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Recommended Citation

Gifford L, Johnson CC, Haque N, Passalacqua KD, Swiderek J, and Kalkanis S. COVID-19 in the hotspot of Metropolitan Detroit: A multi-faceted health system experience. *Int J Health Plann Manage* 2021.

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COVID-19 in the hotspot of Metropolitan Detroit: A multi-faceted health system experience

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Abstract

Health systems were abruptly plunged into a crisis as SARS-CoV-2 exploded into a pandemic in spring 2020. In March–April 2020, Metropolitan Detroit was a US “hotspot.” As a large health system with five hospitals and two behavioural health inpatient facilities, a health insurance company, a medical group and physician network, and 41 ambulatory clinics normally hosting over 10,000 daily patient encounters, the Henry Ford Health System deployed numerous strategies in the management of this upheaval. As hospitals and Emergency Departments were inundated with COVID-19 patients, other services and activities needed to shut down as state-mandated policies were promulgated, new internal and external communication networks established, and management of employees and resources such as ventilators, ICU beds, personal protective equipment, and laboratory supplies became critical challenges. We describe herein the system-wide strategies implemented and lessons learned in the operation of a health system in the initial throes of a global pandemic.

KEYWORDS

COVID-19, health care management, health system, pandemic, SARS-CoV-2

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Highlights

- A pandemic rapid response requires coordination of multiple facets of a health system, best led by a highly centralised incident command model.
- Regular and frequent (at least daily) communication with a wide range of leaders is paramount.
- Early and constant attention to IT infrastructure for data and communications is essential.
- Frequent coordination and communication with the local community and local and regional health care organisations and government agencies are critical.
- Establishment of a pandemic-specific structure for education and research activities is crucial, including a system for ongoing monitoring of public data and pandemic-related literature on topics ranging from epidemiology to infection control to treatment.
- Continuing attention needs to be paid to acknowledging and mitigating the psychological impacts of a pandemic on patients, families and staff.

1 | INTRODUCTION

Soon after the nation confronted the SARS-CoV-2 virus, metropolitan Detroit became a US hotspot. Henry Ford Hospital (HFH) is one of the major hospitals serving the people of Detroit and is part of the larger Michigan-based Henry Ford Health System (HFHS). The five hospitals in the health system received a wave of COVID-19 inpatients between the first admission on March 11th through April 2020, with HFH in Detroit receiving the largest number (Figure 1A,B). During this time, HFHS admitted 10,990 inpatients, including 3044 COVID-19 positive patients, the latter resulting in 531 deaths, some of whom were HFHS health care workers. At its peak on April 6th, HFH had 364 of 561 inpatients (68%) with confirmed or suspected COVID-19. While a pandemic plan to expand beyond normal operations to meet a sudden increased demand was in place, and numerous drills had been conducted, the magnitude of the resources/need ratio and the supply chain issues were unanticipated.

Since the beginning of the pandemic, multiple articles have described how specific hospitals and medical disciplines responded to the COVID-19 crisis, outlining strategies and sharing lessons learned^{1–4} and community-level perspectives.⁵ Here, we take a health system-level view in describing the pandemic response to the first surge at HFHS. Our goal is to illustrate the numerous concurrent, system-wide challenges that the COVID-19 crisis created and outline the many intersecting pieces of the COVID-19 response that demanded coordinated action within the context of a “hotspot” and the lessons learned to serve as a useful case study for health systems and hospitals nationwide to plan strategies (Table 1).

2 | ADMINISTRATION & TACTICAL COMMAND–NAVIGATING AN UNKNOWN PATH

Lesson Learned #1. Establish an Inclusive but Nimble Incident Command Center that includes Numerous, Organised and Unified Channels of Communication. In late February, when the threat of a nationwide pandemic became tangible, HFHS established an Incident Command Center as the system’s centralised decision-making body to coordinate

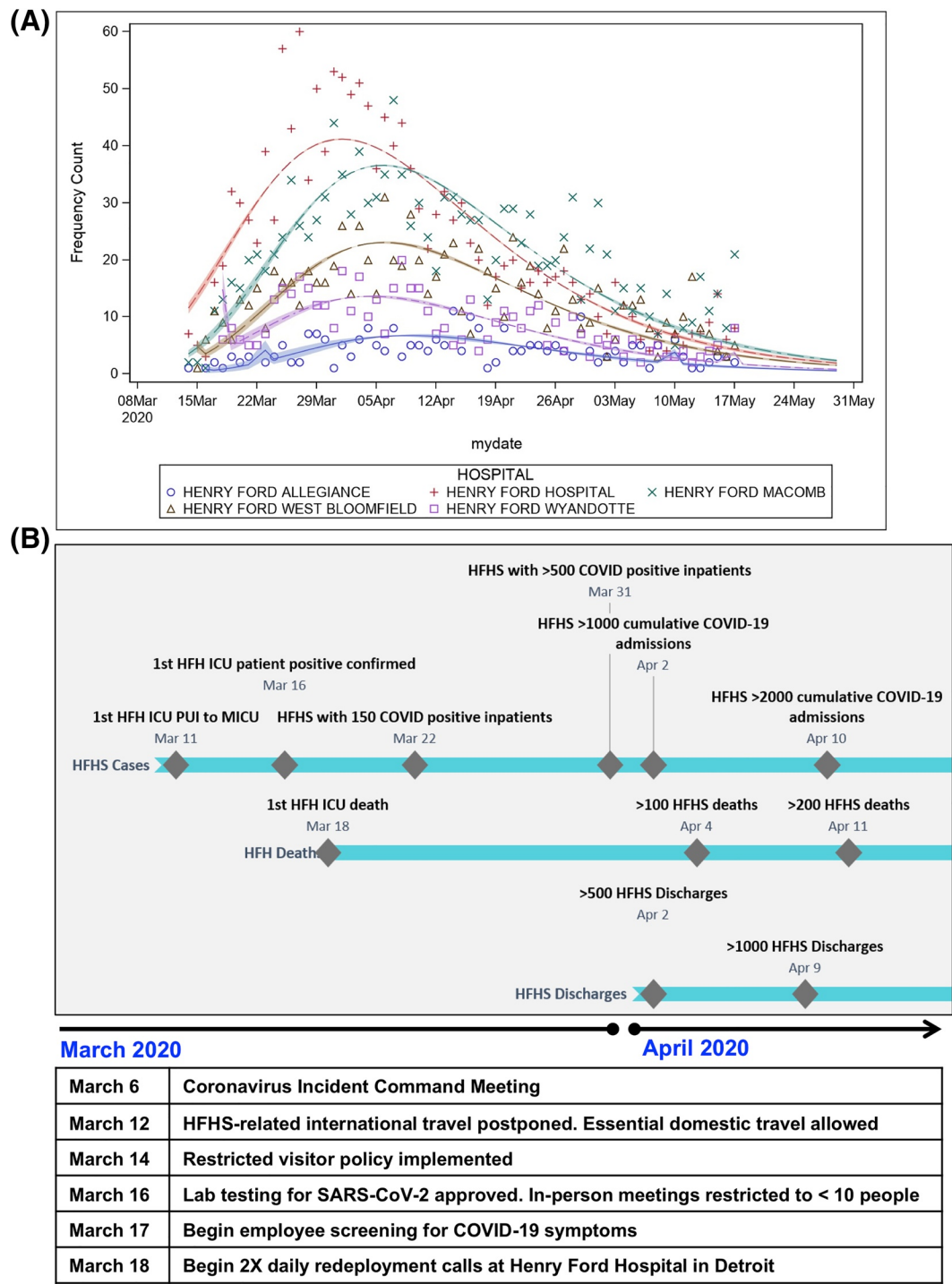


FIGURE 1 Admissions, Deaths, Discharges, and First Administrative Actions & Policies at HFHS, March–April 2020. Administrative Actions at Henry Ford Health System (HFHS) during the first three weeks of March 2020

TABLE 1 Key actions taken and lessons learned during the system-wide response to COVID-19 at Henry Ford Health System in metro-Detroit

<p>Administration & Tactical Command—Navigating an Unknown Path</p> <ul style="list-style-type: none"> Establishing a Central Incident Command can ensure coordinated decision making and immediate, regular, transparent, and vetted information to the health care team Maintaining technical infrastructure is crucial for creating multiple levels of communications, including email, intranet webpages, press releases, clinical documents, infection prevention guidance, human resources materials, and updated research findings A rapid review of all communications to assure accuracy and clarity was essential. Diverting analysts to perform predictive modelling to assess patient load, public behaviour, and availability of critical medical supplies is fundamental to a flexible and efficient response Contributing to regional data acquisition is important for the long-term public health response Using the collective expertise of the entire team to identify needs and create solutions contributes to a resilient response It is critical from the IT perspective to define measures as soon as possible for coding and classification of cases so that statistics and dashboards can be as accurate and straightforward as possible. Ideally, a research/quality-oriented team devoted to the pandemic should be established from the start to plan how to systematically evaluate the impact of interventions and policy changes in real time.
<p>Lessons Learned</p> <p>#1. Establish an inclusive but nimble Incident Command Center that includes numerous, organised, and unified channels of communication.</p> <p>#2. Organise an expert team to conduct continuous predictive modelling & analytics.</p> <p>#3. Reach out locally to coordinate vital data gathering.</p> <p>Communication was the critical, foundational element that affected every level of the emergency response. We learned that the magnitude of the pandemic impeded the chain of communication from leadership to all levels of staff, and that multiple communication huddles for different groups of staff, despite being a repetitive endeavour, would have been a more effective way of guaranteeing that every level of the organization received the same primary information. Also, because redeployed and furloughed staff were not in their usual locations, they often missed key communications—extra effort is needed for tracking and organising personnel movement so that everyone is in the communication line. In short, it is impossible to over-communicate.</p>
<p>Aiming To Do No Harm—The Ethical Ground for Appropriate Medical Action and Treatment Guidelines</p> <ul style="list-style-type: none"> Creating an ethical framework and guidance plan early during a pandemic response is essential because it needs to be tailored to the unique situation. It would have saved time if a draft plan had already been created based on previous pandemics. Practical, easy-to-access resources for how to handle medical equipment allocation and difficult conversations help ensure that providers can implement the plan. Institutions should be prepared for the need to rapidly develop new policies and treatment guidelines.
<p>Lessons Learned</p> <p>#4. Make the establishment of ethics-related policies an early priority.</p> <p>#5. Stay on top of treatment guidelines and adapt quickly as knowledge is gained.</p> <p>The burden of treating a new disease in the absence of clinical knowledge and established guidelines exacerbated an already unfair national health care delivery landscape. We learned that when health care providers are given clear guidance and support in clinical decision-making during an emergency, all patient groups will benefit. Getting everyone, including those in underserved communities, into the clinic for care is necessary for improving health outcomes.</p>
<p>Health Care Infrastructure and Process—Creating Space, Coordinating Medical Duties and Securing Health Care Equipment</p> <ul style="list-style-type: none"> Creating limited, centralised entrances with staff to perform screening is a major need for limiting virus spread.

TABLE 1 (Continued)

- Moving staff from areas where workload has decreased into high demand areas needs to be continuously assessed and monitored to ensure that workers are qualified for new, temporary roles.
- Ensuring 24/7 staffing for all shifts and jobs requires an approach that provides equity and transparency.
- Establishing firm relationships with vendors for reliable supply chain processes for PPE and testing supplies is crucial to prevent shortages. While an emergency inventory had been maintained, the size had been based on a dependable supply chain.

Lessons Learned

- #6. Create space for an unpredictable patient flow and manage who goes in and out.
- #7. Put the right people in the right place.
- #8. Keep protective equipment available.
- #9. Maintain testing capability.

Medical care within the context of a pandemic infectious disease requires solid health care infrastructure, vast quantities of materials and equipment, and complex clinical management. **We learned** not to assume that medical supply chains will be reliable in an emergency situation and to consider reducing use of select clinical spaces rather than shutting them down. We recommend creation of a taskforce to form a plan for warehousing and delivering critical medical supplies during an emergency, whether at the institutional, local, state, or national level and to develop a strategic plan for increasing bed capacity allowing for a much larger magnitude of cases. Also, while shutting down clinics and furloughing staff during the emergency may be the simplest approach, reducing and shifting services and staff would be better for long-term clinical management.

Patient Needs—the Engine Driving the Response

- Both telephone and video telemedicine are vital routes of health care communication during a pandemic, especially when shelter-in-place directives are in place. Both are critical as some patients have technical access or use challenges.
- An action plan for ramping up telemedicine volume is advised.
- Be prepared for unexpected technological barriers that may arise, such as a need for appropriate caller identification.
- Efforts to increase human connections that have been reduced because of infection prevention measures should be creatively explored as a compassionate action to ease patient stress.
- Giving patients tools for home care is a way to create relationships and reduce barriers to proper self-care, as well as help to prevent unnecessary ED visits yet identify the need to seek care, all contributing to better disease and bed management.

Lessons Learned

- #10. Keep patients informed.
- #11. Nothing replaces a smile.
- #12. Care in a box – send help home.

Physical distancing that was required during the pandemic revealed the vast potential of providing health care from a distance. **We learned** that our 2019, pre-pandemic virtual care meeting was fortuitous because it allowed us to take advantage of our electronic medical infrastructure quickly and without a high learning curve. We recommend that telehealth platforms be embraced and continually improved, and that researchers investigate how this health care delivery approach can be optimised. Some patients will have challenges using these modes and will need to be accommodated.

Health Care Providers—Who is Helping the Helpers?

- Safety of health care providers and all staff must be addressed early in a response while providing beneficial resources with clear and adaptable policies.
- Fear and stress on the part of staff must be recognized and acknowledged, and support provided as much as possible.

Lessons Learned

- #13. Nothing gets done without healthy workers.

(Continues)

TABLE 1 (Continued)

<p>Providing health care in an emergency situation with many unknowns and a high level of danger is enormously stressful. We learned that health care leadership needs to commit to a high degree of presence and visibility through regular in-person rounding, even in the most difficult situations; we would have liked to have committed to this more. While telework platforms have been a boon for keeping administrative work flowing, emergency health care cannot be done from a distance. We learned that emergency health care workers are amazingly creative and resourceful in troubleshooting, and direct recognition of health care provider effort and sacrifice is essential. Saying thank you is not enough. Trauma and burnout in the medical profession are a serious problem, and resources for addressing health care provider well-being and efforts to ensure that their work and struggle are recognized are crucial.</p>
<p>Training and Research—Crucial Activities for Professional Development and Knowledge Acquisition</p> <ul style="list-style-type: none"> • Working in conjunction with ACGME in accredited hospitals is needed to ensure that trainees' careers are not sidelined during a pandemic • Moving educational activities to online formats requires training and technology support for instructors and trainees • While many research activities must be put on hold for patient safety and practice reasons during a pandemic, the situation itself creates many new opportunities for research inquiry
<p>Lessons Learned</p> <p>#14. Education: Be prepared to use technology.</p> <p>#15. Research: Be prepared to shift current research activities and for a parallel surge in pandemic-related studies.</p> <p>Platforms for online training need to be maintained and updated with innovative strategies to enhance effectiveness. We learned that a planned strategy for prioritising pandemic-related research projects in a structured manner should be put in place, including working with other local research-oriented organisations, in order to maximise the use of limited resources.</p>
<p>Not Alone—Forging Partnerships and Engaging the Community</p> <ul style="list-style-type: none"> • Financial experts must monitor government responses closely to gain proper pandemic funds and advocate for patients and healthcare workers. • As resources allow, connecting with and serving the local community with testing facilities and monitoring of vulnerable populations is key to ensuring an efficient and equitable pandemic response • Frequent, open communication with other health systems and local and state governments is critical for sharing up-to-date knowledge and establishing region-wide cooperation.
<p>Lessons Learned</p> <p>#16. Work with the top level – connect with the federal government.</p> <p>#17. Forge state and local government connections.</p> <p>#18. Health care is a community activity – connect with and serve those outside of hospital walls.</p> <p>Communicating medical information during an emergency situation within a politically charged social atmosphere is thorny and complex. We learned that the current news media environment may not be receptive to straightforward medical news from the frontline medical community and that policymakers must be pressed to consider the advice of physicians and medical professionals. Medical communicators who are fluent in navigating the current political and social climates and who can, nonetheless, convey accurate, useful medical information are sorely needed, and medical professionals should be included as advisors in policy making during emergency medical situations.</p>

and disseminate key information to employees during the rapidly evolving pandemic and serve as the primary navigational center for the response. This step was in accordance with the health system's Emergency Operations Plan, including a "Quarantine, Isolation and Surge Capacity Plan," that had been established in coordination with local and state public health officials and the US Centers for Disease Control and under the auspices of state and national laws related to disaster management. The integrated system-wide administrative structures and communications platforms were critical to allowing for centralised control for disseminating information about clinical care guidelines, employee safety, and operations updates.

The Command Center included (in addition to operations leaders), representatives from public relations, internal communications, and human resources. This Centre controlled a range of strategic activities, such as daily emails

to staff with vital information; rapid development of a COVID-19 intranet webpage containing infection prevention guidance and updated literature and human resources materials; coordination of daily safety huddles in departments across the system; and a webpage for updating the public. All communications were vetted through this group. A COVID Banner header for emails was used so all system employees knew to read this specific email, and care was taken to limit the number of emails and to ensure they were comprehensive and accurate. Leaders were encouraged to read from these emails during huddles and team meetings to reinforce the message but also to ensure that the messaging was consistent and nothing was lost in translation. An institution-wide "COVID-Challenge" was also put out to all ~33,000 staff to assess emerging needs and gather ideas. Daily calls with the Henry Ford Medical Group (HFMG) department chairs and other leaders were instituted to keep an open line of communication.

Success of the Command Center can be attributed to collaboration between many professional groups, including quality/safety, public relations, clinical/operational, nursing leadership, and medical group executive leadership. In addition, a rapid review process was established to ensure that all disseminated information was accurate and that most materials were reviewed and approved in less than a day. Creating a central hub of diverse experts to identify needs and regulate information dissemination allowed for a system-wide adaptation to the quickly changing landscape. Establishing an Incident Command Center as a hub to regulate policy and information flow is key during a confusing and rapidly changing response situation. Despite the aforementioned successes, the large volume of education and changing policies were often overwhelming to staff. Subsequent discussions with leaders and staff reminded the Command Center team that amongst the busyness of maintaining clinical operations, it was often difficult to review emails. An important learning was that over-communication on any critical topic was not a concern. Emails, updates to the webpage, administrator and physician rounds, and multiple daily huddles were all effective communication mechanisms.

Lesson Learned #2. Organise an Expert Team to Conduct Continuous Predictive Modelling & Analytics. With an ever-changing and unpredictable pandemic, planning for multiple case scenarios was needed. Epidemiologists, statisticians and business analysts at HFHS created a range of predictive analytic models using daily updated state and regional data to estimate the number of expected COVID-19 cases entering the system and to assess supply chain demands. A series of social media surveys were conducted to capture information on statewide and local social distancing behaviours needed for the models.⁶ Whether designed within a system or accessed from outside sources, paying attention to predictive models is critical for making wise and efficient administrative decisions during a fast-changing situation. A lesson learned was to quickly determine a coding system for identifying and classifying patients with COVID-19 as it was initially challenging to ascertain cases accurately, particularly when testing was restricted, when results took days to obtain, and the clinical phenotypes were not yet well-described. It would also have been valuable to identify a team, if available, to *a priori* identify, and measure, metrics for success as interventions and processes were instituted as the pandemic progressed.

Lesson Learned #3. Reach Out Locally to Coordinate Vital Data Gathering. One other major tactical activity was the establishment of a collaborative Detroit-area research registry of COVID-19 inpatient cases. This process required obtaining data user agreements from metropolitan hospitals that were also struggling with large patient loads and establishing a REDCap database registry open to all researchers in participating institutions. While many hospitals will not have the resources to create a regional database, participating in local data gathering greatly enhances the potential for both a robust local public health response and an opportunity to better answer critical research questions important regionally and nationally.

3 | AIMING TO DO NO HARM—THE ETHICAL GROUND FOR APPROPRIATE MEDICAL ACTION AND TREATMENT GUIDELINES DEVELOPMENT

Lesson Learned #4. Make the Establishment of Ethics-Related Policies an Early Priority. The severity of respiratory symptoms in some patients and the highly contagious nature of the virus has made COVID-19 a disease that creates multiple potential ethical dilemmas for medical professionals, from making decisions about which patients will receive ventilators when too few machines are available to knowing how to communicate to patients' families about prognosis

and death.⁷ Therefore, establishing early and thorough ethical guidance and policy was essential for helping medical providers align their activities within the best moral framework possible.

Early in the pandemic, the medical ethics team reviewed over a dozen ethical guidance documents from other health systems, many of them based on other pandemic situations such as Ebola and H1N1 influenza. Over the course of one month, the team drafted a plan, made revisions based on primary review, submitted a second plan to HFHS administration, created an appendix with specific guidance for emergency department (ED) physicians and palliative care professionals, and completed a final plan, which is still in place as of this writing.

Regular meetings were held to ensure that all providers understood the ethical guidelines and were able to implement the plan. Pull-out sections for specific topics, such as ventilator distribution and conversation tips for difficult end-of-life conversations, were particularly important. The long-term emotional and psychological effects the pandemic has had on health care providers is yet unknown, but ethical guidance is the vital foundation for mitigating possible moral injury caused by an unexpected, stressful event.

Lesson Learned #5. Stay on Top of Treatment Guidelines and Adapt Quickly as Knowledge is Gained. Policies for disease management were rapidly developed and modified as the surge progressed, and knowledge was accumulated. In the ICU alone, 23 policies related to COVID-19 care were developed in less than a month (Figure 2A).

4 | HEALTH CARE INFRASTRUCTURE AND PROCESS

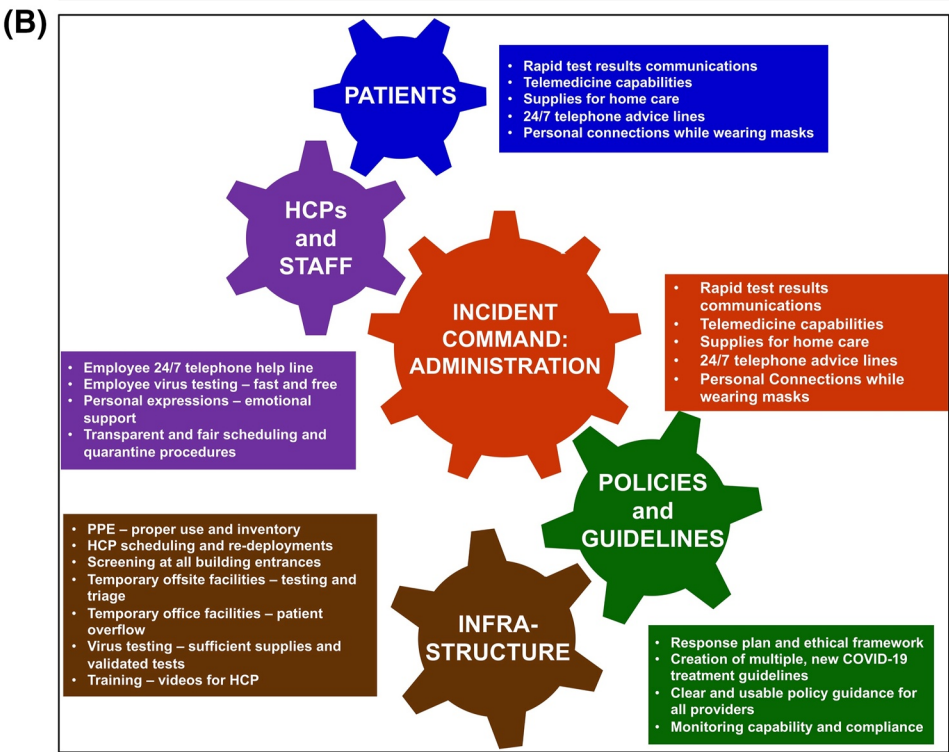
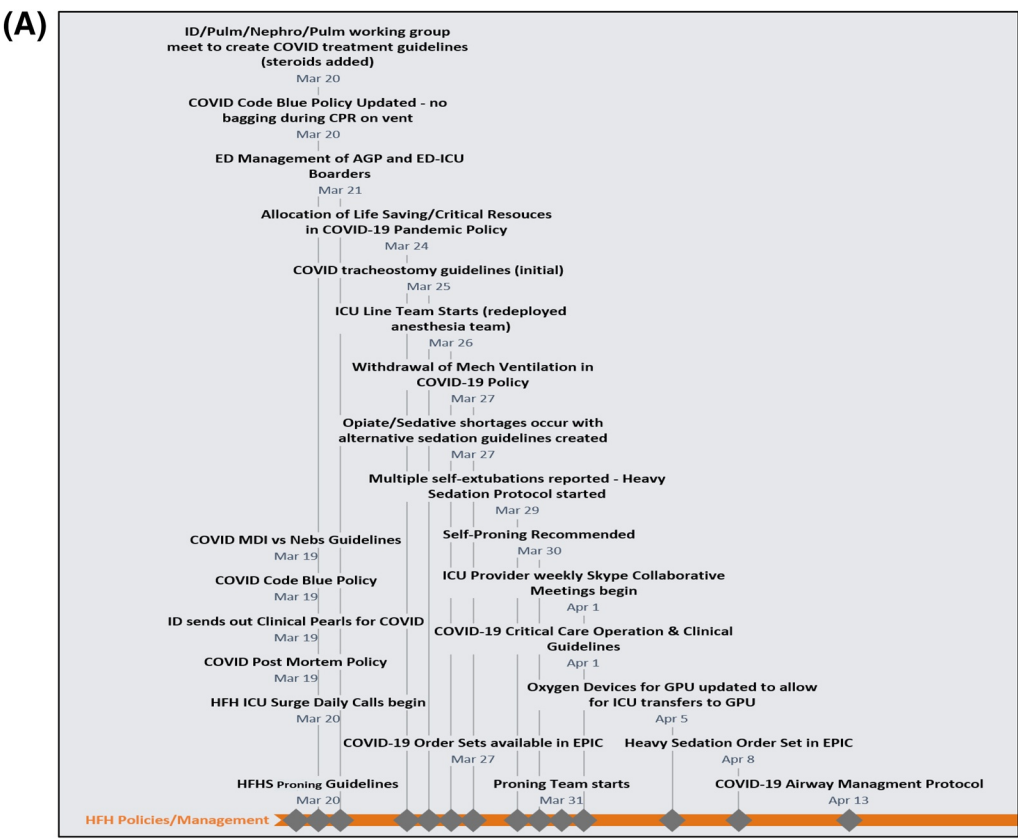
Lesson Learned #6. Create Space for an Unpredictable Patient Flow and Manage Who Goes In and Out. Overall, the HFMG includes health care providers and staff across 44 buildings, totalling 235 various clinics. To conserve personal protective equipment (PPE) and resources, 16 sites were closed, and clinicians were shifted to other locations. The process of finding or creating appropriate space for all patients was a serious challenge that resulted in both successes and failures.

Over 500 staff from around the health system helped build COVID-19 units by redesigning sections of the hospitals and by erecting large adjacent outdoor tents for clinical use to move initial patient points-of-contact away from the main hospitals and to serve as triage stations and waiting areas for suspected COVID-19 patients. Unused hallways were transformed into treatment spaces, and outdoor areas were made into nasal swabbing stations.

Recognising that the hospitals could reach capacity, multiple offsite inpatient units were created in April. For instance, a 15-bed inpatient unit with isolation and negative pressure and a “crash room” were created within a matter of days. Although this unit was only moderately used, the development process provided many lessons and revealed the complexity of establishing and running safe and effective spaces for patients during a pandemic. In addition, 17 ICU “pods” at HFH were rapidly converted to COVID-19 beds between March 14 and April 5, and different teams ran the various pods for the diverse needs. The large number of existing ICU beds at this hospital ($n = 156$) and several other HFHS community hospitals contributed to the ability to manage bed capacity during the surge.

A 17-story clinic building connected to HFH was initially proposed as a space for absorbing the high COVID-19 patient load, as only critical areas remained open in this building during the surge (transplant, haematology-oncology, radiology-oncology, and pathology). However, after evaluation it was determined that it was not possible to shift ambulatory exam rooms to inpatient rooms: exam tables were immovable, and the room architecture and built-in furnishings did not permit conversion to a room suitable for inpatient needs.

Other moves to optimise space also ended unsatisfactorily. For instance, an initial plan to create a “surge space” on the 13th floor of the main clinic building for patients who were unable to return to skilled nursing facilities had to be abandoned because many of the surge patients needed dialysis, and the water pressure on the 13th floor could not support the dialysis machines. If nephrology experts had been consulted earlier, time could have been saved. A “surge space” for non-COVID-19 patients in a satellite ED and ambulatory surgery facility was also established to accommodate non-COVID-19 emergency patients who could be either directly admitted or transferred from other area Emergency Departments. However, the early State of Michigan stay-at-home orders resulted in a significant decrease



in non-COVID-19 related ED visits, especially those involving accidents or trauma, so unexpectedly this space was underutilised.

The large convention centre in downtown Detroit was converted into a regional field hospital to allow for possible patient overflow. This cooperative effort with other health care systems and government agencies transformed the 350,000 square foot building into a temporary hospital. However, admittance rates for this site were extremely low due to stringent admitting criteria (i.e., patients could not be wheelchair dependent) and lack of ICU beds, underlining the difficulty in creating adequate patient capacity.

Lesson Learned #7. Put the Right People in the Right Place. The COVID-19 pandemic created a dualistic problem for health systems—while ED and inpatient volumes rose, outpatient visits declined.^{8–11} The surgery department, in particular, had many procedure postponements as the pandemic grew and the stay-at-home mandate was issued. By mid-March, ambulatory surgery centres were completely closed, with only time-sensitive procedures allowed. Administrative expertise was needed to prioritise and identify clinical necessity for surgeries and to keep track of delayed procedures, over 7200 of them, to be re-scheduled in the future. However, the reduction of surgeries meant that operating room staff could be repositioned to help in the ED and also lowered the demand for entry-screening, saved PPE, minimised the need for environmental services cleaning, and at the HFH campus, freed parking spaces, which reduced the need for the usual shuttles, thus reducing potential exposures. In contrast, there was a great demand for staff to monitor all entrances by taking temperatures and querying patients, essential caregivers, and employees about symptoms. Entrances were restricted to allow for centralised screening, still ongoing as of May 2021.

After repeated significant needs for nursing and environmental services staff were raised by several hospitals, a redeployment team was formed that successfully repositioned many health care providers, including over 300 ambulatory nurses in a single weekend. Nurses were assigned to positions based on the level of previous inpatient experience and years since nursing school graduation. In some locations, nurses worked within a “buddy system,” where they were able to handle larger assignments in teams of two.

An ED operations team created job profiles for newly created positions and a workflow assignment system identifying positions that could be performed by non-ED providers, such as operating room nurses and anaesthesia team members. To manage the workflow, a shared document was created that allowed flexible and transparent scheduling, which revealed that shifts with high COVID-19 patient contact and late/overnight hours were the most difficult to fill. Therefore, specific care teams worked as a group to cover all shifts for defined jobs, which resulted in a more equitable sharing of shifts.

Lesson Learned #8. Keep Protective Equipment Available. A primary task was to make sure that providers had proper PPE, were using non-contaminated PPE properly, and were fully informed on all the latest clinical care protocols, in addition to acquiring and maintaining an adequate PPE inventory. HFHS aggressively sourced equipment through connections with numerous local businesses and organisations. The process included sourcing, vetting, and co-developing new PPE materials through partnerships with large organisations such as Ford Motor Company and General Motors, as well as small to mid-size manufacturers. Because PPE supply chains are still not entirely optimal, active sourcing with local businesses and creative endeavours to develop new materials will likely be needed for the future. In addition, on a day-to-day basis individual departments and locales experienced a range of PPE problems, underlining the need for clear policies and supply chain pre-planning.

Because of the high-volume of PPE use, there was consistent confusion as to how long certain pieces of equipment could be used and what the best decontamination processes were. Staff explored methods for sterilising the N95 respirator, including ultraviolet light, baking, and vapour cleaning disinfection processes, and participated in fit-testing and validation of technologies developed at Battelle and Michigan State University.¹² Other protective equipment projects included creating improved intubation boxes to shield providers from airborne droplets while allowing safe

FIGURE 2 Key aspects of the system-wide response to COVID-19 at Henry Ford Health System (HFHS). (A) Timeline of 23 policies, guidelines, and management changes affecting Intensive Care Unit COVID-19 patient care implemented within one month between March and April 2020. (B) Summary of the critical “moving parts” of the concurrent, system-wide response at HFHS during the first two months of the COVID-19 pandemic

access to patients during intubation, and developing a gastrointestinal endoscopy shield, which is a facemask with an endoscope hole to reduce aerosols during procedures.

To assist medical staff, a series of instructional videos were made to keep them updated on changing protocols, such as best practices for intubation. Even virtual reality tools were used to help train clinicians in patient ventilator workflow.

Lesson Learned #9. Maintain Testing Capability. In addition to PPE, COVID-19 testing supplies and capabilities were difficult to manage. As with PPE, HFHS supply chain experts persistently pursued the acquisition of testing materials through existing professional relationships with diagnostic companies and other vendors. A team of experts regularly monitored the experiences of other labs and other national hotspot hospitals and evaluated alternative testing options. Accordingly, the HFHS clinical laboratory was the first COVID-19 testing site listed on the FDA website and quickly gained CLIA certification for offsite hospital testing. However, many of the initial testing platforms had problems such as poor specificity, high cross reactivity, and a requirement for items such as specific nasal swabs that were hard to obtain. As testing platforms improve, establishing firm supply chain relationships and planning for future increases in testing needs, both within clinic and offsite, should be a top priority.

5 | PATIENT NEEDS—THE ENGINE DRIVING THE RESPONSE

Lesson Learned #10. Keep Patients Informed. The driving force for every aspect of the pandemic response was to provide patients with optimal care and keep them safe. COVID-19 revealed opportunities for improving patient care. Initially, public health messages directed the public not to go to a medical facility without calling first, creating a massive demand for 24/7 phone advising. The already-in-place 24/7 nursing advice system called the “MyCare Advice Line” saw a 600% increase in call volume in March. The MyCare leadership team quickly created an algorithm consistent with CDC guidelines and HFHS infectious disease directives to help manage the calls.

However, call volume was so high that a dedicated COVID nurse line, run by 22 highly trained nurses, was created. A key service they provided was guidance for patients on how to obtain on-demand video visits from primary care physicians. Interestingly, individuals who had not been affiliated with HFHS began to rely on this service, and many people were assigned HFHS medical record numbers as new patients. At the request of the Detroit Mayor, HFHS also created a general hotline for all Detroiters.

COVID-19 created an urgent push to increase the use of video technology for patient care.¹³ Often referred to as “telemedicine” or “e-visits,” HFH had already been using various remote health care technologies on a modest level, but the pandemic created a massive surge in their use, with over 154,000 video e-visits and e-consults and 74,000 telephone encounters made from March through September 2020, compared to 17,000 virtual care visits in all of 2019. Provider technology infrastructure, platform design, health care worker training, and patients' access to and ability with technology and openness to virtual visits all impact the effectiveness of this medium.¹⁴

Lesson Learned #11. Nothing Replaces a Smile. The inability of patients to see the facial expressions of their health care providers because of masking fostered confusion and stress. The “Share Your Smile” initiative was created to ease this burden. Providers were able to wear laminated photos of themselves to show to patients, which helped increase human connection. The programme was developed in coordination with the infectious diseases group to assure that this compassionate effort did not inadvertently become a new vector for viral spread.

Lesson Learned #12. Care in a Box—Send Help Home. HFHS created “COVID Care Kits” for patients who were convalescing at home, containing items such as thermometers, pulse oximeters, and clear directions for using the COVID nurse line. They provided physical and emotional support and safer continuity-of-care and also assisted with bed management by helping people know whether or not they needed to go to the ED. These kits were also key for self-monitoring by health care staff who had been sent home because of moderate COVID-19 like symptoms, allowing them to go back on duty as soon as possible.

6 | HEALTH CARE PROVIDERS—WHO IS HELPING THE HELPERS?

Lesson Learned #13. Nothing Gets Done Without Healthy Workers. The COVID-19 surge created many stressors for all employees, from physicians and nurses to maintenance workers to administrators and research staff.¹⁵ First and foremost, frontline workers faced the risk of exposure to the SARS-CoV-2 virus directly; thus, a process for employee COVID-19 testing was established early in March. The numbers grew through March and declined in April after system-wide stringent and mandatory PPE policies were put in place, even as patient influx remained high.¹⁶ To encourage staff to be tested and mitigate fear over testing consequences such as being quarantined or furloughed, policies had to be created to provide timely, cost-free tests, along with clear absence and return to work guidelines and salary and sick-leave coverage with a special COVID “bank,” with employee well-being as the main focus. A hotline was created to help with system-wide staff concerns, and in one month alone, over 13,000 calls were received.

Because providing care and running a hospital are as much art as science, an online venue for posting personal experiences was quickly created. “Frontline Diaries” is an ongoing project located on the health system’s main employee online portal, and workers across the system, whatever their experiences, were encouraged to share their experiences with text or video. Abundant food donations, signs conveying support, and other spontaneous acts of goodwill were also key to sustaining the health care staff.

7 | TRAINING AND RESEARCH—CRUCIAL ACTIVITIES FOR PROFESSIONAL DEVELOPMENT AND KNOWLEDGE ACQUISITION

Lesson Learned #14. Education: Be Prepared to Use Technology. The Accreditation Council of Graduate Medical Education (ACGME) had to respond quickly to the needs of training hospitals nationwide when it became clear that normal teaching activities would need to be greatly altered in response to COVID-19 and existing disaster policies were not adequate. Therefore, shifting policy, ACGME allowed hospitals to declare pandemic emergency status, which allowed HFHS to move trainees into patient care and to suspend most educational activities.

While formal, in-person classes were put on hold, many physician-educators continued educational activities through online media, which they often had to first learn how to use. Instructional designers in the department of graduate medical education created a training seminar to teach faculty how best to use video-conferencing tools for online teaching, as these platforms would be a permanent feature for at least the next year, if not permanently. Preparing for possible future surges, most in-person educational activities were shifted to online formats, with only small gatherings allowed for specialised training. Thus, traditional educational approaches are now being upended, and a long process of training in new methodologies is underway.

Lesson Learned #15. Research: Be Prepared to Shift Current Research Activities and for a Parallel Surge in Pandemic-Related Studies. While there was a disaster plan in place for shutting down research labs, policies had to be quickly created in response to ever-changing governmental guidelines for ongoing research studies involving patient contact, and a parallel surge in clinical and public health research related to a new pandemic disease was unanticipated. During COVID-19, ongoing research activities had to be significantly rearranged. Guidelines were quickly created internally to provide direction for human subject research, such as continuation of only certain protocols with high and moderate benefit to study participants, with most research projects postponed or cancelled. On the other hand, the pandemic itself created critically important new investigative needs. Clinical research staff were redeployed to establish a biobank of specimens from COVID-19 patients. Emergency use authorisations from the FDA for yet untested treatments, such as hydroxychloroquine, remdesivir, and convalescent plasma, were taken advantage of, with patients being closely monitored in registries and observational and randomized studies. Many formal research inquiries such as clinical trials, case series describing COVID-19 patients, and epidemiological studies were conceived, executed, written, and submitted within only a few months.^{17–25} While some work led to dead ends, the idea early in the pandemic of treating patients with corticosteroids²³ proved to be successful²⁶ and likely contributed to earlier

discharges and better ability to manage beds. In their predictive modelling efforts, HFHS researchers determined that while patients of colour were more highly represented among admissions, their mortality was not higher, which was also found among ICU patients.²⁷ HFHS negotiated to become a site for two COVID-19 vaccine trials to ensure that the Detroit community was represented, eventually contributing over 700 enrollees to both the Moderna²⁸ and Johnson & Johnson trials. Many other research faculty and trainees turned their efforts towards grant writing, data analysis, or planning in their own areas of research. A downstream effect of this increase in COVID-19 research was a large backlog of applications for institutional review board approval for human subject research and a concern about overlapping studies and patient burden, which necessitated the establishment of a formal proposal process and Review Committee for COVID-19 related projects.

8 | NOT ALONE—FORGING PARTNERSHIPS AND ENGAGING THE COMMUNITY

Lesson Learned #16. Work with the Top Level—Connect with the Federal Government. HFHS has had to continually assess the impact of state and federal waivers, executive orders, state supplemental budgets, and the federal stimulus packages on the system. Work in the finance departments identified costs and revenue losses associated with COVID-19 to apply for FEMA and federal communications commission assistance. HFHS also engaged in a range of advocacy endeavours to encourage forgiveness of Medicare accelerated payments loans, fair distribution of funding for disproportionate share hospitals, payment for treatment of uninsured COVID-19 patients, enhancing telehealth capabilities, and expanding mental health support for patients and health care workers. HFH is near the US-Canadian border, and many healthcare staff who are Canadian citizens needed to cross an international border each day for work. This unique situation required that HFH work closely with the federal government to ensure that this essential cross-border traffic not be disrupted.

Lesson Learned #17. Forge State and Local Government Connections. The Governor of Michigan was extremely active in the pandemic response, and HFHS was in continuous contact with state and local leaders with actions such as COVID-19 policies, updates and communications, and virtual town halls. Consistent discussion with state leadership included requests for lab testing and PPE supplies, employee safety issues, skilled nursing facility transfers, and a range of legal questions surrounding data sharing. At the more local level, HFHS worked closely with the office of the Mayor of Detroit and the Detroit Health Department to develop policies and procedures for the city, including the overall public health response.

Lesson Learned #18. Health Care is a Community Activity—Connect With and Serve those Outside of Hospital Walls. COVID-19 had the potential to affect every community group, with some being more vulnerable than others. HFHS worked to coordinate testing strategies to control virus spread in nursing homes, homeless shelters, and detention centres. Setting up testing sites around the city, such as at the local university and at the state fairgrounds, was key for not only tracking infection spread, but also for educating and connecting with the larger population. Screening and triage services were also offered to City of Detroit first responders, gas and electric utility workers, and other community partners, to help them prevent disruptions in services. In addition, care sites for inmates at the state prison of Southern Michigan were created, and close communication with the department of corrections was critical for ensuring proper protocols for the transfer of COVID-19 prisoners for clinical care.

9 | CONCLUSIONS

The many moving parts of a pandemic response are unpredictable and demand a high level of coordination, cooperation, resources, and multi-level expertise. Key to successful management were communication, agility, adaptability, and flexibility. From the activities of clinicians to business and finance experts to professional administrators, the results of the HFHS experience with COVID-19 revealed numerous, concurrent, and often inter-related activities that

needed to be rapidly recognized (Figure 2B). While this work is a case study describing one large health system, our recommendations (Table 1) concur with others.²⁹ As HFHS prepared for a second autumn COVID-19 wave and then a third surge in 2021, clinical activities returned to a "new normal." However, along with the entire country, our future with COVID-19 remains uncertain. We hope that this bird's eye overview of a system-wide response to COVID-19 will help other health care organisations better prepare for pandemic emergencies.

ACKNOWLEDGEMENTS

The authors would like to recognize, with gratitude, the contributors to all the work and creativity described in this paper, including all HFHS health care providers, support staff, administrators, educators, clinical laboratory and research staff, and senior leaders. The authors specifically thank the following individuals who provided essential information for this article during a very stressful time: Brian Ahmedani, Kimberly Baker-Genaw, Rebecca Blanken, John Bollinger, Jackie Chesney, Betty Chu, William Conway, Marc Corriveau, Douglas Ditri, Pauline Do, Scott Dulchavsky, Michael Eichenhorn, Arielle Gupta, Zain Ismail, Cyndy Lambert, Margot LaPointe, Albert Levin, Bruce Muma, Michael Nauss, Pat Patton, Michael Peters, Lisa Prasad, Ilan Rubinfeld, Nancy Sammons, Renee Shimmel, Karen Smith, John Snider, Courtney Stevens, Ed Szandzik, Michelle Johnson Tidjani, Jane Thornhill, Sheri Trudeau, Carrie Tuskey, Kevin Yee, Marcus Zervos, Richard Zarbo. This report was funded by institutional resources.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

ETHICS STATEMENT

The work done in this manuscript did not require any human/animal subjects necessitating the acquisition of such approval.

DATA AVAILABILITY STATEMENT

Data sharing not applicable – no new data generated.

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How to cite this article: Gifford L, Johnson CC, Haque N, Passalacqua KD, Swiderek J, Kalkanis S. COVID-19 in the hotspot of Metropolitan Detroit: A multi-faceted health system experience. *Int J Health Plann Mgmt*. 2021;1-16. <https://doi.org/10.1002/hpm.3392>