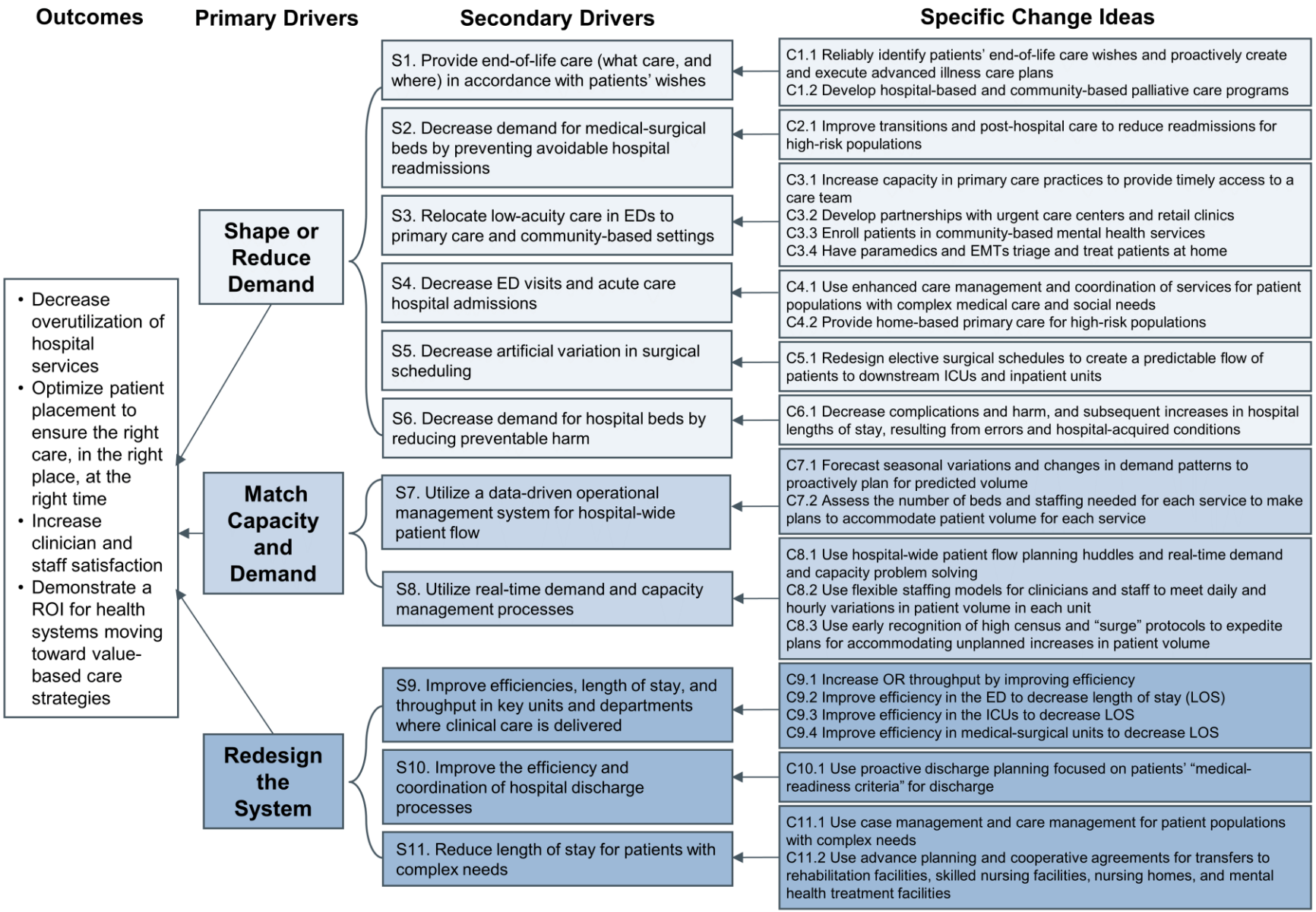
Current efforts to improve patient flow in most hospitals are well intended, but are often characterized by the pursuit of siloed and sometimes conflicting priorities within the organization. This white paper aims to serve as a guide for hospital leaders and quality improvement teams seeking to adopt comprehensive, system-wide strategies to improve hospital-wide patient flow. Reliable delivery of the right care, in the right place, at the right time is an essential priority for achieving the very best outcomes for all patients.

Appendix A: System Map: Patient Flow in the Hospital



Key: Blue arrows: Flow within hospital | **Red arrows:** Flow into hospital | **Green arrows:** Flow out of hospital | **Width of arrows:** Typical flow volumes

Appendix B: Driver Diagram for Achieving Hospital-wide Patient Flow



Appendix C: Specific Change Ideas for Improving Hospital-wide Patient Flow

The specific change ideas (denoted by the letter "C" in this Appendix) are organized first by the three key approaches (primary drivers) for improving hospital-wide patient flow (i.e., shape or reduce demand, match capacity and demand, and redesign the system), and then by the secondary drivers (denoted by the letter "S") for each of these approaches described in the "High-Leverage Change Ideas for Improving Hospital-wide Patient Flow" section in the body of the white paper. (See also the driver diagram in Appendix B.)

Shape or Reduce Demand

S1. Provide end-of-life care (what care, where) in accordance with patients' wishes.

- **C1.1 Reliably identify patients' end-of-life care wishes and proactively create and execute advanced illness care plans.**

  Because the course of advanced illnesses is often unpredictable, it is important to plan ahead. Proactive planning is especially important when risk of exacerbation of symptoms and clinical decline are more apparent in patients with serious illness or older age. In these populations, failure to conduct appropriate advance care planning could result in unwanted treatments and potential harm. Identifying and honoring patients' end-of-life care wishes is essential for providing person-centered care. Physicians and care team members need to engage with patients and family members in shared decision-making discussions by clarifying the medical prognosis, initiating end-of-life care discussions, identifying end-of-life goals, and developing a comprehensive plan of care.[80]

- **C1.2 Develop hospital-based and community-based palliative care programs.**

  Hospital-based palliative care consultation programs result in less time spent in the intensive care unit, with a lower likelihood of dying in the ICU and a higher chance of receiving a referral for hospice care.[81,82] Palliative care programs improve quality of care outcomes, especially for pain and depression. And, through goal setting and matching patient needs with the most appropriate care services, palliative care programs help patients avoid unnecessary emergency department visits and hospital stays.[83] Community-based palliative care programs — which include home care, hospice, and collaborative partnerships with various care service agencies and providers in the community — provide similar services while meeting the desire of patients to be in their own community or home. Community-based options meet the needs of patients who may not qualify for other care settings.[84]

S2. Decrease demand for medical-surgical beds by preventing avoidable hospital readmissions.

- **C2.1 Improve transitions and post-hospital care to reduce readmissions for high-risk populations.**

  Improving care transitions for high-risk patients after an acute care hospitalization is a key strategy for reducing avoidable readmissions. Discharge preparations include a comprehensive assessment of discharge needs; enhanced patient and family caregiver education using the Teach-Back method;[85] improved medication management; timely and complete communication between inpatient clinicians and care teams in the community;

follow-up care arranged prior to discharge; and appropriate referrals to home- and community-based care services.[86] High-risk patients may need additional support and care for a period of time after hospital discharge. The University of Pennsylvania Transitional Care Model, for example, provides care to high-cost elderly patients by connecting advanced practice nurses, patients, and their caregivers to better manage their care, coordinate follow-up care, and provide regular home visits and telemedicine. These efforts resulted in a 36 percent decrease in readmissions and 39 percent decrease in costs for the patient population.[87] The Care Transitions Model developed at the University of Colorado utilizes "transition coaches" to encourage and support patients and family caregivers to take an active role in managing their health care needs at home.[88]

S3. Relocate low-acuity care in EDs to community-based care settings.

- **C3.1 Increase capacity in primary care practices to provide timely access to a care team.**

  A promising approach to reduce low-acuity visits to emergency departments involves expanding access to primary care providers. Convenience is one of the most commonly cited reasons for visiting the ED, beating out perceived quality of care and financial concerns.[89] By expanding primary care access, health care systems can effectively meet the needs of people utilizing the ED for convenience. Extended primary care resulted in a 26 percent decrease in ED visits in Manchester, England.[90] Similarly, in the US, patients reporting difficulty accessing primary care after-hours are 24 percent more likely to visit the ED and 38 percent more likely to experience a hospitalization.[91] In addition to expanding primary care hours, engaging individuals with chronic conditions in primary care group visits reduced ED utilization compared to a similar population without group visits.[92] The use of telemedicine, email, and text messaging also expands primary care provider accessibility and capacity to meet patient needs outside of typical office hours.[93,94]

- **C3.2 Develop partnerships with urgent care centers and retail clinics.**

  Retail clinics provide a limited scope of acute care services, typically treating minor issues like the common cold and the flu as well as providing basic routine care for immunizations, physicals, and routine check-ups. Urgent care clinics provide treatment for acute and chronic medical needs,[95] and increase access for assessment and treatment of non-urgent clinical conditions, especially when timely access to a primary care provider is not available. Developing more formalized relationships between hospitals and retail clinics and urgent care centers through shared medical information across settings has been shown to decrease unnecessary ED utilization. For integrated health care systems like UCLA's Urgent Care facility in Santa Monica, California, connected electronic health records and relationships between primary care, urgent care, and hospital care foster more effective care delivery.[96]

- **C3.3 Enroll patients in community-based mental health services.**

  Individuals with mental health conditions are more likely to seek care in the ED and be admitted to the hospital than individuals seeking care for physical illness.[97] Community-wide approaches to address mental health needs provide opportunities to alleviate the burden of suboptimal ED utilization, while also providing higher-quality, patient-centered care. Opportunities for improvement include collaboration across agencies (including EDs, hospitals, law enforcement, and community-based care services), utilizing mental health specialists and care coordinators in the ED and the community, taking advantage of telehealth options, and investing in community-wide support systems to address mental health needs.[98]

- **C3.4 Have paramedics and emergency medical technicians triage and treat patients at home.**

  Paramedics and emergency medical technicians (EMTs) are the first responders to emergency calls in the home and community. Traditionally, paramedics and EMTs focused on providing immediate care to individuals while transporting them to the ED or hospital. Many situations that paramedics and EMTs respond to do not require transport to the ED, with as many as 52 percent of emergency ambulance calls involving patients with non-serious problems.[99] A growing number of health care systems are employing the services of community paramedics and EMTs to triage and treat individuals in the home. The House Calls program at Northwell Health in New York dispatches a paramedic team, often arriving in SUVs and not ambulances, to treat patients in their home.[100] Video conferencing or other telecommunications with emergency physicians or specialists can enhance the care community paramedics provide in the individual's home.[101] The Houston Fire Department in Texas relies on an Emergency Telehealth and Navigation system that employs mobile technology, community-based paramedicine, and local medical partnerships to connect low-acuity patients to the appropriate care.[102]

S4. Decrease ED visits and acute care hospital admissions.

- **C4.1 Use enhanced care management and coordination of services for patient populations with complex medical care and social needs.**

  Understanding the risks facing a given population and coordinating care around those needs of individuals can lead to better care in appropriate care settings.[103] A common approach for providing care to individuals and managing populations involves team-based care delivery and management.[104] Care management can improve outcomes and reduce costs, although at first it may take time to realize the benefits as care teams and patients adjust to working together in new ways. Successful care management requires a reliable process for identifying appropriate patients in the population and a high-performing care team — including specially trained registered nurses and care managers with smaller patient loads — working in person with patients.[105]

- **C4.2 Provide home-based primary care for high-risk populations.**

  Home-based primary care provides comprehensive, interdisciplinary primary care in the homes of patients with complex medical, social, and behavioral health needs.[106] Common home-based primary care models involve primary care providers, nurse practitioners, physician assistants, physical therapists, social workers, and other care providers delivering coordinated care in a patient's home. A typical scope of care involves management of long-term chronic conditions, preventative care, and environmental assessments.[107] Home-based primary care approaches focus on preventing hospitalizations by bringing the care to the patient, with the larger goal of meeting the patient's care and health goals rather than exclusively assessing and treating the clinical condition.[108] A standard model for home-based primary care does not currently exist. Rather, individual health systems are developing their own approaches based on their patient populations' needs and the local context. Moderate evidence suggests that home-based primary care reduces hospitalizations and hospital bed days, and some evidence shows decreases in ED and specialty care utilization and cost reductions.[109]

S5. Decrease artificial variation in surgical scheduling.

- **C5.1 Redesign elective surgical schedules to create a predictable flow of patients to downstream ICUs and inpatient units.**

Phase two of the IHO Variability Methodology presents a compelling case for how elective surgery scheduling not only affects operating room operations, but also has an enormous impact on downstream inpatient units (particularly ICUs and inpatient units for surgical patients). In most hospitals, surgeons electively schedule surgical cases unevenly throughout the week. This uneven scheduling is often a significant contributor to hospital-wide flow problems, such as "ED boarding" and the inability to place patients on the preferred clinical units. Strategies for "smoothing" the flow of elective surgical patients throughout the week decrease artificial variability and can create more predictable flows of patients from the OR to ICUs and inpatient units; decrease the competition between unscheduled (e.g., ED) and elective admissions; increase patient placement in appropriate units; and help to achieve more predictable and optimal nurse staffing on units.[110,111]

S6. Decrease demand for hospital beds by reducing preventable harm.

- **C6.1 Decrease complications and harm, and subsequent increases in hospital lengths of stay, resulting from errors and hospital-acquired conditions.**

  Care teams in hospitals have the ability to significantly reduce the occurrence of preventable harm in the hospital. These harms include hospital-acquired conditions (HACs), which often lead to complications and unintentional patient harm in the form of hospital-acquired pressure ulcers (HAPUs), catheter-associated urinary tract infections (CAUTIs), surgical site infections (SSIs), and patient falls with harm, among others. Harm can also appear in the form of unnecessary waits, under-diagnosed and inadequately treated pain, as well as boarding and being admitted to the wrong ward. HACs increase length of stay by seven to nine days and cost patients $40,000 more on average.[112] There are many recommended practices for preventing common HACs, including hand hygiene, environmental cleanliness, clear directives from leadership, effective use of personal protective equipment, delivering evidence-based care, appropriate use of antibiotics and medications, respiratory hygiene and cough etiquette, and others. Reliable implementation of these evidence-based practices is the challenge.[113]

Match Capacity and Demand

S7. Utilize a data-driven operational management system for hospital-wide patient flow.

- **C7.1 Forecast seasonal variations and changes in demand patterns to proactively plan for predicted volume.**

  The use of advanced data analytics coupled with the expert knowledge of doctors and other clinicians to understand variation patterns (and in some cases to provide information about the expansion of specific hospital services) provides useful information for mathematical modeling and simulations of patient demand patterns. Demand forecasting provides relevant information for identifying needed actions in advance and expanding the options available to solve operational problems before they occur. It is not only critically important to predict demand for the hospital as a whole, but also to predict demand for separate hospital services (e.g., OR procedures, ED services, intensive care, care on specific medical-surgical inpatient units). Demand forecasting is the first critical step to inform bed capacity planning. The second equally crucial step in bed capacity planning is to ensure that there is adequate staffing to meet the needs of patients on each hospital service and inpatient unit. One of the best ways to optimize staffing utilization and related costs is to forecast demand far enough in advance in order to sufficiently match staff to meet anticipated patient demand without incurring last-minute expenses, such as overtime or supplemental staffing.[114,115]

- **C7.2 Assess the number of beds and staffing needed for each service to make plans to accommodate patient volume for each service.**

  Accurate forecasting of patient demand by season, month, day of the week, and time of day enables leaders to making strategic decisions regarding the resources needed to provide services to the number and type of patients requiring hospital services. Capacity is determined by physical facilities (e.g., ED cubicles, operating rooms, procedure unit rooms, ICU beds, and inpatient beds) and human resources (e.g., doctors, nurses, technicians, and other clinical and support staff). Ideally, after eliminating artificial variability in surgical scheduling and understanding how best to manage the variability of random patient demand, "correctly sizing" hospital service space and inpatient units improves the timeliness of admissions and transfers, enables higher reliability in patient placement in appropriate care settings, and improves space utilization. Equipped with accurate demand forecasts, hospital leaders can reconfigure units and redeploy staff during predicted low-census periods, and units with seasonal occupancy can be closed and repurposed.[116,117]

S8. Utilize real-time demand and capacity management processes.

- **C8.1 Use hospital-wide patient flow planning huddles and real-time demand and capacity problem solving.**

  Most hospitals have some form of bed management system, with daily bed huddles or patient flow meetings to make plans for ensuring real-time patient flow. Bed management huddles usually include administrative decision makers, bed managers, staffing coordinators, and representatives from the ED, OR, ICUs, and all inpatients units. The goal is to develop a proactive plan focused on the specific actions needed to create sufficient capacity to meet the patient care needs that day. These hospital-wide flow administrative meetings need to address predictions for admissions and discharges, synchronization of admissions, and discharges and transfers; specific capacity challenges; and potential solutions for capacity and demand mismatches throughout the hospital.

  Advanced data analytics for hospital-wide operations and command centers in some large health care systems with several hospitals are emerging to provide real-time decision support tools for optimizing hospital-wide or system-wide patient flow, and for expediting patient progression and transfers among multiple hospital settings in large systems. Real-time demand capacity (RTDC) management also includes the identification of constraints and bottlenecks that repeatedly thwart efforts to reduce waits and delays in hospital operations and thereby suboptimize patient flow. Teams accountable for hospital operations and patient flow should study these barriers at the specific unit or departmental level to identify root causes of repetitive capacity and demand mismatches. Leaders at the hospital level should collaborate with unit and departmental leaders to generate potential solutions to test to alleviate recurring constraints and bottlenecks.[118,119,120]

- **C8.2 Use flexible staffing models for clinicians and staff to meet daily and hourly variations in patient volume in each unit.**

  Predictive analytics should be utilized to inform long-term nurse staffing plans and budgets to meet average patient volume, but fluctuations of patient demand require additional strategies to adjust near-term staffing patterns to meet day-to-day and shift-to-shift variations in patient volume. Providing adequate nursing time per patient in the context of acuity and census variability is first and foremost a patient-centric strategy for ensuring patient safety and the best possible care and outcomes for patients.[121,122] Increasing daily staffing to levels that can accommodate peak periods of patient demand, should they occur, is cost prohibitive and inefficient for most hospitals. Thus, most hospitals are intentionally staffing for below-

peak demand levels, and either tolerating periods of increased nursing workload or establishing flexible staffing strategies to fill in during the peaks.[123] Advanced data analytic models hold promise for capturing real-time data on patient demand, available beds, and nurse staffing for each clinical unit. Even a three- to five-day view into future demand and resource requirements gives leaders more time to consider a variety of options for workforce and bed placement optimization.

Taking a flexible approach to hospital resources, including physicians and other medical staff as well as department rooms and resources, shows promise for reducing wait times for elective treatment without negatively impacting wait times for emergencies. Moreover, overall system performance is improved with flexible staffing and resource use as measured by wait times.[124]

- **C8.3 Use early recognition of high census and "surge" protocols to expedite plans for accommodating unplanned increases in patient volume.**

  There is real value for hospitals to adopt practices to regularly respond to non-emergent, unplanned surges in patient volume. "Patient flow requires daily diligence and attention. It should not be something focused on only on busy days, but should be managed each day. By taking a proactive approach to patient flow, the number of days your hospital will be bottlenecked can be reduced."[125]

  A system of visual management specifying hospital-wide census levels for review during bed huddles or for ongoing surveillance within hospital command centers is becoming routine in most hospitals. High census protocols to expedite plans for accommodating unplanned increases in patient volume include expediting discharges, expediting admissions from the ED, and managing variation in elective surgical schedules.[126] Specific levels of census, expected admissions, and patient acuity are generally coded as green (business as usual), yellow (additional awareness and interventions required), or red (immediate action needed). Some best practices for surge planning include defining the roles and responsibilities for personnel at each level of the hospital census, establishing clear lines of authority for decision making, and post-escalation debriefs for learning and evaluation to adopt proactive strategies for the future.

Redesign the System

S9. Improve efficiencies, length of stay, and throughput in key units and departments where clinical care is delivered.

- **C9.1 Increase OR throughput by improving efficiency.**

  In many hospitals, operating room capacity is at a premium. Maximizing efficiencies in OR suites is essential for ensuring that patients have timely access to needed surgical procedures, both scheduled and emergency cases. With respect to hospital operations, ORs are a resource-intensive and costly department, and also a major source of revenue. Thus, increasing workflow efficiencies and throughput in ORs is an essential strategy for maintaining economically viable hospital operations. Lean management strategies can be readily applied to increase OR throughput and service capacity. Increasing throughput and removing waste and inefficiencies requires attention to a wide array of variables, including scheduling OR cases, staff allocation, equipment availability, preparation and induction of patients, adherence to start times, performance of surgery, recovery from anesthesia, and preparation of the OR for the next patient.[127,128] In addition to OR efficiency improvements, separating elective and non-elective surgical cases has resulted in waiting time reductions for urgent and emergent surgical cases, increases in OR throughput, decreases in staff overtime, and

decreases in delays for elective surgeries. Thus, the use of the variability methodology to manage a hospital's surgical services has demonstrated improvement in operational performance and the safety and quality of care.[129,130]

- **C9.2 Improve efficiency in the ED to decrease LOS.**

  The demand for emergency department services has steadily increased, while capacity in most hospitals is severely stressed. Thus, hospital EDs are often plagued with long waits and delays. ED overcrowding contributes to poor care, frustrated patients, increased cost, potential harm, and stress for both patients and staff. Creating more efficient care processes through the application of Lean principles, constraint management, and quality improvement methodologies has dramatically improved ED outcomes and experiences for patients and staff. Some successful strategies for improving ED flow and decreasing ED length of stay include bedside registration; focusing on triage as a process, not a location, and including physicians, physician assistants, or nurse practitioners in the triage process; patient segmentation by acuity level; rapid diagnosis and treatment for patients with low-acuity issues; early decision to admit patients; and cooperative arrangements between ED physicians and hospitalists. In addition to these interventions, staff configurations to meet predicted ED patient volume is a critical step for matching capacity to demand.[131,132]

- **C9.3 Improve efficiency in the ICUs to decrease LOS.**

  Lengths of stay for ICU patients account for the highest costs in hospitals and pose the greatest risk for hospital-acquired conditions. In addition, bottlenecks in ICUs have a negative impact on patient flow, and delays in placing patients in appropriate ICUs may result in suboptimal care. Strategies to optimize the ICU length of stay include four key areas: preventing complications; enhancing interdisciplinary communication and planning; ensuring downstream bed availability by coordinating ICU transfers and floor discharges using prediction, visual management, and twice-daily hospital-wide huddles; and compassionate end-of-life care planning.[133] Bundles and protocols in the ICU must be clearly understood by the entire care team and reliably implemented for optimal management of critical care processes — fluid stabilization and resuscitation, ventilator weaning, early mobilization and delirium prevention, and "zero" complications (e.g., ventilator-associated pneumonias, catheter-related bloodstream infections, urinary tract infections, renal injuries).[134, 135] Each of these, when mismanaged, adds days and costs to ICU stays. In the complex hospital environment, care teams need a standard set of operating principles, clear, agreed-upon plans for each patient, and a designated process to continuously work together to identify barriers and solve problems.[136,137]

- **C9.4 Improve efficiency in medical-surgical units to decrease LOS.**

  Most medical-surgical unit care teams are facing increased demand due to shorter lengths of stay, an aging population, increased patient complexity and acuity, inefficient care processes, and challenges with discharging patients with the "appropriate care" in a timely fashion. These discharge delays often create bottlenecks that negatively impact patient flow throughout the hospital. Some changes that have increased efficiencies and eliminated waste on medical-surgical units include decentralizing clinical workstations, redesigning admission and discharge processes, geographic assignments for hospitalists, bedside rounding, improving interprofessional communication, and care planning with patients and family members.[138,139]

S10. Improve the efficiency and coordination of hospital discharge processes.

- **C10.1 Use proactive discharge planning focused on patients' "medical-readiness criteria" for discharge.**

  Daily multidisciplinary huddles have been effective to proactively assess and plan for discharge needs of patients. On the day of discharge, many hospitals have focused on discharging a percentage of patients by a specified time in the day to free up bed capacity for admissions and transfers. This approach has limited success in most hospitals because they have not adequately addressed inefficiencies in the discharge process. Lack of standardized discharge criteria contributes to unpredictable discharge timing and lengthy delays. Establishment of "medical-readiness criteria" for discharge on admission to medical-surgical units has been shown to drive efficient planning, coordination, and enhanced communication among care team members and with patients and their family members.[140]

S11. Reduce length of stay for patients with complex needs.

- **C11.1 Use case management and care management for patient populations with complex needs.**

  Reducing the hospital length of stay for patients with complex needs requires a comprehensive approach that includes collaboration among engaged clinicians across the continuum of care, who also partner with patients and family members, to establish agreed-upon care priorities to meet the unique needs of these patients. Care and case management have emerged as effective strategies for managing the longitudinal care of patients with complex needs, coordinating and evaluating care providers and services to meet the wide-ranging needs of these patients.[141,142] Using analytics to understand and manage variations in LOS, with special attention to LOS outliers, is also an effective strategy to uncover root causes of excessive hospital utilization. Patients with complex medical and social needs usually constitute a high proportion of patients with lengthy hospital stays.[143] And, individuals seeking emergent care treatment experience predictably longer LOS than those seeking elective care.[144] In some cases, there are lengthy delays for patients awaiting transfer to another care facility in the community, and an increasing number of patients who need care in scarce inpatient psychiatric and mental health facilities. Identifying focused opportunities for improving the overall LOS for patients with complex needs is the one crucial step in developing an integrated care system for this population.

- **C11.2 Use advance planning and cooperative agreements for transfers to rehabilitation facilities, skilled nursing facilities, nursing homes, and mental health treatment facilities.**

  When patients require placement in a variety of community-based care settings and mental health facilities after acute care hospital stays, advance planning and coordination are required to prevent any unneeded additional days in the hospital.[145] One strategy for facilitating timely care transitions is to develop strong partnerships with post-acute providers of care — in nursing, rehabilitation, subacute care, and mental health treatment facilities.[146]

Appendix D: Creating an Action Plan for Improving Hospital-wide Patient Flow

The following recommended steps may be helpful for creating an action plan to get started with organizational efforts to improve or enhance existing initiatives to achieve hospital-wide patient flow.

1. **Complete a diagnostic assessment of your current performance.**
    - Review your current performance and the results of QI projects to improve hospital flow for the 11 secondary drivers noted in the Figure 3 driver diagram. In which departments or units have you achieved the desired results? Where are your biggest opportunities for improvement?
    - Review the list of hospital-wide flow measures presented in Table 1. Which specific measures are you using? How are you learning from these measures? Do you need additional measures (e.g., number of "off-service" patients by service) to accurately depict system-wide performance? Based on your selected measures, what does current performance look like at the hospital-wide and unit levels?
2. **Create an action plan to focus your improvement efforts on three to five high-level strategies to improve hospital-wide patient flow.**
    - Review the secondary drivers (see Figure 3 and section titled "High-Leverage Change Ideas"), in addition to the specific change ideas in Appendix C, to identify the specific interventions that are most likely to have a significant impact on improving patient flow in your hospital.
    - With knowledge of your biggest opportunities for improvement from the diagnostic assessment, and your assessment of specific interventions that would likely lead to improvement, focus on three or four high-leverage change ideas. Develop a portfolio of improvement projects aligned with the selected high-leverage change ideas, and commit the necessary resources to reliably implement these changes (see the "Execution Strategies" section for more information).
    - As desired results are achieved in those selected areas, expand the work to focus on additional high-leverage change ideas to create a reliable system of hospital-wide patient flow.

Hospital Example: Refocusing Efforts to Improve Hospital-wide Patient Flow at UW Health

Background

The diagnostic assessment and action planning approach described above was implemented at UW Health in Madison, Wisconsin, to accelerate existing efforts to achieve desired outcomes for hospital-wide patient flow. This example describes some of the organization's work to improve flow.

UW Health is an integrated health system affiliated with the University of Wisconsin–Madison. Each year, more than 600,000 patients throughout the Upper Midwest receive care from a team of more than 1,400 physicians and 16,500 staff. The system includes six hospitals and 80 outpatient sites.

Over the past several years, leaders at UW Health recognized that their University Hospital was operating at higher capacity than in prior years. As their utilized capacity exceeded 85 percent, hospital administrators recognized that this would drastically impact operations and delay patients throughout in the system. Hospital leaders became increasingly concerned about patient safety and care quality, the patient experience, and lost revenues as a result of these capacity and operations issues. Regular delays and waits for admissions resulted in patients leaving UW Health to seek care at other hospitals and health systems.

Refocusing Flow Improvement Priorities

In October 2015, UW Health leaders convened a hospital flow steering committee to better understand the health system's current performance. The flow steering committee identified various "pain points" and chartered 16 different improvement projects, providing oversight for the project teams. While individual projects achieved some positive results, system-wide improvements in patient flow were not realized.

In November 2016, the director of nursing and operations support, the health systems engineer, the medical director of quality, the vice president of clinical operations, and the senior health systems engineer attended IHI's Hospital Flow Professional Development Program. In this program, they learned two important concepts: "exnovation" (eliminating the things that do not yield desired results) and "flow failures" (areas in which performance did not meet goals).

The team returned to the organization with a new approach: focus on the top three priority improvement projects that address the primary flow failures at UW Health (see Figure 8 below). With the flow steering committee's support, the team redefined the top three improvement project priorities to address the top three flow failures: smooth elective OR scheduling, improve the discharge process, and implement regular bed huddles and an improved system for communication around hospital-wide flow for real-time problem solving.

Figure 8. Three Primary Flow Failures at UW Health Become Improvement Priorities

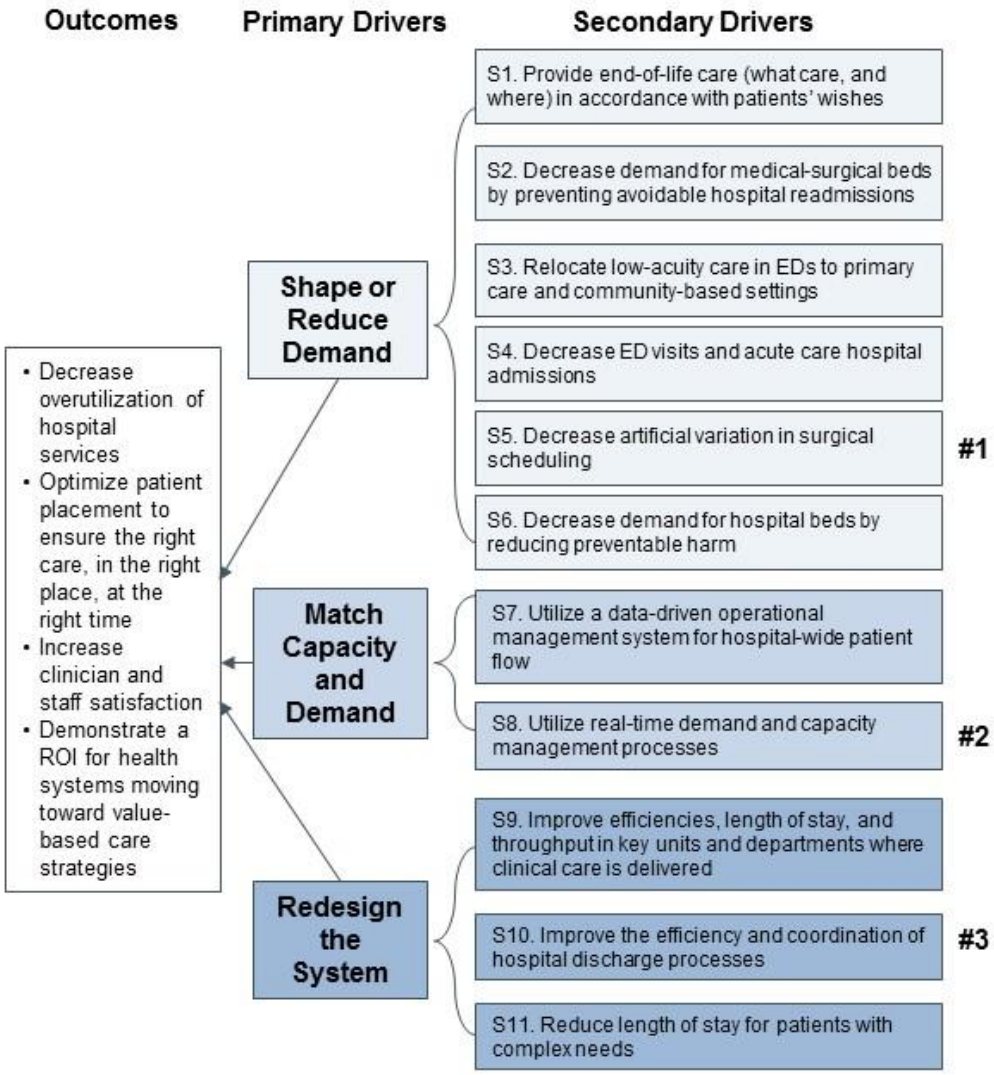
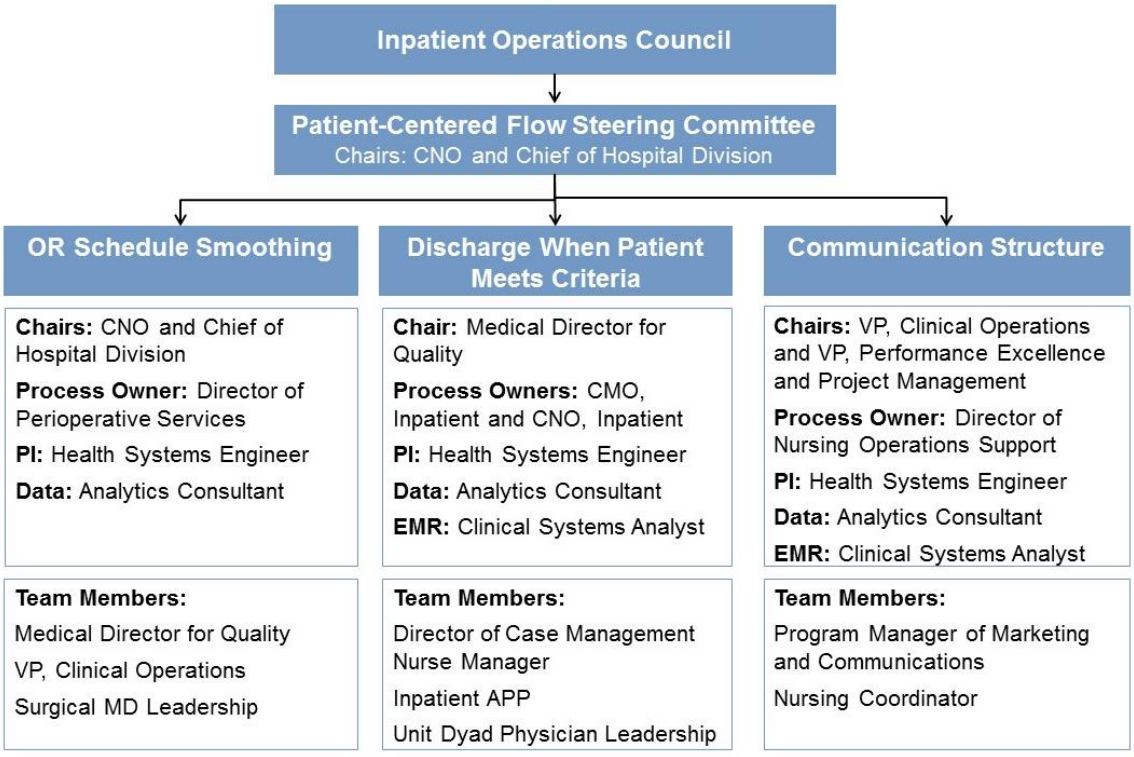


Figure 9 shows the organizational chart for UW Health's three flow improvement projects. The Inpatient Operations Council oversees the progress of all projects, working directly with the Patient-Centered Flow Steering Committing. Each improvement project team reports to the flow steering committee, which is staffed by a chair, process owners, a quality system improver, and a data analyst.

Figure 9. UW Health Organizational Chart for Flow Improvement Initiatives



Progress for each project is tracked through a patient-centered scorecard, which is populated with data from UW Health's electronic health record. The flow steering committee reviews the scorecard every other week, including data on the following measures: occupancy rates, patients turned away, holds in the ED and PACU, discharge before noon, and average unit capacity. Measures are tracked, noting when changes were implemented to help assess the effectiveness of the changes.

In addition to ensuring accountability through the flow steering committee, UW Health's executive leadership team also invested in development of leadership and quality improvement skills for clinical team leaders. For example, the charge nurse role expanded to include more professional development opportunities and leadership responsibilities for patient flow on the unit (and included financial compensation for the additional responsibilities). Each quarter, these nurse leaders participate in training sessions to enhance their quality improvement and leadership skills to improve clinical operations.

Since November 2016, the focus on three priority improvement projects and on making the operational and cultural shifts to improve system-level patient flow has achieved some promising results. While these results are early and cannot yet be assessed as statistically significant, the UW Health team is encouraged that the improvements appear to be positively affecting patient flow: the overall system census continues to increase, but hold times and wait times are not increasing, and there is a decrease in patients being turned away. As progress is made in the three priority areas, the executive team will expand efforts to include other high-leverage changes to continuously improve hospital-wide patient flow.

References

[1] Medicare Payment Advisory Commission. "Chapter 3: Hospital Inpatient and Outpatient Services: Assessing Payment Adequacy and Updating Payments." In: *MedPAC Report to the Congress: Medicare Payment Policy*. Washington, DC: MedPAC; March 2016.

[2] *Optimizing Patient Flow: Moving Patients Smoothly Through Acute Care Settings*. IHI Innovation Series white paper. Boston: Institute for Healthcare Improvement; 2003. http://www.ihi.org/resources/Pages/IHIWhitePapers/OptimizingPatientFlowMovingPatientsSmoothlyThroughAcuteCareSettings.aspx

[3] Jensen K, Mayer TA, Welch S, Haraden C. *Leadership for Smooth Patient Flow: Improved Outcomes, Improved Service, Improved Bottom Line*. Chicago: Health Administration Press with the Institute for Healthcare Improvement; 2007:XI.

[4] Litvak E, Berheim S. The case for patient flow management. *WebM&M*. Patient Safety Network, Agency for Healthcare Research and Quality; November 2011.

[5] Litvak E, Bisognano M. More patients, less payment: Increasing hospital efficiency in the aftermath of health reform. *Health Affairs*. 2011;30:76-80.

[6] Ryckman F, Adler E, Anneken A, et al. "Cincinnati Children's Hospital Medical Center: Redesigning Perioperative Flow Using Operations Management Tools to Improve Access and Safety." In: Litvak E (editor). *Managing Patient Flow in Hospitals: Strategies and Solutions* (Second Edition). Oak Brook, IL: Joint Commission Resources; 2009:97-111.

[7] Resar R, Nolan K, Kaczynski D, Jensen K. Using real-time demand capacity management to improve hospitalwide patient flow. *Joint Commission Journal on Quality and Patient Safety*. 2011 May;37(5):217-227.

[8] Bertalanffy L. *General System Theory*. New York: George Braxiller, Inc.; 1968.

[9] *Quality as a Business Strategy*. Austin, TX: Associates in Process Improvement; 1998.

[10] Deming WE. *The New Economics*. Cambridge, MA: Massachusetts Institute of Technology; 1993: Chapter 3.

[11] Ackoff RL. *Creating the Corporate Future: Plan or Be Planned For*. John Wiley and Sons, Inc.; 1981.

[12] Forester J. *Principles of Systems*. New York: Productivity Press; 1986.

[13] Langley GJ, Moen R, Nolan KM, Nolan TW, Norman CL, Provost LP. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*. San Francisco: Jossey-Bass; 2009: Chapter 6.

[14] Senge P. *The Fifth Discipline*. New York: Doubleday/Currency; 1990:170-171.

[15] Shewhart WA. *The Economic Control of Quality of Manufactured Product*. Milwaukee, WI: ASQ Quality Press; 1980.

[16] Hall RW. *Queueing Methods for Services and Manufacturing*. Englewood Cliffs, NJ: Prentice-Hall; 1991.

[17] Conway E, Batalden P. "Like Magic? ('Every system is perfectly designed…')." Institute for Healthcare Improvement Blog. August 21, 2015. http://www.ihi.org/communities/blogs/_layouts/15/ihi/community/blog/itemview.aspx?List=7d1126ec-8f63-4a3b-9926-c44ea3036813&ID=159

[18] Nolan TW. *Execution of Strategic Improvement Initiatives to Produce System-Level Results*. IHI Innovation Series white paper. Cambridge, MA: Institute for Healthcare Improvement; 2007. http://www.ihi.org/resources/Pages/IHIWhitePapers/ExecutionofStrategicImprovementInitiativesWhitePaper.aspx

[19] Jensen K, Mayer TA, Welch S, Haraden C. *Leadership for Smooth Patient Flow: Improved Outcomes, Improved Service, Improved Bottom Line*. Chicago: Health Administration Press with the Institute for Healthcare Improvement; 2007.

[20] Bisognano M. "So-Called 'Flow Failures' Are Disrespectful to Patients." Institute for Healthcare Improvement Blog. August 25, 2016. http://www.ihi.org/communities/blogs/_layouts/15/ihi/community/blog/itemview.aspx?List=7d1126ec-8f63-4a3b-9926-c44ea3036813&ID=296

[21] "Improving Your Organization's Relationship with Your Physicians." Virginia Mason Institute Blog. May 30, 2012. https://www.virginiamasoninstitute.org/2012/05/part-1-would-you-like-to-improve-your-organizations-relationship-with-your-physicians/

[22] Hsu J, Price M, Vogeli C, Chernew M, Ferris T. The impact of new payment models on care delivery: Reductions in emergency care use among beneficiaries in a Medicare Pioneer ACO. *International Journal for Quality in Health Care*. 2016 Oct;28(Suppl_1):27.

[23] Litvak E, Bisognano M. More patients, less payment: Increasing hospital efficiency in the aftermath of health reform. *Health Affairs*. 2011;30:76-80.

[24] McHugh M, Van Dyke K, McClelland M, Moss D. *Improving Patient Flow and Reducing Emergency Department Crowding: A Guide for Hospitals*. Rockville, MD: Agency for Healthcare Research and Quality; October 2011.

[25] Nolan T, Schall M, Berwick DM, Roessner J. *Reducing Delays and Waiting Times Throughout the Healthcare System: Breakthrough Series Guide*. Boston: Institute for Healthcare Improvement; 1996.

[26] The Dartmouth Atlas of Health Care. "Percent of Deaths Associated with ICU Admission." National Average, 2004-2014. http://www.dartmouthatlas.org/data/table.aspx?ind=14

[27] Papdimos T, Maldonado Y, Tripathi R, Kothari D, Rosenberg A. An overview of end-of-life issues in the intensive care unit. *International Journal of Critical Illness and Injury Science*. 2011 Jul-Dec;1(2):138-146.

[28] AHA Committee on Performance Improvement. *Advanced Illness Management Strategies*. Chicago: American Hospital Association; August 2012.

[29] The Conversation Project. "Conversation Starter Kits." http://theconversationproject.org/starter-kits/

[30] Massachusetts Coalition for Serious Illness Care. http://maseriouscare.org/about

[31] Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *New England Journal of Medicine*. 2009;360:1418-1428.

[32] Krumholz HM. Post-hospital syndrome: An acquired, transient condition of generalized risk. *New England Journal of Medicine*. 2013;368(2):100-102.

[33] Boutwell A, Hwu S. *Effective Interventions to Reduce Rehospitalizations: A Survey of the Published Evidence*. Cambridge, MA: Institute for Healthcare Improvement; 2009.

[34] Rutherford P, Nielsen GA, Taylor J, Bradke P, Coleman E. *How-to Guide: Improving Transitions from the Hospital to Community Settings to Reduce Avoidable Rehospitalizations*. Cambridge, MA: Institute for Healthcare Improvement; June 2013. http://www.ihi.org/resources/Pages/Tools/HowtoGuideImprovingTransitionstoReduceAvoidableRehospitalizations.aspx

[35] Medicare Payment Advisory Commission. *Report to Congress: Promoting Greater Efficiency in Medicare*. Washington, DC: MedPAC; June 2007.

[36] Castellucci M. Results of CMS' readmissions program has hospitals, experts questioning its purpose. *Modern Healthcare*. August 12, 2017.

[37] Benbassat J, Taragin M. Hospital readmissions as a measure of quality of health care. *Archives of Internal Medicine*. 2000;160(8):1074-1081.

[38] Dharmaraian K, Wang Y, Lin Z, et al. Association of changing hospital readmission rates with mortality rates after hospital discharge. *Journal of the American Medical Association*. 2017 Jul;318(3):270-278.

[39] The Care Transitions Program. https://caretransitions.org/

[40] University of Pennsylvania School of Nursing, NewCourtland Center for Transitions and Health. "Transitional Care Model." https://www.nursing.upenn.edu/ncth/transitional-care-model/

[41] Boston University Medical Center. "Project RED (Re-Engineered Discharge) Toolkit." https://www.bu.edu/fammed/projectred/toolkit.html

[42] Society of Hospital Medicine. "Project BOOST Implementation Toolkit." http://www.hospitalmedicine.org/Web/Quality_Innovation/Implementation_Toolkits/Project_BOOST/Web/Quality___Innovation/Implementation_Toolkit/Boost/Overview.aspx

[43] Indiana University School of Medicine. "GRACE Team Care." http://graceteamcare.indiana.edu/publications/publications.html

[44] Institute for Healthcare Improvement. "STate Action on Avoidable Rehospitalizations." http://www.ihi.org/Engage/Initiatives/Completed/STAAR/Pages/default.aspx

[45] Uscher-Pines L, Pines J, Kellermann A, Gillen E, Mehrotra A. Deciding to visit the emergency department for non-urgent conditions: A systematic review of the literature. *American Journal of Managed Care*. 2013 Jan;19(1):47-59.

[46] New England Healthcare Institute. A matter of urgency: Reducing emergency department overuse. *NEHI Research Brief*. March 2010.

[47] Care Redesign Guide: Better Health and Lower Costs for People with Complex Needs. "Strengthening Partnerships." http://www.careredesignguide.org/strengthening-partnerships/

[48] Institute for Healthcare Optimization. "IHO Variability Methodology Services." http://www.ihoptimize.org/what-we-do-methodology.htm

[49] *Call to Action: Preventable Health Care Harm Is a Public Health Crisis and Patient Safety Requires a Coordinated Public Health Response*. Boston: National Patient Safety Foundation; March 2017. https://c.ymcdn.com/sites/npsf.site-ym.com/resource/resmgr/pdf/NPSF_CallToAction_PubHealth.pdf

[50] Centers for Disease Control and Prevention. "Leading Causes of Death." https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm

[51] Vogel L. One in 18 patients harmed in hospital. *Canadian Medical Journal*. 2016 Dec;188(17-18).

[52] Centers for Medicare & Medicaid Services. "Hospital-Acquired Conditions." https://www.cms.gov/medicare/medicare-fee-for-service-payment/hospitalacqcond/hospital-acquired_conditions.html

[53] Kaye KS, Marchaim D, Chen TY, Baures T, Anderson DJ, Sloane R, Schmader KE. The impact of nosocomial bloodstream infections on mortality, length of stay, and hospital costs in older adults. *Journal of the American Geriatrics Society*. 2014 Feb;62(2):306-311.

[54] Medicare Learning Network. *Hospital Value-Based Purchasing*. Washington, DC: Centers for Medicare & Medicaid Services; September 2015.

[55] Centers for Medicare & Medicaid Services. "Hospital-Acquired Condition Reduction Program (HACRP)." https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/HAC-Reduction-Program.html

[56] Litvak E, Long MC, Prenney B, Fuda KK, Levtzion-Korach O, McGlinchey P. *Improving Patient Flow and Throughput in California Hospitals Operating Room Services*. Boston: Boston University, Program for Management of Variability in Health Care Delivery; December 2006.

[57] Litvak E (editor). *Managing Patient Flow in Hospitals: Strategies and Solutions* (Second Edition). Oak Brook, IL: Joint Commission Resources; 2009:136-151.

[58] Jensen L, Mayer T. *The Patient Flow Advantage: How Hardwiring Hospital-Wide Flow Drives Competitive Performance*. Pensacola, FL: Fire Starter Publishing; 2015:43.

[59] Resar R, Nolan K, Kaczynski D, Jensen K. Using real-time demand capacity management to improve hospitalwide patient flow. *Joint Commission Journal on Quality and Patient Safety*. 2011 May;37(5):217-227.

[60] Resar R, Nolan K, Kaczynski D, Jensen K. Using real-time demand capacity management to improve hospitalwide patient flow. *Joint Commission Journal on Quality and Patient Safety*. 2011 May;37(5):217-227.

[61] Buerhaus P, Miller A. "Impact of Patient Flow Issues on Nursing Staff and Patients." In: Litvak E (editor). *Managing Patient Flow in Hospitals: Strategies and Solutions* (Second Edition). Oak Brook, IL: Joint Commission Resources; 2009:15-27.

[62] Martin LA, Neumann CW, Mountford J, Bisognano M, Nolan TW. *Increasing Efficiency and Enhancing Value in Health Care: Ways to Achieve Savings in Operating Costs per Year*. IHI Innovation Series white paper. Cambridge, MA: Institute for Healthcare Improvement; 2009. http://www.ihi.org/resources/Pages/IHIWhitePapers/IncreasingEfficiencyEnhancingValueinHealthCareWhitePaper.aspx

[63] Scoville R, Little K. *Comparing Lean and Quality Improvement*. IHI White Paper. Cambridge, MA: Institute for Healthcare Improvement; 2014. http://www.ihi.org/resources/Pages/IHIWhitePapers/ComparingLeanandQualityImprovement.aspx

[64] Gonçalves-Bradley D, Lannin N, Clemson L, Cameron I, Shepperd S. Discharge planning from hospital. *The Cochrane Database of Systematic Reviews*. 2016 Jan 27;(1):CD000313.

[65] The Better Care Playbook. http://www.bettercareplaybook.org/

[66] Care Redesign Guide: Better Health and Lower Costs for People with Complex Needs. http://www.careredesignguide.org/

[67] Silvester KM, Mohammed MA, Harriman P, Girolami A, Downes TW. Timely care for frail older people referred to hospital improves efficiency and reduces mortality without the need for extra resources. *Age and Ageing*. 2014 Jul;443(4):472-477.

[68] Nolan TW. *Execution of Strategic Improvement Initiatives to Produce System-Level Results*. IHI Innovation Series white paper. Cambridge, MA: Institute for Healthcare Improvement; 2007.

[69] Jensen K, Mayer TA, Welch S, Haraden C. *Leadership for Smooth Patient Flow: Improved Outcomes, Improved Service, Improved Bottom Line*. Chicago: Health Administration Press with the Institute for Healthcare Improvement; 2007.

[70] Plsek P, Greenhalgh T. The challenge of complexity in health care. *BMJ*. 2001;323(7313):625-628.

[71] Litvak E, Bisognano M. More patients, less payment: Increasing hospital efficiency in the aftermath of health reform. *Health Affairs*. 2011;30(1):76-80.

[72] Provost LP, Murray SK. *The Health Care Data Guide: Learning from Data for Improvement*. San Francisco: Jossey-Bass; 2011: Chapter 12.

[73] Anhøj J, Hellesøe AB. The problem with red, amber, green: The need to avoid distraction by random variation in organisational performance measures. *BMJ Quality and Safety*. 2017 Jan;26(1):81-84.

[74] Mountford J, Wakefield D. From stoplight reports to time series: Equipping boards and leadership teams to drive better decisions. *BMJ Quality and Safety*. 2017 Jan;26(1):9-11.

[75] Schmidtke K, Poots A, Carpio J, Vlaev I, Kandala NB, Lilford R. Considering chance in quality and safety performance measures: An analysis of performance reports by boards in English NHS trusts. *BMJ Quality and Safety*. 2017 Jan;26(1):61-69.

[76] Provost L, Leddick S. How to take multiple measures to get a complete picture of organizational performance. *National Productivity Review*. Autumn 1993;12(4):477-490.

[77] Nolan TW. *Execution of Strategic Improvement Initiatives to Produce System-Level Results*. IHI Innovation Series white paper. Cambridge, MA: Institute for Healthcare Improvement; 2007.

[78] McCannon CJ, Schall MW, Perla RJ. *Planning for Scale: A Guide for Designing Large-Scale Improvement Initiatives*. IHI Innovation Series white paper. Cambridge, MA: Institute for Healthcare Improvement; 2008. http://www.ihi.org/resources/Pages/IHIWhitePapers/PlanningforScaleWhitePaper.aspx

[79] Institute for Healthcare Improvement. "Building System-wide Quality Improvement Capability Onsite Diagnostic." http://www.ihi.org/Engage/CustomExpertise/Diagnostics/Building-Improvement-Capability/Pages/default.aspx

[80] McCutcheon Adams K, Kabcenell A, Little K, Sokol-Hessner L. *"Conversation Ready": A Framework for Improving End-of-Life Care*. IHI White Paper. Cambridge, MA: Institute for Healthcare Improvement; 2015. http://www.ihi.org/resources/Pages/IHIWhitePapers/ConversationReadyEndofLifeCare.aspx

[81] Morrison RS, Dietrich J, Ladwig S, et al. Palliative care consultation teams cut hospital costs for Medicaid beneficiaries. *Health Affairs*. 2011;30(3):454-463.

[82] Morrison RS. Cost savings associated with US hospital palliative care consultation programs. *Archives of Internal Medicine*. 2008;168(16):1783.

[83] Meier DE. Increased access to palliative care and hospice services: Opportunities to improve value in health care. *Milbank Quarterly*. 2011;89(3):343-380.

[84] Center to Advance Palliative Care. "Palliative Care in the Community." https://www.capc.org/topics/palliative-care-community/

[85] *Health Literacy Universal Precautions Toolkit* (Second Edition). "Use the Teach-Back Method: Tool #5." Rockville, MD: Agency for Healthcare Research and Quality; February 2015.

[86] Bisognano M, Boutwell A. Improving transitions to reduce readmissions. *Frontiers of Healthcare Services Management*. 2009;25:3.

[87] Health Policy Brief: Improving care transitions. *Health Affairs*. September 13, 2012.

[88] Sevin C, Evdokimoff M, Sobolewski S, Taylor J, Rutherford P, Coleman EA. *How-to Guide: Improving Transitions from the Hospital to Home Health Care to Reduce Avoidable Rehospitalizations*. Cambridge, MA: Institute for Healthcare Improvement; June 2013. http://www.ihi.org/resources/Pages/Tools/HowtoGuideImprovingTransitionsfromHospitaltoHomeHealthCareReduceAvoidableHospitalizations.aspx

[89] Ragin DF. Reasons for using the emergency department: Results of the EMPATH study. *Academic Emergency Medicine*. 2005;12(12):1158-1166.

[90] Whittaker W, Anselmi L, Kristensen SR, et al. Associations between extending access to primary care and emergency department visits: A difference-in-differences analysis. *PLOS Medicine*. 2016;13(9).

[91] Omalley AS. After-hours access to primary care practices linked with lower emergency department use and less unmet medical need. *Health Affairs*. 2012;32(1):175-183.

[92] Jaber R, Braksmajer A, Trilling J. Group visits: A qualitative review of current research. *Journal of the American Board of Family Medicine*. 2006;19(3):276-290.

[93] Kvedar J, Coye MJ, Everett W. Connected health: A review of technologies and strategies to improve patient care with telemedicine and telehealth. *Health Affairs*. 2014;33(2):194-199.

[94] Hayes S, McCarthy D. *Care Management Plus: Strengthening Primary Care for Patients with Multiple Chronic Conditions*. New York: The Commonwealth Fund; December 2016.

[95] American Academy of Urgent Care Medicine. "What Is Urgent Care?" http://aaucm.org/about/urgentcare/default.aspx

[96] Neighmond P. Can't get in to see your doctor? Many patients turn to urgent care. *Morning Edition*. National Public Radio. March 7, 2016.

[97] Luthra S. Scarcity of mental health care means patients — especially kids — land in ER. *Kaiser Health News*. October 17, 2016.

[98] Wiler J, Brown NA. *Care of the Psychiatric Patient in the Emergency Department: A Review of the Literature*. American College of Emergency Physicians; October 2014.

[99] Dale J. Safety of telephone consultation for "non-serious" emergency ambulance service patients. *Quality and Safety in Health Care*. 2004;13(5):363-373.

[100] Span P. Going to the emergency room without leaving the living room. *The New York Times*. November 4, 2016.

[101] Marshall H. Emergency telehealth. *Journal of Emergency Medical Services*. February 10, 2016.

[102] Gonzalez, M, Alqusairi D, Jackson A, et al. Houston EMS advances mobile integrated healthcare through the ETHAN program. *Journal of Emergency Medical Services*. November 2, 2015.

[103] Care Redesign Guide: Better Health and Lower Costs for People with Complex Needs. "Choosing Your Population." http://www.careredesignguide.org/choosing-your-population/

[104] The Better Care Playbook. "What Are Key Elements to Redesigning Care?" http://www.bettercareplaybook.org/questions/what-are-key-elements-redesigning-care

[105] Goodell S, Bodenheimer TS, Berry-Millett R. *Care Management of Patients with Complex Health Care Needs*. Princeton, NJ: Robert Wood Johnson Foundation; December 2009.

[106] Veterans Health Administration. "Home Based Primary Care (HBPC)." https://www.benefits.gov/benefits/benefit-details/302

[107] Effective Health Care Program. *Home-Based Primary Care Interventions Systematic Review*. Rockville, MD: Agency for Healthcare Research and Quality. Research Protocol. November 19, 2014.

[108] Rauch J. *Opportunity Knocks at Home: How Home-Based Primary Care Offers a Win-Win for US Health Care*. Washington, DC: Governance Studies at Brookings; December 2013.

[109] Totten A, White-Chu EF, Wasson N, et al. *Home-Based Primary Care Interventions*. Rockville, MD: Agency for Healthcare Research and Quality. Comparative Effectiveness Reviews. No. 164. February 2016.

[110] Institute for Healthcare Optimization. "IHO Variability Methodology Services." http://www.ihoptimize.org/what-we-do-methodology.htm

[111] Ryckman FC, Yelton PA, Anneken AM, Kiessling PE, Schoettker PJ, Kotagal UR. Redesigning intensive care unit flow using variability management to improve access and safety. *Joint Commission Journal on Quality and Patient Safety*. 2009 Nov;35(11):535-543.

[112] National Patient Safety Foundation. "Safety Issues: Hot Topics — Hospital-Acquired Infections." http://www.npsf.org/general/custom.asp?page=safetyissuesprofl

[113] Institute for Healthcare Improvement. "Changes to Prevent Healthcare-Associated Infections." http://www.ihi.org/resources/Pages/Changes/ChangestoPreventHAIs.aspx

[114] Jensen L, Mayer T. *The Patient Flow Advantage: How Hardwiring Hospital-Wide Flow Drives Competitive Performance*. Pensacola, FL: Fire Starter Publishing; 2015:48-51.

[115] Jensen K, Mayer TA, Welch S, Haraden C. *Leadership for Smooth Patient Flow: Improved Outcomes, Improved Service, Improved Bottom Line*. Chicago: Health Administration Press with the Institute for Healthcare Improvement; 2007:6, 18.

[116] Litvak E (editor). *Managing Patient Flow in Hospitals: Strategies and Solutions* (Second Edition). Oak Brook, IL: Joint Commission Resources; 2009:71.

[117] Hall R (editor). *Patient Flow: Reducing Delay in Healthcare Delivery* (Second Edition). New York: Springer; 2013:285-290.

[118] Resar R, Nolan K, Kaczynski D, Jensen K. Using real-time demand capacity management to improve hospital-wide patient flow. *Joint Commission Journal on Quality and Patient Safety*. 2011 May;37(5):217-227.

[119] Jensen L, Mayer T. *The Patient Flow Advantage: How Hardwiring Hospital-Wide Flow Drives Competitive Performance*. Pensacola, FL: Fire Starter Publishing; 2015:71, 189.

[120] Litvak E (editor). *Managing Patient Flow in Hospitals: Strategies and Solutions* (Second Edition). Oak Brook, IL: Joint Commission Resources; 2009:136-151.

[121] Buerhaus P, Miller A. "Impact of Patient Flow Issues on Nursing Staff and Patients." In: Litvak E (editor). *Managing Patient Flow in Hospitals: Strategies and Solutions* (Second Edition). Oak Brook, IL: Joint Commission Resources; 2009:15-27.

[122] Hall R (editor). *Patient Flow: Reducing Delay in Healthcare Delivery* (Second Edition). New York: Springer; 2013:170, 257-261.

[123] Litvak E, Laskowski-Jones L. Nurse staffing, hospital operations, care quality, and common sense. *Nursing*. 2011 Aug;8:6-7.

[124] Ferrand YB, Magazine MJ, Rao US. Partially flexible operating rooms for elective and emergency surgeries. *Decision Sciences*. 2014;45:819-847.

[125] Cesta T. Managing length of stay using patient flow: Part 1. *Hospital Case Management*. 2013 Feb;21(2):19-22.

[126] Litvak E (editor). *Managing Patient Flow in Hospitals: Strategies and Solutions* (Second Edition). Oak Brook, IL: Joint Commission Resources; 2009:140.

[127] Robinson ST, Kirsch JR. Lean strategies in the operating room. *Anesthesiology Clinics*. 2015 Dec;33(4):713-730.

[128] McMasters KM, Canary J, Jackson L, et al. Improved operating room efficiency via constraint management: Experience of a tertiary-care academic medical center. *Journal of the American College of Surgeons*. 2015 Jul;221(1):154-162.

[129] Institute for Healthcare Optimization. "IHO Variability Methodology Services." http://www.ihoptimize.org/what-we-do-methodology.htm

[130] Ryckman FC, Yelton PA, Anneken AM, Kiessling PE, Schoettker PJ, Kotagal UR. Redesigning intensive care unit flow using variability management to improve access and safety. *Joint Commission Journal on Quality and Patient Safety*. 2009 Nov;35(11):535-543.

[131] Jensen L, Mayer T. *The Patient Flow Advantage: How Hardwiring Hospital-Wide Flow Drives Competitive Performance*. Pensacola, FL: Fire Starter Publishing; 2015:101-138.

[132] Sayah A, Rogers L, Devaraian K, Kingsley-Rocker L, Lobon LF. Minimizing ED waiting times and improving patient flow and experience of care. *Emergency Medicine International*. 2014.

[133] Almoosa K, Luther K, Resar R, Patel B. Applying the new Institute for Healthcare Improvement inpatient waste tool to identify "waste" in the intensive care unit. *Journal for Healthcare Quality*. 2016 Sep-Oct;38(5):e29-e38.

[134] Society of Critical Care Medicine. "Guidelines." http://www.sccm.org/Research/Guidelines/Pages/Guidelines.aspx

[135] American Thoracic Society. "Critical Care." https://www.thoracic.org/statements/cc.php

[136] Hunter A, Johnson L, Coustasse A. Reduction of intensive care unit length of stay: The case of early mobilization. *The Health Care Manager*. 2014 Apr-Jun;33(2):128-135.

[137] Adler J, Malone D. Early mobilization in the intensive care unit: A systematic review. *Cardiopulmonary Physical Therapy Journal*. 2012 Mar;23(1):5-13.

[138] McAlister FA, Bakal JA, Majumdar SR, et al. Safely and effectively reducing inpatient length of stay: A controlled study of the General Internal Medicine Care Transformation Initiative. *BMJ Quality and Safety*. 2014;23:446-456.

[139] Rutherford P, Bartley A, Miller D, et al. *Transforming Care at the Bedside How-to Guide: Increasing Nurses' Time in Direct Patient Care*. Cambridge, MA: Institute for Healthcare Improvement; 2008. http://www.ihi.org/resources/Pages/Tools/TCABHowToGuideIncreasingNursesTimeinDirectPatientCare.aspx

[140] White CM, Statile AM, White DL, et al. Using quality improvement to optimise paediatric discharge efficiency. *BMJ Quality and Safety*. 2014 May;23(5):428-436.

[141] Huber D. *Leadership and Nursing Care Management*. Elsevier Health Sciences; 2013.

[142] Giuliani G, Stewart D, Chang S, Eldred J, Chenok K, Kothari P. *Complex Care Management Toolkit*. California Quality Collaborative; April 2012.

[143] Freitas A, Silva-Costa T, Lopes F, Garcia-Lema I, Teixeira-Pinto PB, Costa-Pereira A. Factors influencing hospital high length of stay outliers. *BMC Health Services Research*. 2012 Aug 20;12:265.

[144] Vetrano DL, Land F, De Buyser SL. Predictors of length of hospital stay among older adults admitted to acute care wards: A multicenter observational study. *European Journal of Internal Medicine*. 2014 Jan;25(1):56-62.

[145] Gittlen S. Survey snapshot: How to achieve post-acute care coordination. *NEJM Catalyst*. November 22, 2016. https://catalyst.nejm.org/survey-post-acute-care-coordination/

[146] Butcher L. Hospitals strengthen bonds with post-acute providers. *Hospitals & Health Networks*. January 1, 2013.

Institute for Healthcare Improvement
20 University Road
Cambridge, MA 02138 USA