

CASE STUDY

Integrating a Real-Time Information Framework with Daily Management to Improve Flow and Revenue

Lucy Xenophon, MD, MPH, John Toussaint, MD

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Prodigious streams of data flow to health care providers. Patient-experience comparisons, throughput dashboards, length-of-stay and early-discharge data, rates of hospital-acquired conditions, hand-hygiene compliance, mortality, and readmissions are just a few examples. Often, however, these data do not convey the information that is needed to improve the delivery of care. Mount Sinai Morningside set out to investigate the hypothesis that a radical change in the way information is accessed and used can increase patient flow and prevent safety events. The authors established a process to collate and share data, in real time, so that clinicians and administrators can better understand where their efforts are best spent every day to improve care. Through the use of a combination of simple television screens and constant data population from legacy IT systems, the information that is needed most is available to everyone.

KEY TAKEAWAYS

- » We believe that sharing carefully selected real-time information and connecting it to a management strategy that focuses on daily improvement is the future of delivering better quality care and better patient experiences at lower cost.
- » Using this information to improve flow has allowed us to achieve many of our targets related to cost, patient experience, and quality.
- » Going forward, we are confident that the real-time availability of information that the James Jones Daily Management and Incident Command Center provides will allow us to achieve aggressive targets for patient outcomes that were not possible just 2 years ago.

The Challenge

One challenge faced by the health care industry is that traditional information-delivery systems foster siloed care. For example, inpatient care unit staff do not know how many patients in the ED are waiting for beds or how crowded the ED is, so they routinely work independently of that demand.¹⁻³ Conversely, ED staff have no knowledge about inpatient bed capacity. A negative downstream effect of this information gap is that admitted patients frequently “board” in the ED for extended periods of time, raising the risk of adverse events and increasing the burden of work and stress on the ED staff.² Further complicating our broken information framework is the fact that hospitals and their complex systems are often managed on the basis of data that are days, weeks, or months old, resulting in a state of information flow that can be described as “too much, too late, and too fragmented.”⁴

Mount Sinai Morningside (MSM), an urban community hospital in New York City and a member of the Mount Sinai Health System, has an average daily census of 300 medical, surgical, critical care, and behavioral health patients. MSM is a level II trauma center that has 90,000 ED visits per year, a staff of 3,000 employees, and an approximately 83% government-payer mix. In 2014, the MSM leadership team laid the foundation for a management strategy, known as the True North,⁵ with four strategic goals:

1. Flow (being on time)
2. Safety and quality (achieving zero harm)
3. Financial stewardship (reducing waste)
4. Patient experience (delivering exceptional care)

These four True North goals define the guidelines for the information that is required to manage our daily operations.

An underlying premise of the MSM daily management strategy is that staff at all levels of the organization are expected to both do the work and improve the work.⁶ Improving the work requires real-time information that will allow staff to easily and quickly visualize whether improvement targets are being met; however, MSM did not have an information framework to support improvement. That gap led to the creation of the James Jones Daily Management and Incident Command Center (DMC).

The Goal

The vision for the DMC was to make select actionable information available in real time, to display the information transparently to multidisciplinary stakeholders, and to make the information easily accessible for both daily operations and potential disasters.

The Execution

Designing the System

We recognized that installing a new electronic health record (EHR) system was only part of the answer to our information flow needs. The Epic system, which was installed in March 2018, stores all of the information related to a patient encounter but does not organize the information in a way that helps to drive improvement. Therefore, to fully realize our vision, we perceived that we would need to design a system that would allow us to extract the critical information required for daily improvement of care processes.

Determining the most important information to be displayed was the work of the DMC Work Group. Starting in 2017, before the installation of the new EHR, the Work Group established a clear vision that focused on: (1) identifying real-time data to be pulled from the EHR; (2) aligning the data with our True North objectives; (3) setting targets and triggers for the information, which would then lead to action; and (4) protecting patient confidentiality.

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The work of identifying the information that would be required started with a series of meetings during which a multidisciplinary team of managers and clinicians shared all of their daily, weekly, and monthly data reports and then compared notes. We discovered that the reports were siloed and often outdated. Managers of interconnected workflows, such as those in the ED and inpatient units, did not have the necessary information to help them understand their impact on one another.

The DMC Work Group then sorted information into several themes: Capacity, Demand, ED Status, Operating Room/Procedure Status, Clinical Status, Case Management, Transitions of Care (TOC), Ambulatory, and Disaster. These themes (and their associated metrics) were chosen to align with core strategic goals and have iterated over time as we learned what was important to drive improvement.

Numerous facilitated meetings involving the DMC Work Group focused on selecting the information that would be needed to improve flow and safety at MSM. We established patient care outcome goals and included a wide range of driver metrics, such as the number of patients with a long length of stay (LOS), heart-monitoring (telemetry) capacity, and transport turnaround times. The information was then populated by data generated from the Epic software.

Finally, we created a vetting process to filter requests for adding or changing displayed information. To be displayed, each data element needs to connect to our True North goals, needs to be measured

in real time, and needs to be actionable. If the data element does not yield information that enables an immediate frontline reaction, it is not included.

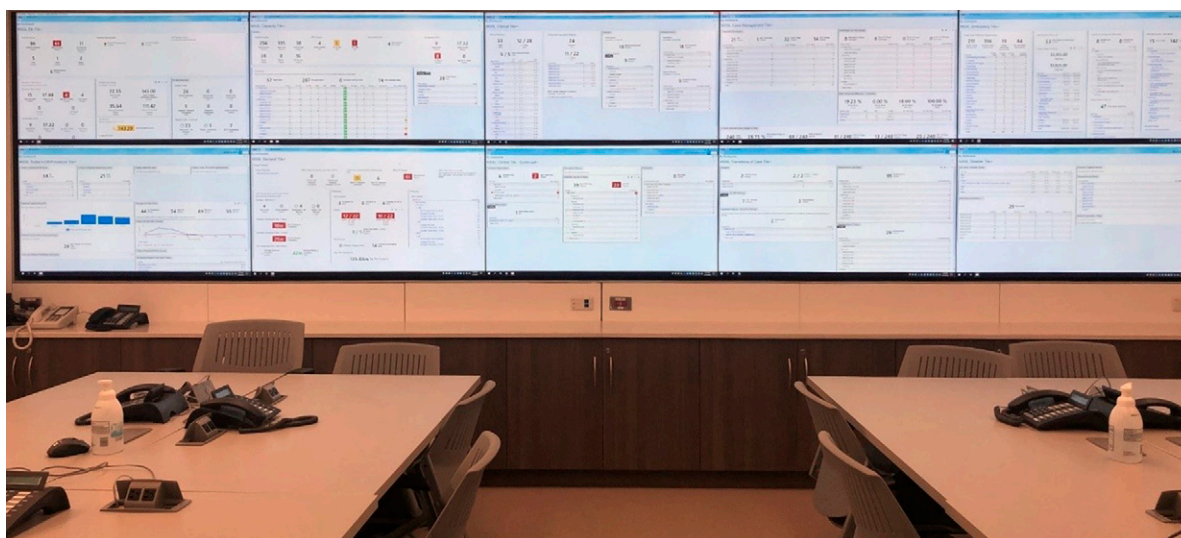
The next stage of our process began with the official launch of the DMC in October 2018.

The Daily Huddle at the DMC

Every weekday morning at 8:30 a.m., a 20-minute multidisciplinary safety huddle is held in the DMC, which houses 10 60-inch television monitors (also known as “tiles”) that serve as digital dashboards. Each tile covers a certain set of metrics pertaining to one of the data themes (e.g., the ED tile shows the number of patients waiting in the ED; the Demand tile shows the total number of telemetry beds requested). Executive leaders and managers from 34 services, both clinical and nonclinical, review the dashboards to identify any notable flow or safety triggers. The dashboard information is populated directly from Epic and refreshes every 3 to 5 minutes. Color-coding is used to indicate whether each metric is within normal limits (green), may soon need intervention (yellow), or requires immediate action (red) (Figure 1).

FIGURE 1

Photograph of the DMC



Source: The authors.

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During the huddle, representatives from the Environmental, Transport, and Imaging services review their turnaround times during the past hour and during the past 4 hours and discuss any obstacles. Representatives from other services, such as Food and Nutrition, Linens, Materials, and Biomedical Equipment, also report any current or potential obstacles. The focus on real-time information has transformed our daily safety huddle from one characterized by generalized responses of “all-safe” to one characterized by specific responses driven by data. The dashboards

provide the huddle team with clarity regarding the current status across multiple services, which allows for a focused and agile plan of immediate action.

Refining the Algorithm Through Validation Exercises

The incorporation of real-time information into the daily huddle was followed by a period of adjustment during which managers who had been used to static reports had to learn to accept data that were refreshed every few minutes. Validation exercises helped us to refine the data definitions, gain trust, and give managers a new perspective on their work — sometimes resulting in the discovery of previously unknown workflow defects. In some cases, the information displayed on the dashboards did not match the information on the static reports that had been previously provided to managers. In such cases, the data definitions were reviewed and updated to more accurately reflect what we intended to measure. In one instance, for example, a manager raised the question of whether the LOS metric referred to all patients or just medical/surgical patients. The validation process enabled us to quickly establish that the metric pertained to all patients. The transparency of this process has helped all of us to gain trust in the information and has given managers a more data-driven perspective on their work.

Using the Dashboard Data to Meet Specific Needs

Data targets and actual outcomes are transparently displayed on the digital dashboards. Managers react to the digital dashboards in real time and collaborate with one another to remove obstacles. For example, the number of “long-stay” patients, defined at MSM as patients who are in the hospital for 8 days or more, was not previously transparent. A greater number of long-stay patients results in fewer available beds for new admissions. Based on data review, we know how many long-stay patients will tip the scale to reduce flow at MSM. In our case, the target to maintain flow is a long-stay census $\leq 20\text{-}25\%$ of total census. Displaying the number of long-stay patients on the digital dashboards enables leaders and managers to immediately see if we are within the target range each day and to thereby focus their efforts on removing obstacles to hasten safe discharge of these patients.

“*Our baseline state of information flow can be described as ‘too much, too late, and too fragmented.’*”

The digital dashboards include multiple additional data points, such as the number of patients boarding in the ED waiting for beds, the boarder wait times, the number of discharge orders already written, and the open bed capacity. The information displayed on the tiles is linked to the actions expected for the director of the DMC and both inpatient and ED care teams. The focus then moves to the resources that will be needed to meet the identified demand.

The Team

An extensive team of managers, leaders, and IT professionals were involved in creating the dashboards that drive our management center. A core team consisting of the chief transformation officer, chief medical officer, IT leaders and project managers, and leadership from Admissions, Nursing, and Emergency Management began to identify the information elements that would be needed for daily clinical and nonclinical operations. Over several months, we also held multiple small, targeted sessions that included representatives from the ED as well as from Transport, Environmental Services, TOC, Medicine, Perioperative Services, Endoscopy, Radiology, Infection Prevention, Ambulatory Care, and Cardiology.

The Metrics

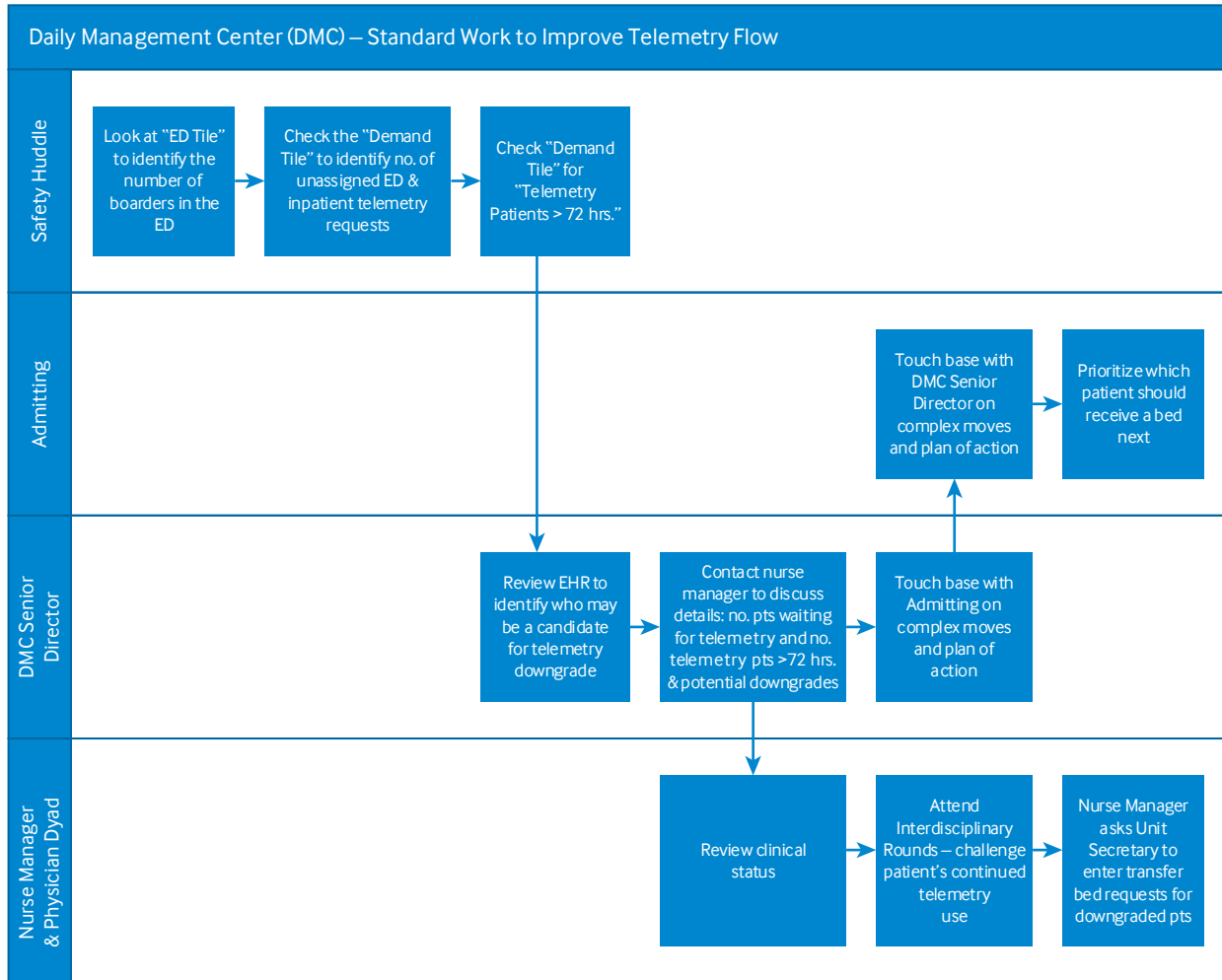
The DMC has allowed management to focus on the critical metrics that measure flow. This improved focus on flow has directly led to a number of specific improvements, some of which are described below.

MSM is a center for cardiac care, and many of our patients require cardiac monitors, which has been one of our major flow obstacles. Real-time information showing how many patients are on telemetry and how many patients are in the queue has driven improvement in flow. Our standard work to address a request for a telemetry bed is to identify available telemetry beds by checking the Demand tile. If no beds are available, we look at the data element that displays the number of patients on telemetry for more than 72 hours, because these patients are likely candidates to have telemetry discontinued. The senior medical director of the DMC reviews the EHR of these patients and consults with the providers to discuss the discontinuation of telemetry orders, as appropriate. In the 6 months preceding this standard work, the median duration of treatment with medical telemetry was 43 hours. In the 12 months since implementing the new standard work, the median duration of medical telemetry is 35 hours, representing a 19% decrease (Figure 2, Figure 3).

FIGURE 2

Process Map for Telemetry Flow

Process map for telemetry flow at MSM. hrs = hours, pts = patients.



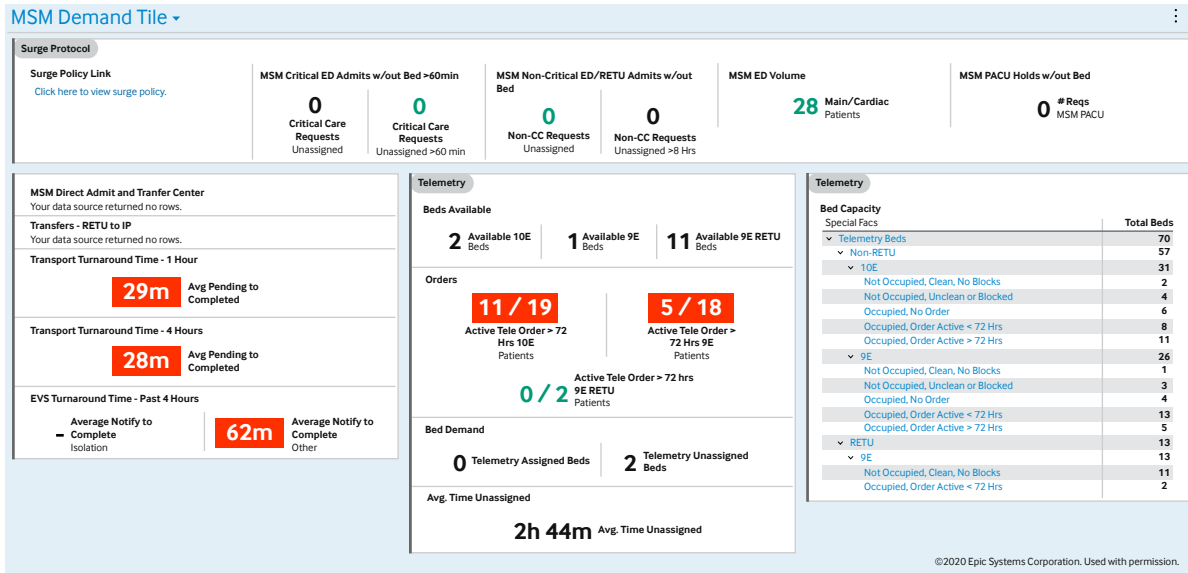
Source: MSM.

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FIGURE 3

Demand Tile Shows Telemetry Status

Demand tile at MSM. w/out = without, RETU = Rapid Evaluation and Treatment Unit, PACU = Postanesthesia Care Unit, CC = critical care, Hrs = hours, # Reqs = number of requests, IP = inpatient, Facs = facilities, m = minutes, Avg = average, Tele = telemetry, EVS = Environmental Services.



Source: MSM.

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Another factor contributing to improved flow is the fact that the digital dashboards have the flexibility to change according to needs. In response to the Covid-19 crisis, for example, we displayed how many Covid-19-positive patients and persons under investigation were in-house (as well as their specific locations). This information gave us immediate insight into the need for additional beds and possible locations for surges. We also monitored Covid-19-positive patient deaths, discharges, and movement to and from the critical-care units. The immediate availability of this information was vital for planning the many patient movements that were required for safety and was a core element of our successful addition of 60 critical-care beds within a very tight time frame. Our incident-management response confirmed how important flow is to patient safety. Driver metrics also were chosen to maximize sharing of resources across the Mount Sinai Health System, such as capacity for interhospital transfer of patients. To support a timely and effective response to a potential disaster, the DMC Workgroup designed the tiles to display the number and location of patients on ventilators, a strategy that proved useful in our response to Covid-19.

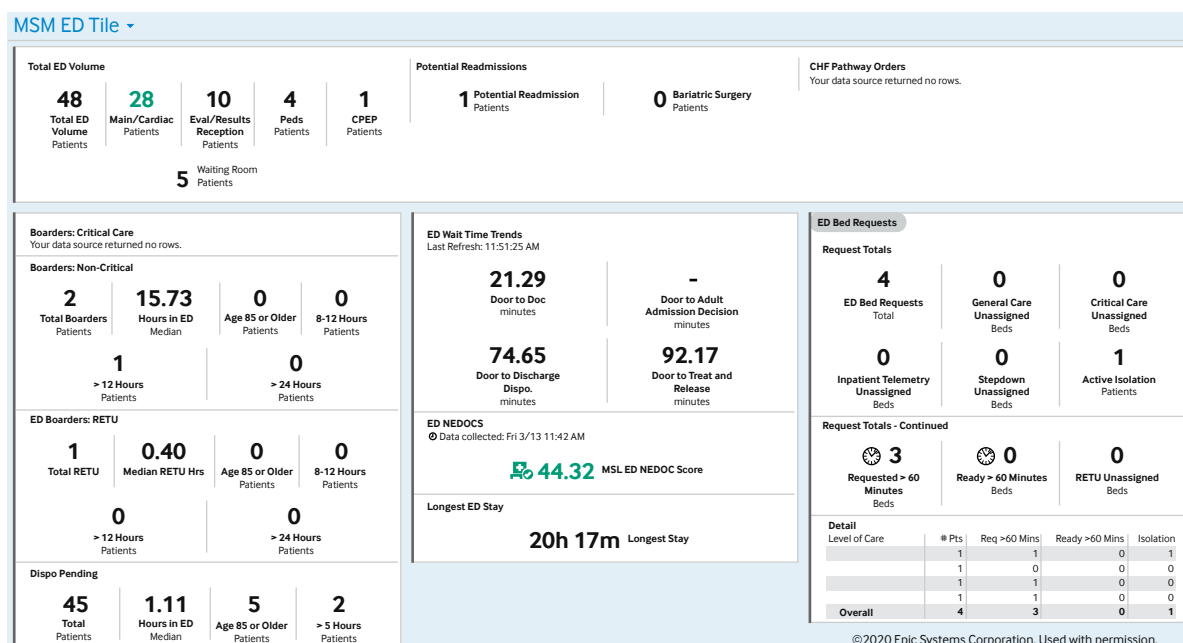
On a daily basis, the demand for inpatient beds exceeds our bed capacity. When support service turnaround times became available following the launch of the DMC, some obstacles to flow became very apparent. Flow management is no longer an isolated bed-board function in the Admitting department. A scan of the tiles in the DMC shows us the ED census; the bed requests from the ED, the transfer center, and the operating room; the number of patients who have already

been discharged; and the number of patients with completed discharge orders (Figure 4). The number of after-visit summaries that have been printed is also visible. Through our daily management improvement work, we now know that printing of the after-visit summaries is the last task in the nursing workflow before a patient is discharged, giving us a proxy of how long it will take until the patient actually leaves the hospital.

FIGURE 4

ED Digital Dashboard

ED digital dashboard at MSM. Eval = evaluation, Peds = pediatrics, CPEP = Comprehensive Psychiatric Emergency Program, CHF = congestive heart failure, Dispo. = Disposition, RETU = Rapid Evaluation and Treatment Unit, NEDOCS = National Emergency Department Overcrowding Scale, h = hours, m = minutes, Obs = observation, Tele = telemetry, # Pts = number of patients.



Source: MSM.

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MSM had 1,895 more discharges in 2019 than in 2018, without adding any more beds. Despite this 15% increase in volume, the average LOS decreased from 5.81 days in 2018 to 5.56 days in 2019. When adjusted for the decrease in LOS, the incremental discharges equate to 2,620 “days gained” and increased capacity for an additional 476 patients. Adjusting for case mix, the contribution margin from the increased flow is about \$11.7 million.

Where To Start

Leaders can start by identifying the information that will result in action. Leaders can create a real-time or near-real-time online dashboard and align this information framework to a daily management system. In our case, we integrated data from our EHR with our daily safety huddle,

during which each participant reports the key information in their area. Every colleague can use the reported information to improve their own operations. At MSM, we have used the information framework, combined with our management system, to increase flow, reduce safety events, reduce waste, and improve experiences for patients and staff.

Because of our need for constant emergency preparedness, MSM chose to dedicate a space as a command center, and this area was a natural fit for displaying our digital dashboards. We also chose an in-person safety huddle, which has fostered transparency and accountability and has led to a better understanding of our interconnected workflows as well as improved teamwork. The behaviors and thinking practiced in our safety huddle were core elements of our successful navigation of the Covid-19 crisis. Everyone knew what information was required for decision-making, and the information was immediately available. Social distancing due to Covid-19 precautions has led to the temporary creation of an alternative model; the safety huddle is currently conducted by phone, with only a small management team in the DMC.

Hurdles

The first hurdle in the process was to share the vision for the DMC with our IT team. That team embraced the vision and built the electronic infrastructure. Since the DMC Workgroup designed the dashboards almost a year before we had access to the new EHR system, our IT partners helped us to understand what content was already included in the EHR and what content might need to be created.

We had already committed to building a space for incident command management and knew that the necessary information would need to be available in that space, but we had to decide how to display it. We considered the option of viewing the dashboards on individual personal computers, which was popular among some of the members of the team, but ultimately decided that displaying the dashboards in a way that could be viewed at the same time by multiple stakeholders would allow for transparency of information. It would also allow the safety huddle and incident management teams to quickly see and understand data themes across departments, breaking down the usual siloed review of data, allowing managers to see their impact on one another, and fostering teamwork between the managers.

Lessons Learned

A seemingly infinite amount of information can potentially flow through the DMC. As tempting as it is to add data, we realize that we will contribute to information overload if we do not maintain a small list of carefully selected data inputs. We have experimented with multiple iterations of the dashboards, resulting in the removal of some of the original driver metrics and the addition of others. In some cases, after learning more about our operations, we set new thresholds for targets. We are guided by the originally articulated vision that information coming into the DMC must be in real time, transparent, and connected to standard work or action.

Next Steps

We are in the infancy of harnessing the power of the information that is available to us. In addition to leveraging real-time descriptive analytics from our EHR, we are working on incorporating predictive analytics into our daily work. Data scientists at Mount Sinai have developed many algorithms for predicting both clinical and nonclinical changes in status. For example, we want to be able to accurately predict census. We know that flu season will result in an uptick in ED visits and inpatient admissions. Exploiting this information to forecast future demand may help us plan more accurately for staffing and other resources.

Lucy Xenophon, MD, MPH

Chief Transformation Officer, Mount Sinai Morningside, New York, New York, USA

John Toussaint, MD

Executive Chairman, Catalysis Inc., Appleton, Wisconsin, USA

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