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IN DEPTH

Development and Expression of a High-Reliability Organization

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Health care organizations have increasingly adopted the principles of high-reliability organizations to improve their safety and quality. These principles must be built into the culture of the organization as well as into the systems and frameworks used to improve processes and evaluate outcomes in a learning health care system. On the basis of its experience responding to disasters — including emerging diseases, tropical storms, and the Covid-19 pandemic — Houston Methodist has established a culture of continual improvement and a learning health care system that supports this goal. In this article, Houston Methodist's leadership reviews the principles of high-reliability health care organizations, describes the tools and systems that Houston Methodist has used to adopt these principles, and explains how these efforts aided in operations during the pandemic.

A high-reliability organization (HRO) is an organization that consistently performs safely, efficiently, and with high quality even in the face of complex challenges with high hazard potential. The HRO concept, which has connections to normal accidents theory,[1] garnered attention around the turn of the century[2,3] and was embraced by health care leaders who found it relevant to their industry.[4] Health care organizations are complex environments of rapid innovation; narrowly focused specialties; and crises, such as emerging diseases. Many organizations have recently worked toward becoming HROs by developing approaches and systems to avoid life-or-death errors even in such an environment. Comprising an eight-hospital system with a flagship academic medial center (Houston Methodist Hospital), six community-based hospitals and one long-term acute care hospital. Houston Methodist has 2,541 operating beds, over 26,000 employees, more than 1,000 employed physicians, and over 4,000 affiliated independent physicians. With Weill Cornell College of Medicine as its primary academic

affiliation, Houston Methodist includes an independent academic institute with annual research funding of one hundred and fifty million dollars, and responsibility for education of over 300 residents and fellows in 59 clinical programs. At Houston Methodist, our focus for the past decade has been to become an HRO and a learning health care system[5] where we can safely perform our normal work on a daily basis and seamlessly shift into disaster mode, when necessary, without sacrificing the quality of care for our patients or the well-being of our employees. Our status as an HRO has been validated by measures of quality and safety, including the 2021 Vizient Quality and Accountability Study, in which all of Houston Methodist's seven hospitals ranked in the top 10% of their respective cohorts. Establishing ourselves as an HRO enabled Houston Methodist to quickly and efficiently meet the unprecedented challenges of the Covid-19 pandemic. This article will discuss the principles of an HRO and how they can be implemented in a health care system, as exemplified by Houston Methodist.

Foundational Elements

The journey begins with a commitment to become a health care learning system and by embracing the five principles of HRO theory. Those principles must be applied to the health care envionment[6]:

1. **Deference to expertise.** Within an HRO, all subject matter experts should have a voice. In the health care setting, the nurses, medical trainees, physicians, and other staff on the front lines often have the most insight into an organization's operations. Leaders should therefore consider that input essential for situational assessment, engagement, and action. HROs must also acknowledge and incorporate the expertise of another group of individuals integral to the organization: patients. Patients are the most qualified to tell us about their needs in the care process.

2. **Sensitivity to operations.** Highly complex organizations have many interconnected systems that must function cohesively for day-to-day operations, and this is even more crucial in times of crisis. Being sensitive to operations means having both a detailed understanding of the state of current processes in play as well as a big-picture understanding of operational complexity and how those processes intersect. In health care, those on the front lines are often most sensitive to flaws in the system and are critical to making improvements in workflows and processes.

3. **Preoccupation with preventing failure.** HROs dedicate significant time and resources to proactively preventing failures. Scenarios are carefully planned to anticipate defects in both current processes and in planned improvements that could lead to failure or misunderstandings. Through auditing, collecting, and analyzing data, as well as by building dashboards, organizations can identify processes requiring improvement. Small failures and near-misses are treated as serious symptoms of larger problems in the system that must be identified and resolved in a timely manner.

4. **Reluctance to simplify.** It is tempting to simplify processes in a system as complex as a multihospital health care system by developing workarounds and universal solutions to

failures. However, HROs accept that complex systems have numerous areas for potential failure and seek to understand new and unexpected failures. They look as far upstream as possible for the root cause to best prevent failures in the future.

5. **Promotion of resilience.** When major challenges arise, HROs are prepared to respond as effectively as possible to detect and contain errors. This depends on having the structure, resources, and culture in place to anticipate trouble spots, improvise during unexpected situations, and correct errors in real time.

The activities of a learning health care system support those HRO principles through the capture and analysis of data on operations and outcomes. This requires aligning science, informatics, incentives, and culture toward continuous improvement. Although the data can be incomplete and, therefore, more challenging to analyze,[7] they are a rich source of information on areas for improvement that should not be ignored.

While there are considerable challenges, a recent review synthesizing the evidence from publications regarding health care organizations implementing HRO initiatives[6] shows that organizations reported a reduction in preventable harm, 55%–100% fewer serious safety events, and better communication around safety.

Establishing an HRO at Houston Methodist

In this article, we address two key aspects in the transformation to become an HRO: a culture of safety and the learning health care system.

Culture of Safety

At Houston Methodist, our culture was already well aligned with HRO principles when we began making concerted efforts to implement them. There was a leadership commitment to meeting zero-harm goals, establishing a positive safety culture, and insisting on a robust process improvement culture. This culture is represented by our ICARE values — integrity, compassion, accountability, respect, and excellence — that are expressed at every level of our operations, from our smallest everyday activities to planning the future of our organization.

> *"In health care, those on the front lines are often most sensitive to flaws in the system and are critical to making improvements in workflows and processes."*

Integrity and accountability force us to confront mistakes rather than create workarounds, consistent with the HRO principle of being reluctant to simplify (Principle #4). We have long been committed to the well-being of all members of our health care team and value their input and concerns regarding processes and patient care, thus deferring to expertise (Principle #1). All

Houston Methodist employees are trained in these values and in how to demonstrate them to patients, coworkers, and the community. This lays the foundation for our efforts toward becoming an HRO. We celebrate the execution of these behaviors through several venues. At meetings of the Board of Directors of Houston Methodist, we give "good catch" awards to those individuals who have prevented harm to patients by averting a near-miss. On an annual basis, we solicit nominations and give Culture of Safety awards to individuals and teams across our system.

Such an award was given recently to a catheterization laboratory technologist. A patient who reported chest pain 2 days earlier was noted to have a mildly elevated enzyme (troponin) suggestive of myocardial infarction. The patient was brought to the cardiac catheterization laboratory to investigate the cause of chest pain and elevated troponin. An angiogram was performed, and no blockages were found during the procedure. Before the patient was transferred to the holding area, the technician who was assisting in the case spoke up and shared with the attending cardiologist that he thought there might be a previously unobserved blockage in the ramus intermedius branch, a blood vessel that occurs in a minority of people. The cardiologist and the technician reviewed the case together and agreed that there was a potential "stump" of a vessel, which could represent an occluded ramus intermedius branch. The patient was informed of this possibility, and a repeat angiogram was performed. A blockage in the ramus intermedius was confirmed, a coronary stent was placed, and the vessel was reopened. This case represents the importance of all employees speaking up and identifying potential concerns; had the technologist not been empowered to share his observations, the patient's quality of care would have been reduced significantly.

Learning Health Care System

Houston Methodist uses several improvement and evaluation tools to work toward being an HRO, which also support our parallel efforts to become a learning health care system, including:

- **Communication tools.** Our clinical teams are trained so that, on a daily basis, when confronting complex issues, they communicate within the SBAR framework: describing the **S**ituation, providing the **B**ackground, formulating an **A**ssessment, and presenting their **R**ecommendations. They are trained and rewarded to stop the line with scripted, nonconfrontational, and nonjudgmental language such as "Doctor, I need clarification of this order," and to use the CUS tool: "I am **C**oncerned" escalating when necessary to "I am **U**ncomfortable," and, when there is imminent danger to a patient, "This is a **S**afety issue."

- **PDSA paradigm.** To implement new projects, measure their impact, and adjust to improve the project, we routinely and formally use the **P**lan, **D**o, **S**tudy, and **A**djust (PDSA) paradigm. In the PDSA structure, the A commonly refers to Act. However, Adjust more fully reflects the nature of continuous improvement and promotes a culture of experimentation that includes learning from results. Our PDSA work is conducted with data collection and analysis that drive required adjustments to enable the success of a project.

- **Root Cause Analysis (RCA).** When near-misses, harmful events, or unexpected poor outcomes occur, we gather all data and use cause mapping and common cause analysis in an

RCA to find the factors that led to the error and then formulate actions. Our process is rooted in Just Culture,[8] with a primary focus on identifying system issues that enabled a defect (error) to occur. If an individual error is identified, we endeavor to determine the cognitive bias that may have influenced the outcome, such as framing bias, anchoring bias, or confirmation bias. We share our learnings throughout our system through chief nursing and medical officer councils, presentations to our Boards of Directors, and education processes to train our staff. Our RCAs and learnings direct our strategic planning, training, and focus issues throughout the year.

- **Lean Six Sigma.** Lean Six Sigma tools such as A3 and Kaizen events are used to identify and remove process waste and to fix errors. Although Lean methods are historically focused on removing waste, we do not distinguish the use of Six Sigma and Lean depending upon whether we are focusing on removing defects or other process wastes. We advocate A3 thinking for problem solving, and the A3 structure works well for addressing all types of problems, because it is rooted in PDSA and the scientific method of problem solving. The Kaizen life cycle, from problem identification to countermeasure implementation and sustainability, can range from 7 weeks to 21 weeks. These projects result in a reduction in variation and the development of standard work.

Quality and safety measures — including risk-adjusted mortality index, hand hygiene compliance, and various postoperative complications — are reported monthly to the Houston Methodist Board of Directors. We have seen significant success across our system in improving key measures of quality and patient safety. For example, after implementing a sepsis-prevention program,[9] sepsis-associated inpatient deaths at Houston Methodist Hospital (HMH) fell from 29.7% in 2006 to 9.4% in 2021. In Vizient's Comprehensive Academic Medical Centers cohort, since 2019, HMH has ranked first in mortality in Vizient's Quality and Accountability Study (Q&A) (Table 1). In Vizient's Large, Specialized Complex Care Medical Centers cohort, Houston Methodist Sugar Land ranked #1 in the mortality and safety domains in the 2020 Q&A and #3 in safety in 2021. In Vizient's Complex Care Medical Centers cohort, Houston Methodist The Woodlands ranked #1 in safety in the 2020 and 2021 Q&A and #2 in mortality in 2021.

Table 1. Performance of Houston Methodist in Quality and Accountability

Vizient cohort	Comprehensive academic medical center	Large specialized complex care medical center	Complex care medical center				Community hospitals
Centers in cohort (n)	101	117	121				226
	HMH	HMSL	HMB	HMW	HMWB	HMTW	HMCL
Overall rank	6	4	8	4	9	1	22
Mortality rank	1	6	7	10	12	2	32
Safety rank	9	3	24	16	17	1	9

Results of the Vizient Quality and Accountability Study for 2021 include cohorts that are defined by complex caseloads. Medical centers are ranked overall on the basis of performance in six domains, which include mortality and patient safety. Six Houston Methodist hospitals are in the top 10 for their cohort, with five ranking in the top 10 for mortality. All Houston Methodist hospitals rank in the top 25 for safety. HMH = Houston Methodist Hospital, HMSL = Houston Methodist Sugar Land Hospital, HMB = Houston Methodist Baytown Hospital, HMW = Houston Methodist West Hospital, HMWB = Houston Methodist Willowbrook Hospital, HMTW = Houston Methodist The Woodlands Hospital, HMCL = Houston Methodist Clear Lake Hospital. Source: Belimat Askary, Houston Methodist

Another way that we evaluate the safety improvements made through these formal processes is by conducting an annual Culture of Safety survey of all 26,000 clinical and nonclinical employees. Since the survey was established in 2017, we have had an 85% rate of completion among our employees. Questions focus on prevention and reporting, resource and teamwork, pride and reputation, and direct care safety items. Employees indicate how strongly they agree with safety-related statements, including the following:

- I can report patient safety mistakes without fear of punishment.
- In my work unit, we discuss ways to prevent errors from happening again.
- Employees will freely speak up if they see something that may negatively affect patient care.
- We are actively doing things to improve patient safety.
- Mistakes have led to positive changes here.
- When a mistake is reported, it feels like the focus is on solving the problem, not writing up the person.
- Where I work, employees and management work together to ensure the safest possible working conditions.
- I feel free to raise workplace safety concerns.

In 2020, Houston Methodist scored significantly higher than the National Top Decile Average on each of these questions. Only 1%–7% of Houston Methodist employees responded unfavorably to these questions (Appendix).

Because Houston Methodist is a large and complex system, there are quality and safety staff and leaders at multiple levels to track, analyze, and interpret safety and quality information and to make data-driven improvement decisions. For example, there is a system-wide quality and patient safety team, and each of our hospitals within the system and our employed physician organization has a quality and safety officer. Each of these officers reports directly to their CEO and indirectly to the system chief physician executive. Quality and patient safety committees at multiple levels report to the System Quality Integration Committee. Keeping the highest levels of leadership involved in safety and quality while incorporating input from the front lines is essential to ensure the entire Houston Methodist system is focused on improving processes and outcomes.

> *"While the HRO principle of preoccupation with failure can lead us to be extremely careful and make small, incremental changes, we also need to be willing to take risks in developing and implementing new technologies and systems."*

Houston Methodist considers innovation a priority in all areas, including patient care, business processes, and scientific research. The Houston Methodist Center for Innovation is focused on driving medical care and research forward in creative and novel ways. Many members of our quality and safety teams also contribute to the Center for Innovation, tying this group closely to existing operations. While the HRO principle of preoccupation with failure can lead us to be extremely careful and make small, incremental changes, we also need to be willing to take risks in developing and implementing new technologies and systems. The key to doing this responsibly is transparency: we continually communicate our new developments with our employees and with the community, encouraging feedback while generating the excitement needed to drive new discoveries.

As an academic medical center, we are well prepared to collect data on our operations and outcomes and draw conclusions that are scientifically sound. The Houston Methodist Academic Institute, which includes our Research Institute and Education Institute, is focused on translating discoveries into better patient care and preparing the next generations of clinicians and scientists. Our Center for Outcomes Research (COR) aims to improve health outcomes for diverse patient populations by designing, testing, and implementing health care innovations. Operating within project-by-project institutional review board approval, COR has direct access to data from our enterprise electronic health record so that we can gain real-time insights into the impact of our treatment on clinical outcomes and adjust treatment when indicated (i.e., the essence of a learning health care system).

This integration between clinical and research activities allows faster application of data to decision-making. After Hurricane Harvey devastated the Houston area in 2017, COR found that patients who had used the patient portal in the 4 weeks prior to the storm were much more likely to use the portal during the storm; portal communication facilitated updating appointments, redirecting prescriptions, responding to patient queries, and providing referrals for displaced residents.[10] This led Houston Methodist to develop training programs to familiarize patients with the portal in preparation for future challenges. During the pandemic, COR created a surveillance and outcomes registry that set the stage for all of the clinical Covid-19 outcomes research at Houston Methodist.[11] This registry allowed COR to examine racial and ethnic disparities in Covid-19 infection in 2020,[12] and when the Covid-19 vaccines became widely available in 2021, this information drove Houston Methodist's efforts to increase vaccination rates in populations at higher risk of infection. In addition to driving new improvements, COR is equipped to evaluate projects that are implemented to improve patient care and to identify their limitations and barriers. For example, as the pandemic began, telehealth visits were offered to patients with cancer, a highly vulnerable population, in place of in-person visits. COR scientists worked with those in the Houston Methodist Cancer Center to analyze the types of patients who chose to participate in telehealth visits, patient satisfaction, and provider satisfaction.[13] By having the resources in place to carefully and rigorously analyze the innovations that we implement, we can be sure they are leading to real improvements and solving critical problems.

Expression of HRO Principles in a Pandemic

For many organizations, the Covid-19 pandemic has exposed strengths and weaknesses, refined priorities, and driven innovation. At Houston Methodist, the pandemic has illuminated which parts of our culture are most important for reliable and resilient performance in the face of challenges. Our experience handling natural disasters, typically in the form of hurricanes and flooding events common on the Gulf Coast of Texas, has prepared us to shift resources, reprioritize activities, and maintain efficient communication. Although our established values and system coordination provided a resilient structure, it was the need for mobilizing and engaging (essential behaviors required to combat the pandemic) that necessitated a deliberate, structured, multipronged approach. In this article, we highlight how our HRO principles and established infrastructures allowed us to effectively communicate with employees and the public, safely deliver Covid-19 treatments and vaccines, and rapidly convey changes and needs within clinical units.

> *"The high physician approval of communication and leadership is not a national trend; a survey conducted by the University of Chicago found that only 53% of physicians report trusting their organizational leadership."*

Deference to Expertise, Principle #1

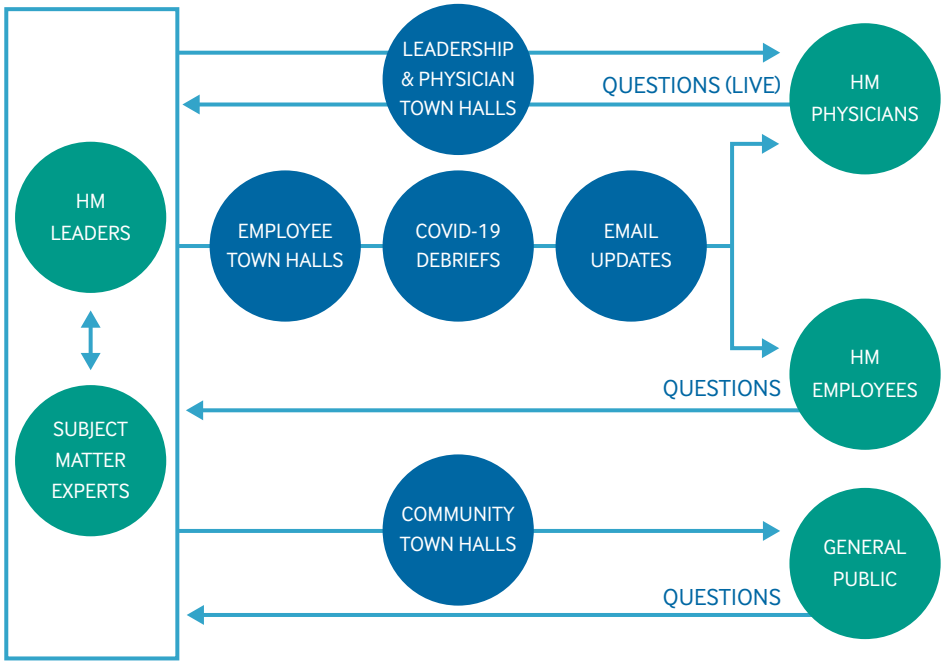
Expertise, rather than authority, must take precedence, especially during a crisis. When conditions are high risk and change rapidly, on-the-ground subject matter experts (physicians and other staff) are essential for situational assessment and engagement; they must have a voice. It is critical to create a cohort of experts to distill the most essential and timely messaging within the established culture of promoting the safety and well-being of patients and our entire health care team. As an academic medical system with research and clinical expertise, Houston Methodist built out a centralized system-level Incident Command as well as entity-level (localized) command centers to ensure that messaging was consistent, accurate, precise, and timely. Early in the pandemic, system-level Incident Command met daily to review input from researchers, frontline workers, and assembled panels and worked to synthesize and prioritize messages. Messaging policies and content were then disseminated through the command structure. To serve and engage those within our system while maintaining our commitment to give everyone a voice, we continue to take both a top-down and a bottom-up approach toward communication, creating a feedback loop (Figure 1).

Our communication strategy during the pandemic and the four Covid-19 surges, discussed below, allows for input from multiple levels, including panels of physicians, executive groups, and frontline workers. The voice of frontline workers was particularly critical in establishing policies on elective surgeries.[14,15] Physician/leadership town halls are key in ensuring that hospital and patient care leaders have an opportunity to ask questions of the experts and understand the most accurate and up-to-date information on Covid-19 and hospital policies. Employee town halls ensure that employees at all levels have opportunities to seek answers of

FIGURE 1

Communication at the Hospital Includes Feedback from Employees

The Houston Methodist (HM) communication model features top-down and bottom-up communication pathways designed to accommodate the needs of physicians, employees, and the general public.



Source: Rachael Whitehead, MS

concern to themselves and their families. On average, physician/leader and employee town halls have been attended by more than 800 people and lasted 90 minutes. Community town halls are used to provide expert guidance to the greater Houston area to ensure that everyone in the region has a trusted source of accurate Covid-19 information. In addition to town halls, a dedicated Covid-19 information email, existing HR departments, and existing employee health departments provide at least weekly and often daily updates on pandemic and hospital policies (Figure 2).

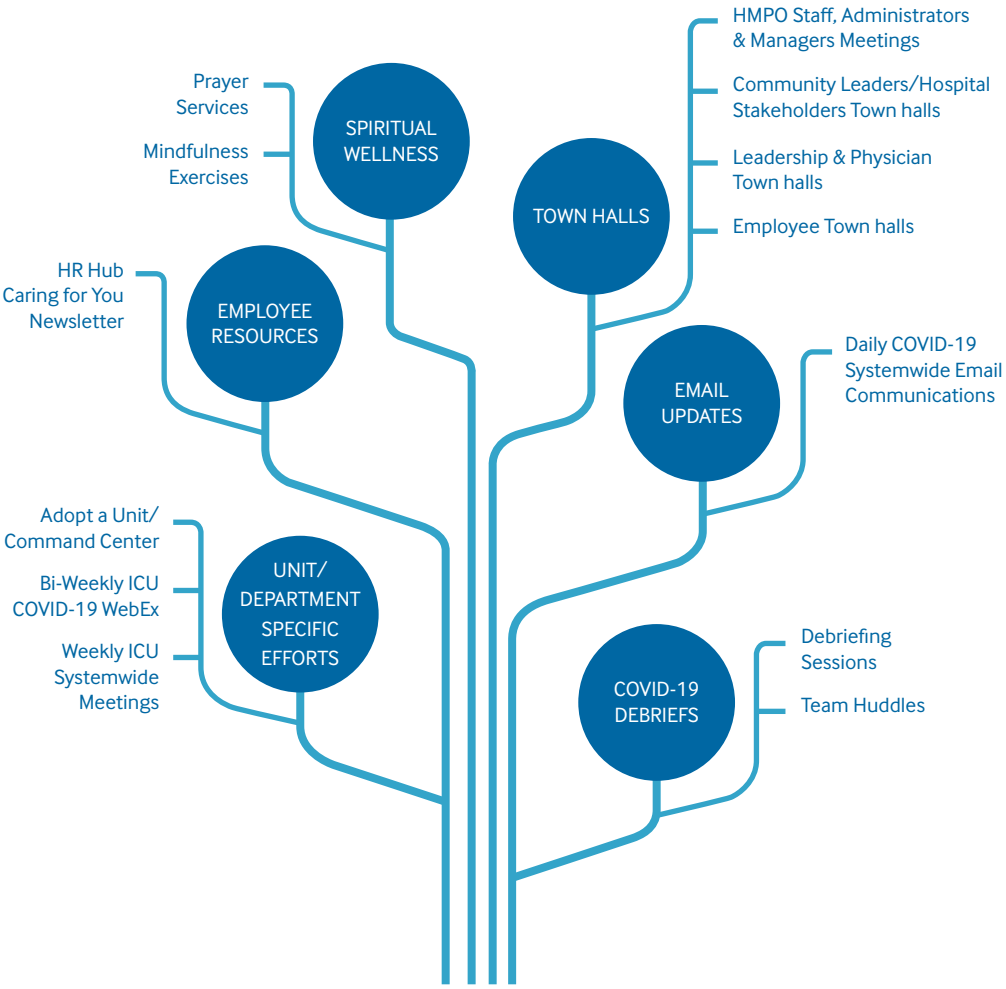
Ensuring that our employees have many opportunities to provide input has built rapport with key groups, ensuring that messaging has a high impact. Employees appreciate that communications are consistent, timely, and honest. This enables employees to rely on these mechanisms for critical news and information. Feedback is solicited in each communication to ensure staff voices are heard.

We are able to assess our communication strategy according to questions submitted by staff before biweekly town halls and by the live questions asked during the weekly physician/leadership town

FIGURE 2

Mechanisms of Communicating with Staff

A variety of communication mechanisms are deployed to ensure that a useful format is available to suit the needs of staff and stakeholders on the basis of their preferences and circumstances. HM = Houston Methodist, HMPO = Houston Methodist Physician Organization.



Source: Rachael Whitehead, MS

halls, as well as through the topics of those town halls. During the first surge in spring 2020, town halls focused on readiness, treatment algorithms, infection control, personal protective equipment (PPE), and ICU capacity. During the same period, our staff had questions regarding testing, PPE, ICU capacity, and convalescent plasma. Throughout the second surge in summer 2020, our town halls focused on reviewing the stages of the pandemic, convalescent plasma and other therapies, and ICU capacity, mirroring staff questions on PPE, convalescent plasma and other therapies, and testing. In the fall and winter of 2020, which included a third surge, town halls covered vaccines

and rollout strategies, monoclonal antibodies and other therapies, testing, and PPE. Our staff questions were focused on vaccination, testing, monoclonal antibodies, and PPE.

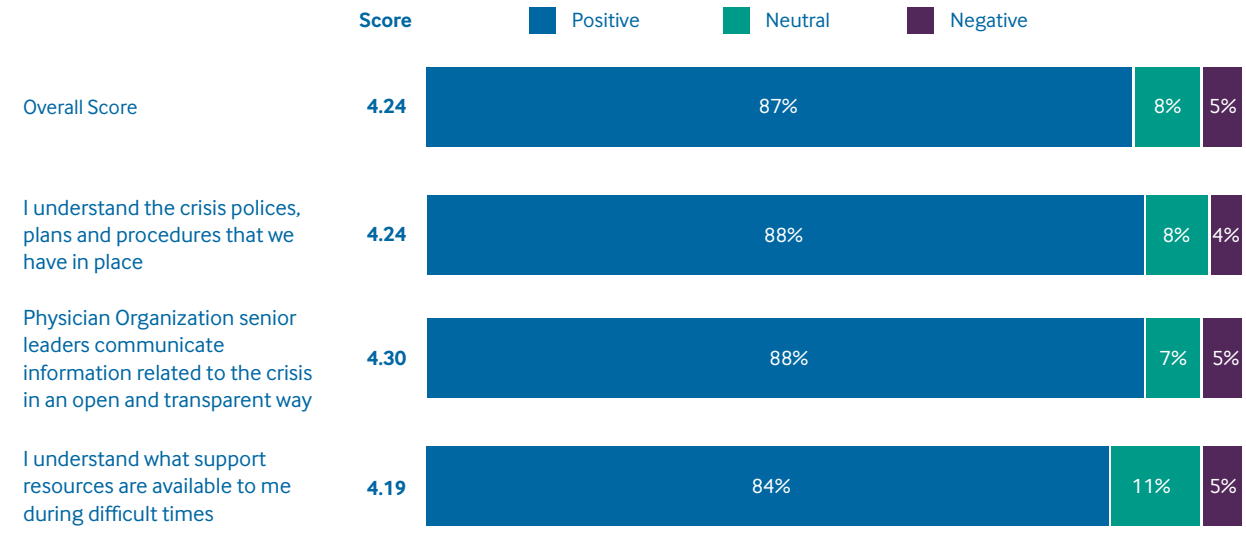
During the fourth surge in the summer and fall of 2021, questions focused on the demographics of hospitalized patients (e.g., percent unvaccinated vs. vaccinated), whether we are evaluating the impact of exemptions from our vaccine mandate for pregnant and lactating women as vaccine safety in this population emerges, and advice on the safe return of children to school. These and other issues are being addressed in ongoing town hall meetings, direct one-on-one communications with physicians and employees, and email communications from leadership. The close alignment of town hall topics and questions submitted to leadership indicates that Houston Methodist successfully anticipated and responded to staff concerns.

In October 2020, Houston Methodist conducted an employed physician–specific survey. We invited 856 physicians to participate and received 685 responses, a response rate of 80%. Three questions were included to assess the physician response to Covid-19 communication over the previous 8 months. Physicians were asked if they understood the crisis policies in place, if communication related to the crisis was open and transparent, and if they knew what support resources were available; a Likert scale was provided for responses. Overall, 87% of Houston Methodist physicians had a favorable view of Covid-19 communications, with only 4%–5% of physicians responding negatively to the communications (Figure 3). The high physician approval of communication and

FIGURE 3

Physicians Assess Covid-19 Communications Effort

In response to a survey, nearly nine in 10 physicians expressed support for components of Houston Methodist's communication efforts related to the Covid-19 pandemic.



Source: Rachael Whitehead, MS

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leadership is not a national trend; a survey conducted by the University of Chicago found that only 53% of physicians report trusting their organizational leadership.[16] Physician satisfaction with communication at Houston Methodist was a factor that drove the 2020 Press Ganey engagement and alignment survey results: the Houston Methodist Physician Organization was in the 89th percentile for engagement and 96th percentile for alignment with leadership.

Sensitivity to Operations, Principle #2

Our physicians and other staff on the front lines are best positioned to recognize defects and to identify opportunities for improvement in workflows and processes. A key tool in this process is the use of a platform developed by Evergreen, Colorado–based Safe & Reliable Healthcare: LENS (**L**earning and **En**gagement **S**ystem) boards, which locally are referred to as digital learning boards. These are digital whiteboards configured so that staff can post any issue or concern and have their voice heard, validated, and acted upon by management. Digital learning boards are unit specific for most employees, facilitating in-unit communication; some leaders, including those in System Quality and Patient Safety, have access to boards outside of their unit. While some boards are placed in break rooms, most are placed in areas visible to staff or patients; boards are located in the area where the unit huddles to promote use. Employees can engage with the boards through their touch screen capabilities, but many users choose to interact through their phones or computers.

> *"In the ICUs measured, burnout climate perception decreased by 7% after digital learning boards were implemented, and personal burnout was down by 8%. When examining teamwork, there were no significant changes from before to after digital learning boards, but units reported reduced communication breakdowns."*

In 2018, we began using digital learning boards to help our clinical teams communicate about cultural, clinical, and operational issues. Through this project, we hoped to express our HRO principles in a way that would improve our processes and thereby improve quality and safety. All staff within a unit can add to the digital learning boards, even by text message, giving everyone an equal voice. Each team member is an expert on their particular role in the patient care process, and the rest of the team can then defer to their expertise in identifying issues and suggesting improvements. This enhances sensitivity to operations because everyone can see the issues that their team members are facing in real time. Leaders, such as unit managers, can then prioritize, address, and update these issues immediately; when appropriate, these changes may be extended beyond the original unit where they were proposed. Overall, this helps to build a culture that normalizes sharing issues and ideas and that avoids simplifying or working around problems. These digital learning boards also strengthen the cohesiveness of teams. The boards can improve communication between day and night shifts and allow new team members to be introduced to everyone more quickly. There is also a community tab for sharing personal updates, posting photos, and congratulating colleagues on achievements. By solidifying their

relationships, teams become more resilient, and so does the organization as a whole. In a 1-year period (October 2020–October 2021), digital learning boards had 708 active users who identified more than 2,400 issues; 95% of units use the digital learning boards for updates, and 66% use the boards for huddles.

We analyzed improvements in engagement, teamwork, and burnout in nine ICUs from before (March 2019) and after (February 2020) implementation of the digital learning boards in a survey separate from the annual employee survey. In 2019, 1,225 ICU physicians and staff were invited to respond, with 686 responses received. In 2020, 1,205 ICU physicians and staff were invited, and 518 responses were received. Employee engagement was measured as part of our annual employee opinion survey, an important tool for understanding our culture and teams. Units are categorized in a three-tiered structure on the basis of survey responses, in which Tier 1 represents high engagement and low rates of burnout and Tier 3 represents low engagement and significant burnout in need of intervention. Before digital learning boards, seven of the nine ICUs ranked their engagement at Tier 1 and the other two at Tier 2. After implementation, all nine ICUs ranked engagement at Tier 1.

Burnout and teamwork were assessed using Safe & Reliable Healthcare's SCORE Survey. This survey captures both personal burnout and the perception of burnout climate, which can include how the environment affects other employees around them. In the ICUs measured, burnout climate perception decreased by 7% after digital learning boards were implemented, and personal burnout was down by 8%. When examining teamwork, there were no significant changes from before to after digital learning boards, but units reported reduced communication breakdowns (212 reports in 2019 and 150 in 2020). We are always striving to create better environments for our employees, so there are likely confounding factors that affected these improvements. However, on the basis of our communication with employees, we expect that the digital learning boards were one contribution.

During the pandemic, these digital learning boards have allowed our Incident Command to communicate constantly changing processes and priorities to clinical teams, which helps increase sensitivity to our day-to-day operations. The evidence-based changes we made in patient care processes and hospital policies were reiterated on the digital learning boards, and staff were able to ask questions to make sure they understood the changes. For example, the changes to PPE reuse guidelines were drastically different from those before the pandemic-driven shortages, and units had questions about how to follow the guidelines in certain situations. The boards also functioned in the opposite direction, bringing frontline workers' concerns and updates to Incident Command in real time. This was facilitated by labeling posts on the basis of categories and creating reports to summarize issues. For example, staff proposed new procedures to disinfect items and surfaces that had not been a concern before Covid-19.

In addition to process and operations issues, the digital learning boards allowed the sharing of immediate concerns with the team, such as possible Covid-19 exposures. To improve resilience, Houston Methodist created an adopt-a-unit program that connected nonclinical departments with a specific Covid-19 unit to volunteer their support and encouragement. This program was able to make use of the digital learning boards to share their messages and images with the

entire team and to let them know when gifts or treats were available. Overall, this multidirectional communication tool has allowed us to maintain the highest quality care possible during this challenging situation. As a result of the success of the digital learning boards, our ED and operating room (OR) councils have requested boards for all EDs and ORs throughout our system.

Preoccupation with Preventing Failure, Principle #3

As an HRO, we focus on identifying potential failures or misunderstandings in the process of patient care before they occur. A prime example of this was paying constant attention to the safety protection afforded by our PPE during the Covid-19 pandemic. Houston Methodist established a procedure for reprocessing PPE, including N95 masks essential to critical care workers, very early in the pandemic. By working with our research enterprise, we developed safety protocols that were peer reviewed and distributed to our staff.[17] We held multiple town halls and created newsletters explaining the process by which PPE would be sterilized and the science behind its safety and efficacy. Overall, while PPE remained a large concern for our staff, the reprocessing program was successful, in part because of our targeted messaging strategy and anticipation of potential problems in the reprocessing protocols before they occurred. As a result, we had a low rate of severe acute respiratory syndrome coronavirus 2 infection among our patient-facing employees.[14]

> *"In addition to process and operations issues, the digital learning boards allowed the sharing of immediate concerns with the team, such as possible Covid-19 exposures."*

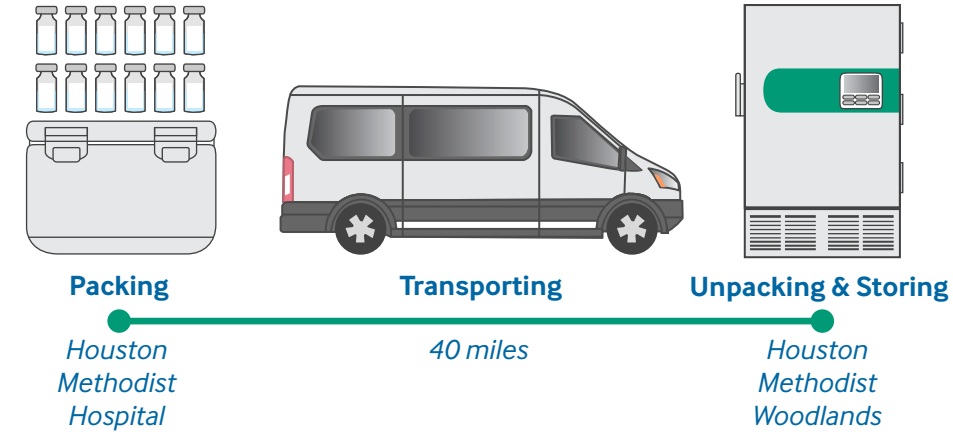
Another key place for potential failure was the unprecedented rollout of the Covid-19 vaccine. Not only was Houston Methodist prepared to vaccinate all 30,000 of our health care system employees and physicians, but also the main hospital was designated a vaccine hub for the city of Houston — both scenarios in which multiple critical failures could occur. Preparing to deliver vaccines to our employees and the community required rapidly establishing new procedures without compromising patient safety or wasting any valuable doses of the vaccine. Houston Methodist not only created plans for transporting, storing, and using the vaccine, but also rehearsed the entire process. In a dry run, staff simulated the process of packing the vaccine at the Houston Methodist Hospital in downtown Houston, transporting it 40 miles to Houston Methodist The Woodlands and unpacking and storing it for future administration (Figure 4).

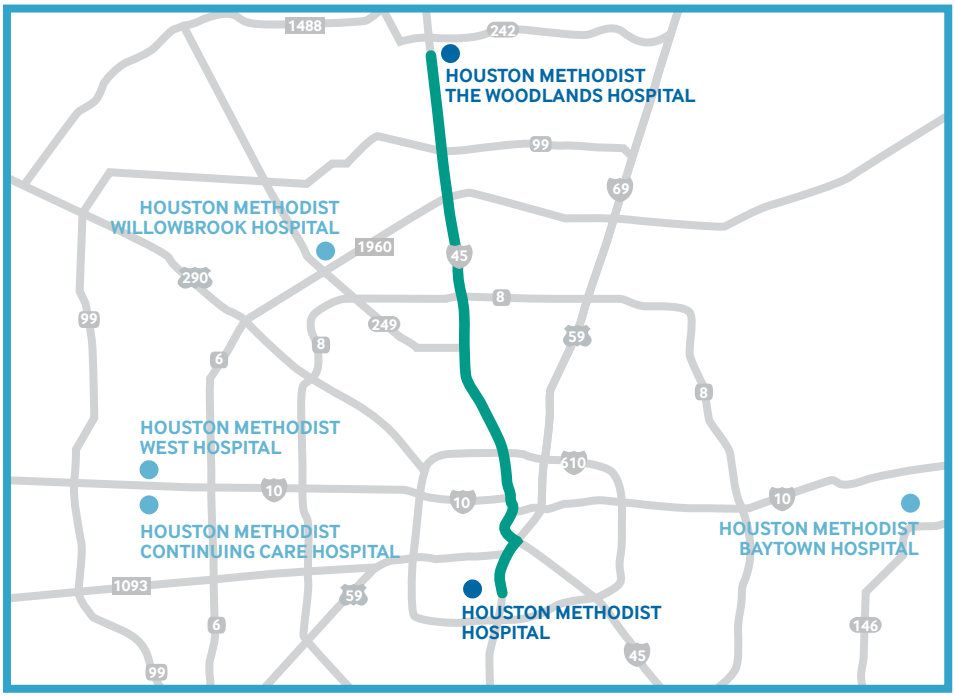
It was particularly important to anticipate failures in this process given the stringent storage requirements of the Pfizer vaccine, which was the first that we received. Staff used all of the actual equipment required for this process and drove the approximately 40-mile route between the two Houston Methodist hospitals. This preoccupation with failure and sensitivity to operations allowed for a smooth vaccine rollout experience and paved the way for the delivery of more than 900,000 vaccine doses through our ambulatory network.

FIGURE 4

Simulation Exercise for Covid-19 Vaccine Handling and Distribution

Houston Methodist, as a designated Covid-19 vaccination administration hub for the city, was responsible for handling and distributing hundreds of thousands of doses of the vaccine. Leaders developed and executed procedures and did preliminary testing of the system through simulation exercises.





Source: Rachael Whitehead, MS

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Reluctance to Simplify, Principle #4

Despite our preparation for the massive vaccine rollout, errors still occurred. In one incident, a 64-year-old presented at the Covid-19 vaccination site on the first day during which both first

and second doses were being administered by Houston Methodist staff. While working at the vaccine clinic, a medical assistant (MA) failed to verify in the medical record that the patient's first vaccine was a Pfizer vaccination and gave the patient the Moderna vaccine for the second injection. The MA reported the error to their supervisor immediately on recognition. The patient was informed of the error, as was the patient's physician.

While the effect of the mixed vaccine on patient immunity was unknown at the time of the error, it was not deemed to be dangerous or to put the patient at a significant disadvantage related to immunity. Rather than relying on this knowledge to dismiss the error as noncritical or to accept that such errors will happen with the challenges that accompany a new workflow, we conducted an RCA looking as far upstream as possible. Using the Just Culture framework described earlier, our primary focus was on identifying system issues that enabled this defect/error to occur.

The anticipated system challenge involved the first day of administering both first and second doses to 1,000 patients. We identified unanticipated workflow challenges, including the fact that the Pfizer vaccine did not arrive at Houston Methodist as expected and that the second dose was unexpectedly in short supply that morning. Because of concerns that there might be a shortage of the Pfizer vaccine that day, the pharmacy shipped over an additional 300 Moderna vaccines. The MA was provided a supply of Moderna vaccines, anticipating that she would be giving out first doses. She did not have the Pfizer vaccine. Furthermore, there was a perceived urgency: the need to attend to the patient right away because there were so many patients waiting in line, many visibly anxious, and the fact that the patient told the MA that he was in a hurry. The individual failure was determined to be that the staff failed to follow the Five Rights of medication administration, which are the right: medication, route, dose, time, and patient.

As a result of this RCA, we implemented an action plan to address failures at both the upstream (systems) and individual levels. System improvements to the workflow included designated stations for each type (first or second dose) on days that clinics are administering both vaccines and badges worn by vaccinators that indicate the manufacturer and booth number to aid with dispensing of the vaccine from the pharmacy. Upon check-in for second doses, the patient is provided with a sticker that is color-coded as either Pfizer or Moderna. In the vaccine booth, the MA or clinical staff administering the vaccine verbally confirm the first or second dose and the name of the manufacturer if the patient presents for a second dose. Additionally, we developed an educational brochure of best practices and guidelines for safely administering second doses and disseminated it to all vaccine locations.

One of the problems faced by the scientific and medical communities during the pandemic is misinformation. Some of this misinformation is malicious or unfounded, and some of it is because of shifting recommendations based on evolving science. Rather than ignoring misinformation in our communication strategies or changes in our recommendations, we address misunderstandings and changes directly. For example, early in the pandemic, the best scientific evidence suggested that masks were not effective in preventing the spread of Covid-19. Therefore, in our all-employee meetings in early March 2020, we told our staff that masks were not necessary. As researchers accumulated more information, we realized that masks were actually one of our most

effective tools to prevent the virus from spreading. In late March 2020, we transparently admitted at our Covid-19 town halls and in email communications that our previous recommendation was no longer appropriate and that the new information was leading to new policies.

> *"Research suggests that physicians should receive training in interpersonal management, systems management, and communication and planning, starting in medical school and continuing throughout their early medical careers. These are well aligned with HRO cultures and systems."*

As Covid-19 vaccines were being developed, Houston Methodist began sharing information with our staff and the greater community through the various communication channels described previously. The vaccination messaging strategy began months before any vaccines were approved and hinged on transparency. Committing to transparency requires addressing knowledge gaps in the emerging situation. To establish realistic expectations while maintaining trust, the continually evolving nature of emerging disease research was emphasized. When research could not provide a direct answer, we informed the audience and routinely updated them as more information became available. As vaccines were approved and rollouts began, hospital staff were cautious. Early in the vaccine campaign, we identified that nurses were taking the vaccine at much lower rates than physicians; we worked specifically with this group to ensure that transparent, evidence-based information was communicated, improving the vaccination rates substantially. We believe that this open, two-way communication and education process was a critical element that allowed Houston Methodist to lead the nation as the first hospital system to mandate Covid-19 vaccines for all of its employees and physicians.[18]

As with internal messaging, our community messaging adheres to the latest scientific data and is candid about the limitations of science evolving in real time. Accordingly, when evidence or guidance changes, we maintain credibility with our community. When communities across the nation became divided on how to handle the pandemic, Houston Methodist chose to be transparent and to rely on science to solve challenges. We created plans, even if they were often fluid; having these plans gave everyone a sense of control and purpose in the face of uncertainty. Houston Methodist values the process of communicating in a patient-centered, data-driven, evidence-based manner. As with internal messaging, it is critical that the message given to the public is consistent across platforms. For example, as masking was established as a critical component of national and local pandemic responses, Houston Methodist created campaigns encouraging the community to mask, including a successful campaign urging physical distancing during the July Fourth holiday in 2020.

Promotion of Resilience, Principle #5

During a crisis, especially an extremely long crisis like the Covid-19 pandemic, competing priorities and needs can overwhelm any organization. At Houston Methodist, our established

culture and learning health care system infrastructure were prepared to rapidly identify existing challenges and predict future issues during the Covid-19 pandemic. Houston Methodist had experience in rapidly setting up Incident Command teams at the system and hospital levels to respond not only to the challenges of tropical storms and other natural disasters, but also emerging diseases such as the Ebola virus, requiring both clinical and academic expertise and channels for communication between leaders in these areas and those on the front lines. This afforded Houston Methodist the resilience to make rapid decisions and to convey them to the staff, patients, and local community.

To build trust and establish channels to share information in the chaotic environment of the pandemic, Houston Methodist employs an open-door policy for national media and extends important messaging beyond the Houston community. Our faculty and physicians are encouraged to give interviews and share their expertise widely, which they have done with *The New York Times*, *Houston Chronicle*, CNN, National Public Radio (NPR), and *The Washington Post*. These nationally distributed articles established Houston Methodist as a trusted source of pandemic news. When NPR covered our monoclonal antibody infusion operation, one of the largest in the country, it bolstered support within the Texas community and increased referrals to this operation. Our national reach was improved by a coordinated effort to rapidly publish research findings in high-impact journals, ensuring that work performed at Houston Methodist could benefit other health care systems. We established teams to assist researchers with publishing their Covid-19 research to support clinicians as they were both caring for patients on the front line and disseminating their vital knowledge. Houston Methodist has successfully communicated internally and to the community by using a transparent approach, bringing people together to face the pandemic on a united front by always reflecting well-evaluated, consistent, data-driven messages. It was possible to achieve this, even during a crisis, because of our established culture and communication processes. This trust was invaluable during subsequent spikes in Covid-19 cases and as the science continued to evolve rapidly.

Our focus on building flexible and resilient systems for patient scheduling, communication, and care over the past several years enabled us to continue providing safe and efficient care during the pandemic. When developing our consumer-centric platform, we deferred to the ultimate experts on patient health care needs: the patients themselves. Our patients expressed that they wanted help immediately, leading us to expand virtual convenient care services and make scheduling easier and more flexible. Patients prioritized ease, encouraging us to examine and improve our check-in and follow-up processes. After receiving care, patients wanted to be remembered and not just considered a number. We therefore increased data transparency and connectivity between different providers. When the pandemic hit, we were able to apply these systems to perform check-ins by text message and communicate important public health issues to patients. We were prepared for flexible and fast vaccine scheduling when the vaccines were available and could follow up with recipients.

Early in the Covid-19 pandemic, researchers found that monoclonal antibodies can be used to treat high-risk patients with Covid-19, reducing hospitalization and mortality. Houston Methodist had been involved in clinical trials for monoclonal antibodies and used the knowledge gained through this experience to plan to treat patients as soon as the antibodies were authorized for use, facilitating the rapid setup of infusion clinics.[19] During this process, we combined a resilient

communication system with sensitivity to operations to identify the best locations for Covid-19–positive patients to return to infusion clinics without risking other patients and to develop an approach to let a single infusion nurse monitor multiple patients at once.

Challenges to Embracing HRO Principles in Health Care

Health care organizations are exceedingly complex. Providers work within teams that are often siloed, and even within the team, there is a range of roles and duties. Different aspects of patient care may be fragmented across different disciplines. While the culture of health care has shifted toward a cohesive view by incorporating multiple teams, there are still separations that can limit sensitivity to operations. Because of the vast number of roles played by health care providers and support staff, hierarchical structures have developed. If the authority gradient in these hierarchies is too steep, it can prevent organizations from deferring to the expertise of workers on the front lines, leading to a disconnect between leaders and those treating patients directly. Houston Methodist, like many organizations, is working to flatten these hierarchies, but there is still room for improvement.

Creating a culture of psychological safety to identify issues can be challenging in health care. Organizations face potential litigation if they make errors in patient care, and that can result in threats of punishment for the employees involved. Whether these threats are codified in policies or simply perceived by employees, they prevent the reporting of important issues. When issues go unreported, teams and leaders remain unaware of the underlying weaknesses in their policies and procedures; therefore, more errors are likely to occur, creating a dangerous cycle. Organizations need to balance accountability while promoting a nonpunitive environment that encourages reporting and transparency. Over time, this culture will become self-sustaining as new employees join teams that feel safe talking about potential and actual mistakes and participating fully and transparently in the organization's analyses of any errors that do occur.

> *"By mid-2022, through either a business school or a school of public health venue, we will have exposed nearly 10% of our 1,000-person employed physician group to formal training in strategy, leadership, operations, financial controls, team and organizational dynamics, and change management, a program we began in 2012."*

Leaders form a key bridge between establishing a learning health care system and developing a culture consistent with HRO principles. They guide the assessment and improvement of operations and disseminate information about changes and decisions throughout the groups they lead. Physicians frequently play leadership roles and influence the cultures within their teams. We believe physicians must become part of our decision-making during growth and improvement so that they are part of the change. The large and complex Houston Methodist system includes physician employees and affiliated physicians. They may be working in one of our seven hospitals, in our acute long-term care facility, or in the more than 200 locations where

our Primary Care Group and Specialty Physician Group see patients throughout the greater Houston area. The fragmented nature of our physician population makes it difficult to incorporate them into improvement projects and to ensure their buy-in.

We are working to address this through multiple approaches, including: (1) embedding physician leadership in system clinical councils (e.g., ED, ICU, OR, and cardiovascular surgery); (2) organizing physician leaders from across the system into cross-disciplinary teams to address fundamental operational issues such as standardization of preoperative testing and assessment; (3) tying 20% of primary care physician compensation to the achievement of preset quality and safety measures; (4) linking 20% of the compensation bonus potential for our academic chairs (which accounts for about 20% of their total compensation) to quality and safety measures that are chosen each year for their specialty; and (5) engaging physicians in our ACO in quality metrics. To build a physician culture focusing on HRO principles, we focus on deference to expertise and sensitivity to operations. We actively seek input through multiple avenues from frontline staff, including physicians, on what we can do to make them more effective, more efficient, and more satisfied with their jobs. We have found that this approach actively engages the physicians, and they know that we take them seriously. Our Press Ganey scores for physician engagement and alignment are in the 89th and 96th percentile, respectively, and we rank several standard deviations above the mean for satisfaction with the electronic health record.

Another potential barrier to incorporating physicians into the process of building an HRO is a lack of formal management skills training during medical education. Physicians and medical trainees with a specific interest in leadership and management may participate in a certificate or graduate program, but most physicians do not have any formal training in this area. Research suggests that physicians should receive training in interpersonal management, systems management, and communication and planning, starting in medical school and continuing throughout their early medical careers.[20] These are well aligned with HRO cultures and systems. Physicians with strong interpersonal management skills will be prepared to listen to concerns and issues and to address them fairly and efficiently. Knowledge of systems management skills and tools would allow physicians to assess their own operations on the basis of appropriate metrics and make process improvements, especially when working in independent settings outside the hospital. Communication and planning skills are always essential and can assist physicians in disseminating decisions and changes from their leaders to their staff and colleagues.

However, these skills are very different from the skills that physicians use when caring for patients. Compared with diagnostic reasoning, management reasoning is less black and white, more complex, less consistent, and more interactive.[21] By mid-2022, through either a business school or a school of public health venue, we will have exposed nearly 10% of our 1,000-person employed physician group to formal training in strategy, leadership, operations, financial controls, team and organizational dynamics, and change management, a program we began in 2012; this training includes a 6-month program for emerging leaders and a 2-year management degree for advanced leaders. Through these efforts, we aim to develop a workforce of physicians who are prepared to be fully involved in the process of improving safety and reliability and to act as a bridge between the leaders of such initiatives and other health care staff. Additional

programs are offered to nonclinical staff on the basis of their scope of work and needs, ensuring that all employees at Houston Methodist are growing key skills.

Looking Ahead

To embody the five principles of HROs — deference to expertise, sensitivity to operations, preoccupation with preventing failure, reluctance to simplify, and promotion of resilience — health care organizations must build and maintain a culture of safety and a learning health care system. At Houston Methodist, our organization's culture and priorities were already well aligned with these principles even before the pandemic, and we have worked over the past decade to implement the tools and processes that allow us to be a safe, reliable, and high-quality academic medical center. First and foremost, our goal is to improve safety and outcomes for our patients, but HRO approaches also improve our efficiency, make employees feel heard and appreciated, and maintain our reputation for excellent care.

Replicating our strategy in other health care systems would require leadership to (1) identify subject matter experts, (2) prioritize evidence-based messages, (3) commit to transparency, and (4) actively seek participation from staff and prioritize their concerns and needs. To prepare for potential difficulties, develop a resilient Incident Command structure and support scientific experts in designing and implementing new processes. Test and rehearse new procedures. When problems occur, face them head-on as a learning health care system and use them as opportunities to improve your processes and communication strategies. Consider how your existing resources can best be used to anticipate failures and create innovative solutions for problems. Becoming an HRO is a continual process of improvement and assessment, and building this into the culture of an organization will create a better health care experience for everyone.

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Appendix

Survey Trends Related to Employee Trust at Houston Methodist

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