

CLINICAL

At U.S. Ground Zero for coronavirus, a hospital is transformed

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Dr. David Baker

Though COVID-19, the novel coronavirus that was sickening tens of thousands in the Chinese province of Hubei, was in the back of everyone's mind in late February, he said he wasn't really expecting the call notifying him that two of the patients with pneumonia had tested positive for COVID-19.

[Michael Chu, MD <https://www.evergreenhealth.com/dr-michael-s-chu-md-hospitalist-internal-medicine>](https://www.evergreenhealth.com/dr-michael-s-chu-md-hospitalist-internal-medicine), was coming onto EvergreenHealth's hospitalist service at about the time Dr. Baker was rotating off. He recalled learning of the first two positive COVID-19 tests on the evening of Feb. 28 – a Friday. He and his colleagues took in this information, coming to the realization that they were seeing other patients from the same facility who had viral pneumonia and negative influenza tests. “The first cohort of coronavirus patients all came from Life Care,” the Kirkland assisted living facility that was the epicenter of the first identified U.S. outbreak of community-transmitted coronavirus, said Dr. Chu. “They all fit a clinical syndrome” and many of them were critically ill or

failing fast, since they were aged and with multiple risk factors, he said during the interviews he and his colleagues participated in.



Dr. Michael Chu

As he processed the news of the positive tests and his inadvertent exposure to COVID-19, Dr. Baker realized that his duty schedule worked in his favor, since he wasn't expected back for several more days. When he did come back to work after remaining asymptomatic, he found a much-changed environment as the coronavirus cases poured in and continual adaptations were made to accommodate these patients – and to keep staff and other patients safe.

The EvergreenHealth COVID-19 Experience	
Isolation	<ul style="list-style-type: none">• Low threshold for testing, isolation• Separate portion of ED for evaluation and testing of PUIs
Personnel/Facilities	<ul style="list-style-type: none">• 24/7 coverage model for hospitalists/intensivists• General medical and ICU units converted to COVID-19 care
Communication	<ul style="list-style-type: none">• Regular team debriefings• Established area of sharing of essential information (whiteboard, can be cloud-based)• Efforts were truly unified and 360 (i.e., supply chain, engineering, environmental services)
Clinical observations	<ul style="list-style-type: none">• Early intubation when supplemental oxygen demands rose – bridging did not appear to work• Early proning seemed to have benefit• Standard ARDS ventilation followed• Elevated D-dimer levels and highly elevated CRP seemed to portend a worse illness course• Moderately and severely ill patients treated with hydroxychloroquine of approximately 4-5 days duration• Code status established on admission – due to possible rapid decompensation and restrictive visitor policies

Source: Weijen Chang, MD, SFHM, FAAP, Chief of Pediatric Hospital Medicine, Baystate Health (Springfield, Mass.), Editor, *The Hospitalist*

The hospital adapts to a new normal

The usual protocol in EvergreenHealth's ICU is for the nocturnist hospitalists, such as Dr. Baker, to staff that unit, with intensivists readily available for phone consultation. However, as the numbers of critically ill, ventilated COVID-19 patients climbed, the facility switched to 24/7 staffing with

intensivists to augment the hospitalist team, said [Nancy Marshall, MD](https://www.evergreenhealth.com/dr-nancy-a-marshall-md-hospitalist-internal-medicine)

[<https://www.evergreenhealth.com/dr-nancy-a-marshall-md-hospitalist-internal-medicine>](https://www.evergreenhealth.com/dr-nancy-a-marshall-md-hospitalist-internal-medicine) , the director of EvergreenHealth's hospitalist service.



Dr. Nancy Marshall

Dr. Marshall related how the entire hospital rallied to create appropriate – but flexible – staffing and environmental adaptations to the influx of coronavirus patients. “Early on, we established a separate portion of the emergency department to evaluate and test persons under investigation,” for COVID-19, she said. When they realized that they were seeing the nation’s first cluster of community coronavirus transmission, they used “appropriate isolation precautions” when indicated. Triggers for clinical suspicion included not just fever or cough, but also a new requirement for supplemental oxygen and new abnormal findings on chest radiographs.

Patients with confirmed or suspected coronavirus, once admitted, were placed in negative-pressure rooms, and droplet precautions were used with these patients. In the absence of aerosol-generating procedures, those caring for these patients used a standard surgical mask, goggles or face shield, an isolation gown, and gloves. For intubations, bronchoscopies, and other aerosol-generating procedures, N95 masks were used; the facility also has some powered and controlled air-purifying respirators.

In short order, once the size of the outbreak was appreciated, said Dr. Marshall, the entire ICU and half of another general medical floor in the hospital were converted to negative-pressure rooms.

Dr. Marshall said that having daily team debriefings has been essential. The hospitalist team room has a big whiteboard where essential information can be put up and shared. Frequent video conferencing has allowed physicians and advanced practice clinicians on the hospitalist team to ask questions, share concerns, and develop a shared knowledge base and vocabulary as they confronted this novel illness.

The rapid adaptations that EvergreenHealth successfully made depended on a responsive administration, good communication among physician services and with nursing staff, and the active participation of engineering and environmental services teams in adjusting to shifting patient needs, said Dr. Marshall.

“Preparedness is key,” Dr. Chu noted. “Managing this has required a unified effort” that addresses everything from the supply chain for personal protective equipment, to cleaning procedures, to engineering fixes that quickly added negative-pressure rooms.

“I can’t emphasize enough that this is a team sport,” said Dr. Marshall.

The unpredictable clinical course of COVID-19

The chimeric clinical course of COVID-19 means clinicians need to keep an open mind and be ready to act nimbly, said the EvergreenHealth hospitalists. Pattern recognition is a key to competent clinical management of hospitalized patients, but the course of coronavirus thus far defies any convenient application of heuristics.

Those first two patients had some characteristics in common, aside from their arrival from the same long-term care facility. They each had unexplained acute respiratory distress syndrome and ground-glass opacities seen on chest CT, said Dr. Marshall. But all agreed it is still not clear who will fare well, and who will do poorly once they are admitted with coronavirus.

“We have noticed that these patients tend to have a rough course,” said Dr. Marshall. The “brisk inflammatory response” seen in some patients manifests in persistent fevers, big C-reactive protein (CRP) elevations, and likely is part of the picture of yet-unknown host factors that contribute to a worse disease course for some, she said. “These patients look toxic for a long time.”

Dr. Chu said that he’s seen even younger, healthier-looking patients admitted from the emergency department who are already quite dyspneic and may be headed for ventilation. These patients may have a low procalcitonin, and will often turn out to have an “impressive-looking” chest x-ray or CT that will show prominent bilateral infiltrates.

On the other hand, said Dr. Marshall, she and her colleagues have admitted frail-appearing nonagenarians who “just kind of sleep it off,” with little more than a cough and intermittent fevers.

Dr. Chu concurred: “So many of these patients had risk factors for severe disease and only had mild illness. Many were really quite stable.”

In terms of managing respiratory status, Dr. Baker said that the time to start planning for intubation is when the supplemental oxygen demands of COVID-19 patients start to go up. Unlike with patients who may be in some respiratory distress from other causes, once these patients have increased Fio_2 needs, bridging “doesn’t work. ... They need to be intubated. Early intubation is important.” Clinicians’ level of concern should spike when they see increased work of breathing in a coronavirus patient, regardless of what the numbers are saying, he added.

For coronavirus patients with acute respiratory distress syndrome (ARDS), early proning also seems to provide some benefit, he said. At EvergreenHealth, standard ARDS ventilation protocols are being followed, including low tidal volume ventilation and positive end-expiratory pressure (PEEP) ladders. Coronavirus ventilation management has thus far been “pretty similar to standard practice with ARDS patients,” he said.

The hospitalist team was able to tap into the building knowledge base in China: Two of the EvergreenHealth hospitalists spoke fluent Mandarin, and one had contacts in China that allowed her to connect with Chinese physicians who had been treating COVID-19 patients since that outbreak had started. They established regular communication on [WeChat](https://www.wechat.com/en/) [<https://www.wechat.com/en/>](https://www.wechat.com/en/), checking in frequently for updates on therapies and diagnostics being used in China as well.

One benefit of being in communication with colleagues in China, said Dr. Baker, was that they were able to get anecdotal evidence that elevated D-dimer levels and highly elevated CRP levels can portend a worse illness course. These findings seem to have held generally true for EvergreenHealth patients, he said. Dr. Marshall also spoke to the value of early communication with Chinese teams, who confirmed that the picture of a febrile illness with elevated CRP and leukopenia should raise the index of suspicion for coronavirus.

“Patients might improve over a few days, and then in the final 24 hours of their lives, we see changes in hemodynamics,” including reduced ejection fraction consistent with cardiogenic shock, as well as arrhythmias, said Dr. Baker. Some of the early patient deaths at EvergreenHealth followed this pattern, he said, noting that others have called for investigation into whether viral myocarditis is at play in some coronavirus deaths.

Moderately and severely ill coronavirus patients at EvergreenHealth currently receive a course of hydroxychloroquine of approximately 4-5 days’ duration. The hospital obtained remdesivir from Gilead through its compassionate-use program early on, and now is participating in a clinical trial for COVID-19 patients in the ICU.

By March 23, the facility had seen 162 confirmed COVID-19 cases, and 30 patients had died. Twenty-two inpatients had been discharged, and an additional 58 who were seen in the emergency department had been discharged home without admission.

Be suspicious – and prepared

When asked what he'd like his colleagues around the country to know as they diagnose and admit their first patients who are ill with coronavirus, Dr. Baker advised maintaining a high index of suspicion and a low threshold for testing. "I've given some thought to this," he said. "From our reading and what information is out there, we are geared to pick up on the classic symptoms of coronavirus – cough, fever, some gastrointestinal symptoms." However, many elderly patients "are not good historians. Some may have advanced dementia. ... When patients arrive with no history, we do our best to gather information," but sometimes a case can still take clinicians by surprise, he said.

Dr. Baker told a cautionary tale of one of his patients, a woman who was admitted for a hip fracture after a fall at an assisted living facility. The patient was mildly hypoxic, but had an unremarkable physical exam, no fever, and a clear chest x-ray. She went to surgery and then to a postoperative floor with no isolation measures. When her respiratory status unexpectedly deteriorated, she was tested for COVID-19 – and was positive.

"When in doubt, isolate," said Dr. Baker.

Dr. Chu concurred: "As soon as you suspect, move them, rather than testing first."

Dr. Baker acknowledged, though, that when testing criteria and availability of personal protective equipment and test materials may vary by region, "it's a challenge, especially with limited resources."

Dr. Chu said that stringent isolation, though necessary, creates great hardship for patients and families. "It's really important for us to check in with family members," he said; patients are alone and afraid, and family members feel cut off – and also afraid on behalf of their ill loved ones. Workflow planning should acknowledge this and allocate extra time for patient connection and a little more time on the phone with families.

Dr. Chu offered a sobering final word. Make sure family members know their ill loved one's wishes for care, he said: "There's never been a better time to clarify code status on admission."

Physicians at EvergreenHealth have created a [document](https://www.evergreenhealth.com/covid-19-lessons) <<https://www.evergreenhealth.com/covid-19-lessons>> that contains consolidated information on what to anticipate and how to prepare for the arrival of COVID-19+ patients, recommendations on maximizing safety in the hospital environment, and key clinical management considerations. The document will be updated as new information arises.

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Correction, 3/27/20: An earlier version of this article referenced white blood counts, presence of lymphopenia, and elevated hepatic enzymes for patients at EvergreenHealth when in fact that information pertained to patients in China. That paragraph has been deleted.

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