Improving Hospital Efficiency Through Data-Driven Management

A Case Study of Health First, Florida

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Key findings

- Metrics provided by Health First and staff interviews suggest that patient-flow initiatives substantially streamlined hospital operations and produced enormous gains in efficiency. Three years after Health First embarked on an effort to streamline patient flow and improve throughput, adult transfers have increased by more than 300 percent and emergency department times between admission and inpatient bed occupancy decreased by 37 percent.

- One key to initiative success was that the health care system's executive management articulated clear strategic goals and supported efforts to implement process improvement initiatives that focused on streamlining patient flow.

- The bed-tracking and hospital operation software used in our case study generates actionable, real-time data. It is used routinely by Health First associates to inform and execute operational decisions and allows system managers to spot bottlenecks, hold individual units and employees accountable, and track the health system's overall performance.

- Health First managers focus on continual process improvement, listen to suggestions from their associates, and create an environment of accountability and friendly competition with incentives for improved performances.

SUMMARY ■ In the United States, 31 cents out of every health care dollar—about $750 billion per year—is spent on hospital care (Martin et al., 2012). To constrain further growth in health care spending, the Center for Medicare and Medicaid Services (CMS) and other third-party payers are experimenting with bundled payments, Accountable Care Organizations, and other alternatives to change how hospitals are paid (Hussey et al., 2012). As these efforts grow, hospitals will face increasing challenges in providing better care at lower cost (Hussey et al., 2012; Hsia, Kellermann, and Shen, 2011).

While CMS and other payers are trying to find ways to constrain payments, hospitals must contend with the steadily rising cost of pharmaceuticals, supplies, medical technology, and personnel. Until now, most hospitals have been able to leverage their power in local markets to negotiate favorable rates (Hussey et al., 2012). As a result, the growth of operating income in hospitals has offset declining revenue from investments and charitable contributions (Health Leaders Media, 2013). However, as payment reform gathers steam, this strategy will become increasingly difficult to pursue.

Operational issues in hospitals add to these challenges. Aggregate national and state-level occupancy rates in hospitals mask the fact that occupancy tends to be high in large urban community and teaching hospitals (Health Leaders Media, 2013; National Center for Health Statis-

tics, 2012, 2013; Institute of Medicine, 2006). More than ten years ago, a Lewin Group survey (2002) for the American Hospital Association reported that 90 percent of Level I Trauma Centers and hospitals with more than 300 beds were operating "at or above" full capacity, and high occupancy continues to plague hospitals today (Institute of Medicine, 2006; Pitts et al., 2012; US Government Accountability Office, 2009). Hospitals that operate at full capacity operate less efficiently, something that affects patient flow with spillover effects throughout the system, prolonging emergency department (ED) lengths of stay for admitted patients who then have to "board" in ED exam rooms or hallways (Institute of Medicine, 2006; Pitts et al., 2012; U.S. Government Accountability Office, 2009; Kellermann, 2010; Rabin et al., 2012). When ED crowding becomes unmanageable, many hospitals divert inbound ambulances (Burt, McCaig, and Valverde, 2006), and private providers choose to send elective admissions to other facilities, resulting in a loss of potential revenue, delays in care, and worse health outcomes (Henneman et al., 2009; Morganti et al., 2013; Shen and Hsia, 2015; Sun et al., 2013).

In the coming years, the fiscal and operational challenges U.S. hospitals face are expected to become more acute from a confluence of factors: the aging population (Strunk, Ginsburg, and Banker, 2006), the growing prevalence of chronic diseases (Thorpe and Howard, 2006), and expanded coverage but less generous payments (Kellermann et al., 2012; Litvak and Bisognano, 2011). Hospitals will not be able to respond as they once did by building larger facilities and charging higher fees. To address these changes, hospitals will need to operate more efficiently, while at the same time maintaining or improving quality of care and health outcomes (Kellermann et al., 2012; Litvak and Bisognano, 2011; California Healthcare Foundation, 2011).

In this report, we present a case study of how one health system—Health First, in Brevard County, Florida—addressed these challenges by using *Lean thinking* (see text box for a description of this methodology) enabled by information technology (IT). Examining Health First provides an opportunity to learn about how one hospital system addressed these challenges by making fundamental changes in its operations in advance of the shift toward accountable care. Health First's experience may provide lessons and insights for all hospitals looking to improve operational efficiency.

To conduct our assessment, we reviewed relevant published literature, documents and videos, and performance metrics provided by Health First's leadership. During a one-day site visit to Health First in May 2015, we conducted semistructured interviews with seven key leaders in Health First's administration. Leaders were identified in consultation with hospital management based on key domains chosen by the research team. Because our study did not involve personal health information or an experimental intervention, it was exempt from human subjects review.

This study was funded by TeleTracking Technologies, Inc., the company that developed the IT solution used by Health First. TeleTracking sought an objective, independent assessment of the effect of its software on efforts to increase hospital efficiency in one setting and selected Health First as the site of the study. RAND conducted this study after securing an agreement with TeleTracking that it would publish study findings regardless of whether they were positive or negative.

What Is Lean Process Improvement?

To improve quality and efficiency while constraining costs, some hospitals have adopted quality improvement methodologies from industries outside of health care (Mason, Nicolay, and Darzi, 2015; Niemeijer et al., 2012). One such approach is *Lean methodology*. Initially developed by Toyota, Lean focuses on process improvement, affecting both structural components (e.g., technology, staffing, physical setup) and operational processes (Holden, 2011; Joosten, Bongers, and Janssen, 2009).

The key goal of Lean is to deliver value to the consumer—in this case, the patient (Joosten, Bongers, and Janssen, 2009; Bowerman and Fillingham, 2007). Value is added by eliminating waste and duplicative elements of a system (Joosten, Bongers, and Janssen, 2009; Bowerman and Fillingham, 2007; Brandao de Souza, 2009). Instead of departments acting as individual units, departments are coordinated with streamlined operations (Bowerman and Fillingham, 2007). Lean is often combined with Six Sigma, an approach created by Motorola, which seeks to standardize processes to reduce errors (Joosten, Bongers, and Janssen, 2009). (Six Sigma is a data-driven approach and methodology for eliminating defects [driving toward six standard deviations between the mean and the nearest specification limit] in any process—from manufacturing to transactional and from product to service.)

Lean implementation occurs in a stepwise approach. First, a given organization must assess current operations and determine what is considered valuable to the patient as a consumer (Radnor, Holweg, and Waring, 2012). Next, the organization must take steps to implement improvement-oriented measures in a rapid cycle approach by bringing associates together to brainstorm and redesign various processes (Radnor, Holweg, and Waring, 2012). Finally, such changes are reassessed by reviewing performance data to ensure that the revised approach offers benefits (Radnor, Holweg, and Waring, 2012). The process is repeated multiple times as needed to address multiple aspects of a system performance.

A critical enabler of implementing Lean process improvement is access to data (Hsieh, Lin, and Manduca, 2007). In Lean, data are used at all levels of an organization and at every step in process improvement. IT can play a critical role in enabling the collection and use of data to assist with real-time daily operations and for review by managers to modify processes and improve efficiency (Hsieh, Lin, and Manduca, 2007).

IMPROVING HOSPITAL OPERATIONS: THE CASE OF HEALTH FIRST AND TELETRACKING

The Setting

Health First is the only not-for-profit, fully integrated health system in central Florida. It has more than 8,000 employees distributed across four hospitals, a medical group, a health plan, and a number of outpatient services (Health First, undated). Health First's four hospitals have a combined total of 900 beds. Its central flagship institution is Health First's Holmes Regional Medical Center, a multispecialty hospital with 550 beds and a Level II Trauma Center. It also has three smaller community hospitals: Cape Canaveral, Palm Bay, and Viera. (Viera opened in mid-2011.) Holmes accepts interhospital transfers, mainly from its within-system community hospitals, but it also accepts some transfers from external hospitals. Its payer mix is 60 percent public insurance (Medicare and Medicaid), with the remainder coming from private insurance.

The Challenge

In 2012, Health First faced three major challenges: financial problems, low quality scores, and low patient satisfaction ratings. With the addition of President and Chief Executive Officer (CEO) Steven Johnson in 2011, and Chief Operations Officer (COO) James Stuart Mitchell in 2012, Health First charted a new course utilizing a three-pronged strategy that corresponded to the key challenges the organization faced: improving care quality, increasing patient satisfaction, and becoming an effective steward for hospital financials. All subsequent improvement activities were to be centered on these areas.

Lean Process Improvement and the Focus on Patient Flow

Both the CEO and COO came from health systems that used the process improvement methodology called Lean and were aware that it could make hospital operations more efficient, as well as address the organization's three strategic goals. They hired Bill Griffith, a Lean expert, as Health First's Executive Director of Operational Excellence. Griffith also had experience

applying Six Sigma (another process improvement methodology) and using IT tools to improve operational efficiency. The executives assigned Griffith to assess Health First's operations for opportunities to achieve the organization's strategic goals.

Griffith quickly identified patient flow processes as a key opportunity. Individual hospitals within Health First operated as separate units, often transferring patients outside the system. Within each of the four hospitals, nurses had to manually find and assign beds and were not always motivated to take new patients. Busy times, such as changes of shift, resulted in bottlenecks and led to prolonged wait times for inpatient beds for patients admitted from the ED.

Other hospital functions also faced challenges related to patient flow. For example, to locate beds of recently discharged patients for cleaning, Environmental Services (EVS) used a manual process. Similarly, patient transport services within the hospitals operated in a fragmented, decentralized fashion: Transporters would be notified of potential jobs, but they had the option to select more desirable jobs and refuse others.

The Health First leadership team recognized that these inefficiencies had a negative impact on the hospital's strategic goals. Slow bed turnaround, delays in bed assignments, and, ultimately, ED crowding reduced care quality and patient satisfaction. Because capacity was restrained by a lack of clean, functional beds and delays in patient flow, Health First sometimes lost transfers to external hospitals outside its system, which affected its finances. Health First was unable to pinpoint inefficiencies because it had little operational performance data. Most metrics had to be pulled through manual chart review. Without readily available metrics, managers were limited in their ability to identify specific sources of inefficiency or prioritize improvement efforts.

Furthermore, having meaningful metrics is a key component of implementing Lean process improvement. To generate metrics that could be used to apply Lean and optimize patient flow, Health First implemented hospital operations software from TeleTracking Technologies, Inc., a hospital operations IT solution that enables hospitals to manage patient flow and that interfaces with electronic health records (EHRs) and other health IT products. Although TeleTracking had been in place at Health First prior to 2012, it was not implemented in a way that enabled rapid process improvement. For example, TeleTracking provided some metrics such as the percentage of beds occupied at any given time, but it was not being used as an operational platform to assign beds and assist in patient flow activities. Instead, the nursing associates were handling such functions as bed assignments manually, and metrics related to their activities were not recorded electronically.

In February and March of 2013, Health First began centralizing bed tracking across all four hospitals using TeleTracking as its IT platform, and the full rollout of the system occurred between May and October 2013. Health First has now implemented an end-to-end patient flow process.

## How Health First Improved Patient Flow

Several components work jointly to improve operations at Health First (see Table 1 and Figure 1). At the heart of the system is a center called Central Patient Logistics (CPL). The CPL is staffed by nonclinical personnel, with nurse oversight as needed, and is responsible for managing bed assignment. CPL associates have a bird's-eye view of hospital resources and process across all four hospitals, including available beds, incoming

Table 1: Components of the Health First Patient-Flow Management Process

Component	Definition
CPL	Operated largely by nonclinical associates—manages bed assignment and bed management
Centralized registration	Manages registration of transfers and direct admits (admissions that are initiated from a location other than the ED), including insurance review for nonemergent transfers
Centralized utilization review	Run by nurses who make sure the admission status and associate floor assignment is appropriate in consultation with the ED doctor and floor doctor
Transfer access nurse	Helps coordinate transfers from other hospitals, both inside and outside the Health First system, using dispatch logic, which computes the optimal assignment based on priority, proximity, and mode of transport, to efficiently assign available transporters to respond to requests
Electronic Intensive Care Unit (eICU)	Staffed by a nurse, a housing unit coordinator, and (after 5 p.m.) an intensivist; eICU is a software program that interfaces with TeleTracking. The intensivist can help initiate after-hours transfers from the ICU to the floors to help free up beds, a process that can be further managed by the CPL to help with the flow of patients to these floor beds

Source: Interviews with Health First Associates

Figure 1: How Patient Flow Management Works at Health First
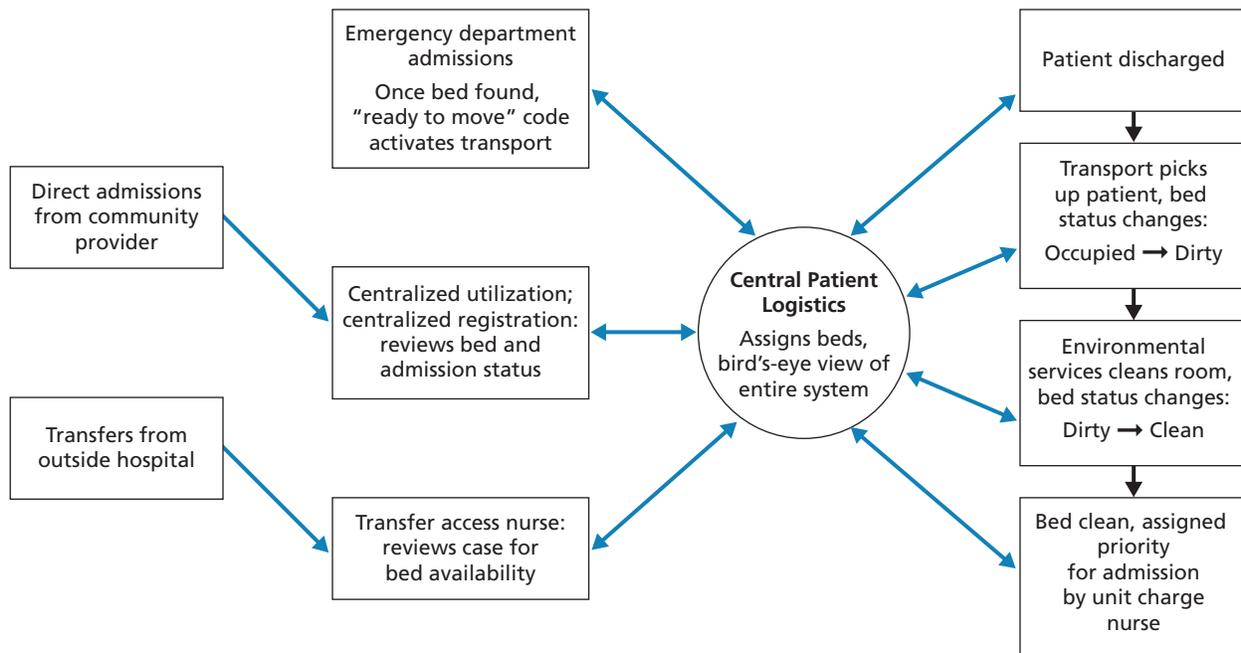
SOURCE: Interviews with Health First Associates.
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transfers and admissions, and the performance of key individuals and groups that are essential to patient flow.

At each workstation in the CPL, monitors display the unit-by-unit status of the health system's beds. Data are color-coded to indicate if a bed is occupied, "dirty" (i.e., vacated and available for cleaning), or available for the next admission. On the walls of CPL and on units, flat-panel monitors display the health system's "dashboard"— summary statistics of performance in real time. Executive leadership at Health First frequently review these dashboards and use these metrics to understand unit performance and identify any potential staffing changes needed to improve patient flow. For example, by reviewing a consistent trend in transport delays over a defined period, executive leadership was able to identify an emerging need to hire more transport associates.

When a patient has been admitted from the ED, CPL is notified through the TeleTracking software so CPL associates are aware of an upcoming bed assignment request. ED associates have 30 minutes to complete all tasks or the ED management team receives a notification and is expected to intervene to complete the process. Once admitting orders are in place (done by the floor physician) and all essential tests have been completed in the ED, the nurse pushes a "Ready to Move" button, triggering CPL to assign a bed, which then automatically triggers transport. (The transport process is described later.)

To assign a bed, CPL associates use TeleTracking's capabilities to monitor capacity and bed turnover on a real-time basis, allowing them immediately to match an incoming patient with the available bed most appropriate for that patient's needs. Beds are assigned a priority ranking based on type of bed and availability for patient admissions. A higher ranking means the bed is more readily available for assignment than a lower-ranked bed. The charge nurse makes these priority assignments using his or her knowledge of other needs of the unit. For example, if a nurse has a critical patient and is unable to take a new admission at a certain time, beds under that nurse's supervision would be assigned a lower priority. The CPL associates can view bed priority rankings in the TeleTracking software and use an advanced search functionality to identify an appropriate bed. The advanced search algorithm considers priority ranking (favoring the top-ranked priority beds), bed characteristics (such as the type and location of the bed), patient characteristics (e.g., gender), and type of unit requested.

TeleTracking also facilitates direct admissions and transfers. In the case of a direct admission, community physicians first call Health First's CPL to initiate the process. (To ensure that associate-to-associate communication and requests from referring physicians are handled in a professional manner, all calls to and from the transfer center are recorded.) A centralized utilization review team of trained nurses evaluates the admission to ensure

Discharges are the number-one priority for transporters to allow capacity for future admissions.

that the proper bed status and unit are assigned. Orders for to-be-admitted patients are written by attending physicians through an order software program, called Allscripts, that interfaces with TeleTracking, so orders are available to the utilization review team (Allscripts, undated). A centralized registration team manages registration and insurance review of direct admits (as well as transfers). Admitted patients are given a printed card stating that they are a direct admit and instructed to show the card to the hospital information desk associates, who will help guide them to their bed. Transfers from outside facilities contact the system through a transfer access nurse, who similarly ensures that the proper bed placement can be arranged seamlessly and prior to transport, thus avoiding unnecessary ED stays.

Transfers within the hospital and from the ICU are facilitated through the same process as ED admissions. As noted in Table 1, Health First's eICU is staffed by a nurse, a housing unit coordinator, and, after 5 p.m., an intensivist stationed in the eICU (Philips, undated). The eICU provides remote monitoring of patients in the actual ICU through a high-definition video camera. Nurses in the eICU can communicate directly with patients in ICUs at all four hospitals, a total of 102 ICU beds. After 5 p.m., there is no floor intensivist; instead, an intensivist stationed in the eICU manages the ICUs. CPL uses TeleTracking to initiate after-hours transfers to the floors to help free up beds, facilitating the flow of patients.

Because the CPL assigns beds for all four of Health First's hospitals, when a unit is near capacity at one hospital, the CPL can assign direct admits and transfer patients to beds at other hospitals, allowing Health First to distribute workloads evenly across multiple hospitals. This functionality helps make more-efficient use of all of Health First's hospital beds and associates.

A key component of Health First's implementation of patient flow initiatives using TeleTracking is its electronic interfaces with other hospital IT systems, including Allscript's Sunrise Clinical Manager (undated) for the electronic medical record (EMR), Kronos (undated) for scheduling, and Phillips eICU (undated) for ICU remote management. These systems provide data feeds into TeleTracking, giving users a more complete view of hospital events. For example, interfaces with the EMR allow operators who assign beds to use data elements

related to a patient's health needs. Without these interfaces, the operators would need to spend more time looking for information in other systems to make bed assignment decisions, which might also require that they have additional clinical knowledge.

Transports are automatically assigned based on *dispatch logic*, which (as discussed in Table 1) computes the optimal assignment based on priority, proximity, and mode of transport (e.g., wheelchair versus stretcher). Transport assignments are based on zones, taking into account the proximity of transporters and the most-recently completed transport, to minimize excess travel time between jobs and to maximize efficiency. At each stage of the transport process (e.g., when a transporter arrives to transport a patient, when the patient arrives at the destination), the transporter enters a numerical code to denote location and completion of the transport task, allowing the dispatch logic to make better decisions and Health First management to view real-time data on performance.

Discharges are the number-one priority for transporters to allow capacity for future admissions. When an inpatient is discharged from Health First, the transporter who arrives to escort the patient prompts TeleTracking by entering a numerical code to change the bed's status from "occupied" to "dirty." Ambulance staff can similarly trigger the discharge process when a patient is picked up for external transport. This automatically triggers the room changeover processes initiated by EVS. The moment a member from the EVS team arrives, he or she enters a numerical code on the room's telephone to indicate that cleaning is under way. When the task is finished, a second telephone entry changes the bed's status from "dirty" to "available." All turnover times are captured for analysis. These data are used to compare individual associates, nursing units, and supervisors across the organization and to inform efforts to target improvement. For example, when one transporter was found to be a low performer, the manager shadowed the transporter to identify opportunities for skipping unnecessary steps. As a result, the transporter's performance improved substantially.

In addition to expediting the placement of patients and the turnover of beds, the TeleTracking software generates summary metrics that display how well the system is meeting various performance benchmarks and goals. These data can help managers

adjust staffing to meet patient-flow needs based on times of maximal volumes during the week, shifting associates from one site to another as needed.

THE CASE OF HEALTH FIRST AND TELETRACKING: THE RESULTS

In our evaluation of Health First's use of TeleTracking, we focused on implementation process results and implementation outcome results.

Process Results

In accordance with Lean methods, Health First implemented changes in patient flow by identifying key opportunities for improvement and then bringing together all affected associates to describe their experiences and contribute to improving the process. By involving all associates, Health First was able to achieve buy-in from the beginning of process improvement efforts. For example, when Health First managers recognized that their lengths of stay could be improved, they brought together physicians, nurses, techs, transport associates, paramedics, and others for brainstorming sessions and root-cause analyses—an approach to problem-solving that is used to identify the root causes of faults or problems. With Bill Griffith and his team facilitating, Health First associates generated a list of all the key process issues, prioritized them, and began addressing them by integrating TeleTracking software and other process changes through pilot testing, followed by larger-scale rollouts. At each step, the managers produced metrics to track progress. Health First used this method for all its process improvement efforts.

Health First encountered several challenges to improving patient flow. The biggest was convincing associates that there were opportunities for improvement in the first place. In many cases, the hospital associates were so accustomed to their existing processes and workflows that they did not realize the degree of inefficiency. Health First managers needed to hold several discussions with the staff over the course of several months in which they presented data describing where the health system stood on specific metrics compared with other institutions. Managers also described the existing processes to associates in detail so that potential waste could be clearly identified. The managers found that the most effective way to convince associates that there was an opportunity to improve processes was to show them objective data about how such changes could benefit patients, such as by reducing wait times in the ED or shortening lengths of stay. Once associates agreed that there was an opportunity for improvement and were engaged in describing all aspects of the problem, it was relatively straightforward to introduce process changes, such as adopting TeleTracking's patient-flow solution, because the associates felt ownership of the new process and could see the impact in the form of metrics.

Health First encountered three additional challenges during implementation of their patient-flow improvement efforts. First, associates needed to learn to use the new system consistently. To function correctly, the software requires associates to input information manually through a telephone system to note time stamps for certain tasks (e.g., EVS starting and finishing bed cleaning, transport pickups and drop-offs). If codes were not entered, it caused delayed prompts for further steps in the system. These issues were mitigated with additional training and reminders. Although Health First does offer training for its associates, nurses who infrequently take on a different role (e.g., as a charge nurse who has to assign a priority to a bed) have reported some challenges if they have not received recent training.

Second, while there was substantial associate buy-in to shift bed assignment authority to the CPL (partly because the associates agreed that the existing process—with the charge nurse required to be at a computer to manage bed assignments—was problematic, resulting in delays), some nursing associates were reluctant to forgo the authority to determine bed assignments because of concern over receiving admissions for which they might not be prepared. Support by Health First leadership in favor of the shift in bed assignment authority to the CPL was

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important to allow the implementation to proceed. Once the processes were in place and hard data were available that showed the benefits, these concerns were largely resolved.

Finally, Health First previously had not routinely incorporated the use of summary metrics and measures of performance in a way that would increase accountability and motivate improvements in productivity. In response, department managers incorporated various approaches to reward associates for productivity, including sponsoring contests for performance and social activities to increase team morale. When associates did not meet productivity goals, managers made efforts to help them improve, which included formal training, pairing them up with high performers, or verbal and written discussions about how to improve performance.

Outcome Results

From 2012, the year Health First began full implementation of Lean management using TeleTracking, through 2014, the total number of admissions at all four hospitals increased by 27 percent, from 34,788 to 44,152. Total ED volume in the Health First system increased by 12 percent, from 151,416 visits to 169,763. (See Table 2 and Figures 2 and 3 for additional detail.) Total adult internal campus transfers increased by 348 percent, from 401 to 1,797.

Despite this increase in volume, average wait times decreased across all four sites over the years examined. (See Figures 2 and 3.) The length of stay between an ED request for a bed and the initiation of the bed assignment process decreased by half, from 90 minutes to 45 minutes. The time for assignment of a bed once the patient was ready to move (RTM)—i.e., all ED workup complete and orders written—decreased by 71 percent, from 30.2 minutes to 8.8 minutes during this same period. The "pull time," or total time between when the RTM button was activated by the ED associates and when the patient was listed as admitted and occupying the assigned bed on the floor, decreased by 37 percent, from an average of 50.6 minutes in 2012 to 32.0 minutes in 2014. EVS decreased the time to clean a bed by 12 percent, from 56.4 to 49.6 minutes.

These results were achieved without any change in the number of health system beds, which remained stable at 900 over the three years. The number of admissions per bed increased by almost 30 percent during this period, with a decrease in mean inpatient length of stay by 0.75 days. EVS and transport were both able to increase efficiency despite a decrease in number of full-time equivalent associates, which in accordance with Lean thinking occurred because of natural attrition rather than layoffs. While we did not assess the intended or unintended impacts of the intervention on care quality, it is worth noting that as these efficiency improvements were occurring, Health First institutions received multiple awards related to care quality: Health First's Viera Hospital received a five-star rating for patient experience from the Centers for Medicare and Medicaid Services (CMS) in 2015 (Health First, 2015a), and Health First's Holmes Regional Medical Center received a top rating from the Society of Thoracic Surgeons for quality metrics for coronary artery bypass surgery for 2014 (Health First, 2015b).

Table 2: Health First Metrics 2012–2014

	2012	2013	2014	% Change 2012–2014
Total admissions[a]	34,788	39,535	44,152	**26.92**
Total adult internal—campus-to-campus transfers	401	1,750	1,797	**348.13**
Mean inpatient length of stay (days)	4.89	4.47	4.14	**−18.75**
Total ED volume	151,416	160,763	169,763	**12.12**
ED physician first orders to RTM	90.18	47.26	45.07	**−50.02**
Time to place—RTM from the ED to assignment to a clean bed (minutes)	30.19	13.11	8.84	**−70.74**
Pull time—RTM to patient occupancy of a clean bed (minutes)	50.64	42.38	32.04	**−36.72**
EVS—time from dirty to clean bed (minutes)	56.40	52.75	49.63	**−12.01**
Total licensed inpatient beds	900	900	900	**0.00**
Monthly admissions/licensed bed	151.70	172.81	196.72	**29.68**

[a] Includes scheduled admissions (cardiac catheterization, pre-admit, post-anesthesia care unit/scheduled surgeries), emergency department admissions, direct admissions, and transfers.
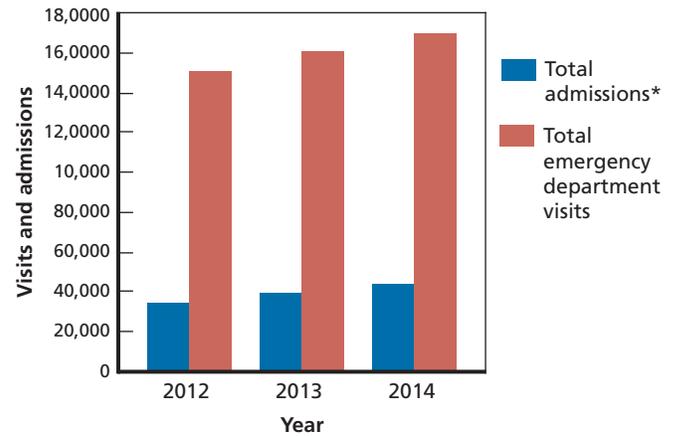
Figure 2: Health First Performance Metrics 2012–2014
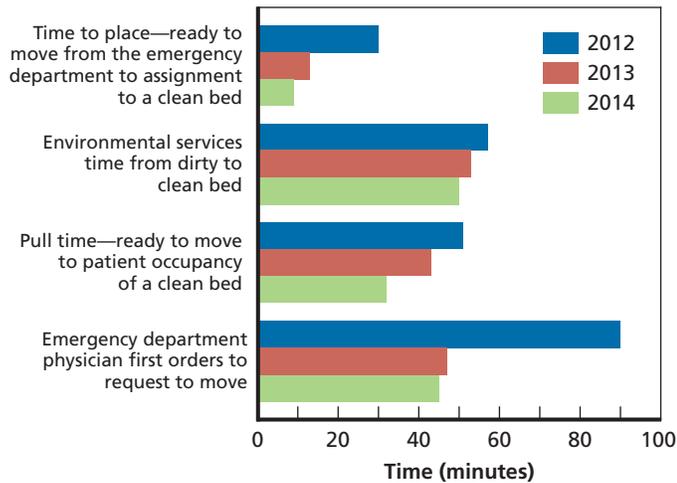
SOURCE: Health First.
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Figure 3: Change in Visits, Health First 2012–2014

SOURCE: Health First.
*Includes scheduled admissions (cardiac catheterization, pre-admit, post-anesthesia care unit/scheduled surgeries), emergency department admissions, direct admissions, and transfers.
RAND *RR1342-3*

CONCLUSIONS

Based on both management science and the real-world experience of health systems such as Health First, there is growing evidence that America's hospitals have substantial latent capacity (Litvak and Bisognano, 2011). To succeed in the modern era, hospitals must learn to operate more efficiently. Furthermore, as fiscal pressure increases, hospitals may face a "safety tipping point" where patient safety is compromised once resources become limited (Kuntz, Mennicken, and Scholtes, 2014). Once this tipping point is reached, higher rates of adverse outcomes will occur, such as premature discharges resulting in readmission, medical errors, and, ultimately, higher mortality rates (Holden, 2011; TeleTracking, undated). Care quality and patient satisfaction will also suffer as a result.

To react to cost pressure while maintaining safety standards, this case study suggests that a focus on patient flow using Lean process improvement methods supported by an IT infrastructure could be a recipe for success. Health First uses a data-driven approach to implement Lean process improvement initiatives that is supported by TeleTracking, a hospital operations IT solution that enables hospitals to manage patient flow and that interfaces with EHRs and other health IT products. Metrics provided by Health First and staff interviews suggest that patient-flow initiatives substantially streamlined hospital operations and produced enormous gains in efficiency. Three years after Health First embarked on an effort to streamline patient flow and improve throughput, adult transfers within the

system have increased by more than 300 percent and ED times between admission and inpatient bed occupancy ("pull time") decreased by 37 percent.

Our findings are consistent with recommendations from the Institute of Medicine, the Institute for Healthcare Optimization, and other groups that have also endorsed the importance of focusing on patient flow as a way to enhance patient safety, improve satisfaction, and increase case volumes without incurring the cost of building new facilities (Litvak and Bisognano, 2011).

Our evaluation suggests that the following are key factors in Health First's success:

- **Leadership support**—The health care system's executive management articulated clear strategic goals and supported efforts to implement process improvement initiatives that focused on streamlining patient flow.
- **Timely and usable data**—TeleTracking's bed tracking and hospital operation software generates actionable, real-time data. It is used routinely by associates to inform and execute operational decisions and allows system managers to spot bottlenecks, hold individual units and employees accountable, and track the health system's overall performance.
- **Proactive front-line managers**—Health First managers focus on continual process improvement, listen to suggestions from their associates, and create an environment of accountability and friendly competition with incentives for improved performances.

We conclude that the adoption of centralized, data-driven management of regional referrals, inpatient admissions, and bed turnover at Health First streamlined throughput and freed up substantial latent capacity in its network of four hospitals.

Two decisions proved decisive. First, the hospital management's decision to convert inpatient admissions from a hospital-centered and unit-controlled process to an enterprise-wide endeavor transformed Health First's approach to capacity management. Much as an air traffic control tower manages inbound and outbound flights and guides aircraft to their gates, Health First's CPL facilitates regional transfers and assigns patients to beds. Second, making full use of TeleTracking's patient-flow software allows CPL associates to visualize, in real time, the status of every bed in Health First's four hospitals. Interfaces between TeleTracking and EHRs and other clinical systems greatly facilitate the collection of meaningful data; easier interoperability among hospital IT systems would likely foster even more efficiency. Armed with data and metrics, the health system's leadership and front-line managers can identify bottlenecks and make needed changes in a timely manner. In summary, our interviews suggest the improvements in efficiency reported to us in Health First's metrics can be attributed to the management team's effective deployment of technology to support the health system's strategic goals.

There are some limitations. Our analysis is based on metrics, documentation, and interviews in a single, multihospital health care system. Because of the small sample size, we could not reliably calculate confidence intervals to see if metrics from year to year were statistically significant. We did not independently audit the health system's quality assurance records and financial reports to verify data or information obtained through interviews. We interviewed key informants selected by Health First managers and may not have included all perspectives. Because we only examined one system, it is possible that Health First's results are not generalizable to other settings. However, Health First is not the only health care system that has achieved favorable results by focusing on capacity management. Sharp HealthCare in San Diego, Calif., a six-hospital system with more than 1,500 beds, used a similar model of Lean management supported by bed tracking software in 2013 and, as a result, decreased the time between RTM and bed assignment by 162 minutes. Sharp now has bed turnover times of less than 60 minutes systemwide (Teletracking, undated). Cincinnati Children's Hospital, a major regional referral center in Ohio, implemented perioperative flow management in 2006. By the end of fiscal year 2009, clinical revenues were up 34 percent and overtime as a percentage of total personnel costs was reduced by 26 percent. The hospital's leadership calculated that implementation of capacity management was equivalent to building a $100 million, 100-bed expansion (Ryckman et al., 2009). Finally, as Health First had multiple improvement initiatives occurring concurrently, it is possible that changes in the metrics are partially attributable to those other initiatives. However, more than half of Health First's initiatives since 2012 have been related to patient flow, and many of the other initiatives are limited to specific clinical conditions related to CMS quality metrics.

Despite these limitations, we conclude that the adoption of centralized, data-driven management of regional referrals, inpatient admissions, and bed turnover at Health First streamlined throughput and freed up substantial latent capacity in its network of four hospitals. As a result, Health First was able to substantially increase monthly admissions and improve efficiency without investing in a larger physical plant or a bigger clinical workforce. Although an increasingly robust body of evidence points to the benefits of focusing on patient flow, few hospitals have actively embraced this approach. As the fiscal and operational pressure on hospitals grow, this may change (Litvak and Bisognano, 2011). Health First's experience suggests that improved efficiency can be accomplished by employing technology and process improvement methods to streamline hospital operations.

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About This Report

In this report, we present a case study of how one health system—Health First, in Brevard County, Florida—addressed resource challenges by using Lean thinking enabled by information technology. Examining Health First provides an opportunity to learn about how one hospital system addressed these challenges by making fundamental changes in its operations, in advance of the shift toward accountable care. Health First's experience may provide lessons and insights for all hospitals looking to improve operational efficiency.

This case study was sponsored by TeleTracking Technologies, Inc., the vendor of the patient-tracking technology used by Health First. TeleTracking sought an objective, independent assessment of the effect of its software on efforts to increase hospital efficiency in one setting and selected Health First as the site of the study. RAND conducted this study after securing an agreement with TeleTracking that it would publish study findings regardless of whether they were positive or negative. When RAND conducts work for a private client, it reserves the right to independently publish its findings.

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