

LISA DE BODE

# INNOVATING

## “In the Here and Now”

Under COVID-19, nurses are inventing the future of health care.

**N**adia Andrade, a 31-year-old critical care nurse practitioner who has volunteered in war zones, thought she was prepared when she entered Brooklyn’s Maimonides Medical Center last April. When a landmine went off in Syria, for example, she’d get four or five wounded people in an hour, stabilize them, and get ready for the next wave. But the COVID ward was different. “You have 20-something very sick people on the floor with two nurses,” she says. “It is very, very, very hard to be on top of everything.” The infusion pumps dispensing fluids and medicines became a big concern: if one of them ran dry, or the beeping of an empty pump’s alarm was drowned out by another alarm, the patient could go into cardiac arrest, and die. Andrade says there was “beeping, beeping everywhere.” She remembers the constant alarms in the intensive care unit, sirens wailing outside, and feeling “moral distress.”

The nurses had to constantly run in and out of patient rooms to tend the pumps, moving from contaminated areas to clean ones rapidly. With as many as 400 COVID-19 patients in the hospital, a shortage of personal protective equipment (PPE), and nurses already falling ill from the disease themselves, Andrade and her coworkers began to improvise. Nurses moisturized the straps of their masks so they didn’t break when taken off; they refitted their gowns with safety pins. On the social networking site LinkedIn, she learned that nurses at other hospitals were moving the infusion pumps to hallways, where they could replace bags and respond to alarms without entering the rooms.

Moving the pumps away from the bedside allowed the nurses to care for more patients while reducing transmission risks, but the longer tubing changed the physics of the diffusion process: the added resistance slows the machines down, and sometimes air bubbles form. One shift last spring Andrade pulled out her phone and used Twitter to contact the company that produces the pumps. “Hey, can you send the guidelines for increasing the tubing length?” she wrote. The company responded, and Andrade shared the advice to increase the pumps’ pressure with the team. The moment, she says, was typical of how this spring was spent “reimagining and reinventing our units and the way our units work.”

For nurses across the country, this process of improving the delicate calculus of care for COVID patients has become deeply personal. At New York’s Lenox Hill Hospital, the critical care float nurse Ernesto Barbieri explained how he became acutely aware of his own impulses after moving the pumps into the hallway. “The instinct as a critical care nurse is to run in the room,” he said. “But that was something that we had to really be careful about and stop ourselves. You cannot run into the room without your PPE because it’s not just about you, and it’s not just about the patient: it’s about the other patients that you’re going to see after that—because now, you might be a carrier.”

When we talk about medical innovation, we usually speak of *things*—for example, a new molecule discovered by a scientist, or an endoscopic robot wielded by a



Illustration by Shonagh Rae

surgeon. But the truer nature of nursing's inventiveness, and its historically complex relationship with patients and technology, has been revealed as nurses have created new methods of COVID care on the fly, keenly aware of the risks they are taking on themselves. Nurses' stories of rapid improvements in care, communication, and logistics reveal the deep and unexpected role of trust in innovation, as well as how changes instituted in the pandemic could shape health care for years to come.

### **An evolving standard of care**

Nurses have long been key players in hospitals, but COVID-19 has underscored their uniquely essential role. The strikingly high death rates of the COVID patients who first entered New York hospitals last March—measured

at three hospitals at 25.6%—had fallen by August, when the death rate was 7.6% at those same hospitals. Another study in the United Kingdom found similarly higher rates of survival in critical care units over time. Even after accounting for age, ethnicity, and other factors, the researchers attributed the improvement to changes in care, and lower bed occupancy rates—meaning more staff attention per patient.

These changes included drug therapies, notably the steroid dexamethasone, but also an array of procedures and techniques including proning (turning patients onto their stomach to improve blood oxygen levels), managing patients' needs on mechanical ventilation, and coaching and encouraging patients not on ventilators to adopt new behaviors. News of these innovations diffused

from hospital to hospital, and ward to ward, through formal channels—including briefings by supervising physicians and guidelines from the Society of Critical Care Medicine—as well as informal channels, including social media.

The importance of nurses became clear early in the pandemic, even though the public conversation focused on the availability of hardware such as ventilators. “It’s all well and good [to have] the industrial community coming together and giving us another 5,000 ventilators overnight,” says Bilal Mateen, a physician and clinical data science fellow at the UK’s Alan Turing Institute. “I can’t train another 5,000 nurses on how to use them overnight.”

This became only more obvious as the wards filled up. In normal times, one nurse tends to only one patient in an intensive care unit. “That’s what makes an ICU: the patient-to-nurse ratio. That’s why an ICU is an ICU,” says Cameron Kyle-Sidell, an emergency room doctor at Maimonides Medical Center. In March, those ratios went up to four-to-one, or seven-to-one in extreme cases. Kyle-Sidell adds that while bedside care is seen as guided by doctors, in fact it is generally the domain of nurses. “Every moment-to-moment thing, it’s the nurse who is the eyes on the patient,” he says. “Once you exceed your capacity to really

when you have to put on all that PPE,” Barbieri said.

And some of the innovations in therapy required further changes in the way nurses worked with patients. Some patients did much better if they were not intubated and put on a ventilator, but were instead given oxygen through a nasal cannula (a two-pronged tubing device that is placed in a patient’s nostrils). What these patients then needed was a lot of supervision, or “coaching,” to self-prone and not pull out their cannulas on bathroom breaks. Kyle-Sidell recalls treating several patients who were found face down in hospital lavatories, suffering from lack of oxygen. “Our job was to circle [the ward] and make sure they kept their oxygen on—really encourage them to turn over and flip over and not get out of bed, and to eat and drink,” he says. “But it required a tremendous amount of caretaker attention.”

As the idea of what constituted proper care evolved, all this work coaching and encouraging added to the kinds of care that floor nurses are managing, says Lewis J. Kaplan, the president of the Society of Critical Care Medicine. “When you are sick with COVID in the hospital, you’re really worried you’re going to die. And every day and every moment that you are capable of doing

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watch the patients, that’s when it turns into a disaster.”

A long-known truth about modern hospitals is that they are not built to function at very high capacities, says Mateen, who analyzed occupancy data from hospitals across the United Kingdom. He says bed occupancy rates—and the availability of nurses and other staff—has a “clear effect” on patients’ survival rates. “If you get admitted to an intensive care unit on a day where there’s more than 85% of the mechanical ventilation beds occupied, your risk of dying is significantly higher,” he says.

Modifications to care followed quickly. Before March was out, teams around the country began practicing proning, the technique, first documented in the 1970s, of turning patients onto their stomachs to increase the amount of oxygen in their blood. Barbieri, who regularly “flipped” patients, explained that in an ideal situation, a registered nurse would work with a team of four or five to perform the maneuver on an intubated patient. The process is physically difficult for staff and hard on patients, he says, with dangers that include kinking or ripping out IV lines, bending endotracheal tubes, and causing the patient to bleed because of skin breakdown on the face. “If the patient goes into cardiac arrest it’s very hard to flip them and start doing compressions—especially

something for yourself that helps keep your lungs open [means] you are now engaged in your own care where it reinforces hope,” he says, adding that “the power of hope and a positive outlook really cannot be overstated.”

But at the same time, the extra workload—from managing machines to managing emotions—puts an enormous burden on nurses. “They’re stretched thin,” Kaplan says, “and it is potentially dangerous because the more tired you are, the more likely you are to err, especially when you are dealing with doffing [PPE] after having been in a COVID room.”

Even as patient survival rates rose dramatically through the spring and early summer, COVID-19 took a toll on nurses themselves. National Nurses United (NNU), the nation’s largest nurses’ union, estimates that by mid-September 2020, close to 259,000 health care workers had been infected, and more than 2,100 died, of whom at least 213 were registered nurses. These deaths revealed entrenched health disparities: Filipino nurses, who make up just 4% of nurses nationally, accounted for 31.5% of the dead, and Black nurses, who comprise 12.4% of the nursing workforce, accounted for 17.8%, according to NNU. Among factors placing these nurses at greater

risk, Filipino nurses are more often employed in higher-risk positions such as ICUs, emergency rooms, and inpatient settings, according to Jennifer Nazareno, an assistant professor of public health and entrepreneurship at Brown University and the codirector of the Philippine Health Initiative for Research, Service, and Training. Black nurses, in turn, more frequently work in underfunded hospitals that lack PPE and adequate protection, according to the National Black Nurses Association.

Nurses' unions have long been leaders in championing improved standards of care and working conditions, and during the pandemic they have continued that work. Shortly after the first cases of coronavirus hit, NNU surveyed the amount of PPE available in hospitals, discovering that they were largely unprepared. On August 5, NNU organized more than 200 protests demanding more PPE, a safe workload of patients, and other protections. In September, California started requiring hospitals to store N95 masks at typical usage rates in defiance of the industry's just-in-time inventory model. In November, nurses again rang the alarm bells about the shortage of staff; "extreme levels of moral distress," caused by the lack of support and supplies to care for patients; and the need for a course correction to avoid "catastrophic levels of deaths and suffering."

These actions build on years of union work to improve the safety of nurses and their patients, famously including the RN Mary Magee, who contracted HIV from an accidental needle jab in San Francisco General Hospital's Ward 5B in the 1980s. She then led a union-backed effort to have hospitals purchase safer needles, which are now standard in California, and Congress soon mandated safer standards nationwide. Martha Dawson, the president of the National Black Nurses Association, remembers working with early cases of HIV at the University of Alabama at Birmingham, when nurses used Coca-Cola bottles, or even IV bottles, until needle storage containers were invented. "Out of chaos can also come creativity and innovation," she says.

### **"The habit of ready and correct observation"**

As with HIV, the COVID-19 pandemic has again exposed tensions around nurses' central role as innovators in patient care that go back to the very origins of Western nursing. Florence Nightingale's 1860 manual, *Notes on Nursing*, introduced guidelines on ventilation, noise, diet, and sleep—many of which remain valid today. It ends with a chapter on the powers of observation that pushes back against the idea that nurses are doing innately "female" work by staking their vocation firmly in the domain of scientific knowledge production. It "may safely be said, not that the habit of ready and correct observation will by itself make us useful nurses, but that without it we shall be useless with all our devotion," she wrote.

As hospitals evolved, nurses took on the task of organizing large wards for the sick. Over the years, prominent nurses would strive for professional recognition, defending nursing as skilled, paid work, and distinguishing it from unseen domestic labor. By the time of the 1918 Spanish flu pandemic, when a third of the world's population was infected, nursing care might have been the single most effective treatment to improve a patient's chances of survival, the historian John M. Barry writes in *The Great Influenza*.

As new technologies for diagnosis and treatment, including x-rays and antibiotics, entered the field of medicine after World War II, nurses' work became associated with the running of hospitals and equipment rather than being seen as an area of constant innovation itself. "Nursing was the soft technology that allowed physicians to use the new hardware of diagnosis," Margarete Sandelowski writes in *Devices and Desires: Gender, Technology, and American Nursing*.

### **The role of trust in innovation**

The pandemic, however, shattered some of the fixed hierarchies of knowledge production, with hackathons, WhatsApp threads, and social media channels hosting feverish exchanges between global networks of health care professionals. And it has facilitated new avenues for innovation.

"So often people talk about the nurses as sort of doing lots of workarounds. So basically [they work with] what's in front of you and what's going to work best in that particular situation," says Patricia Davidson, the dean of the Johns Hopkins University School of Nursing. What nurses innovate on is the stuff of everyday life in the ward. "When you're in the here and now, and the issue is in front of you—that's a pretty good motivation to do something different and better," Davidson says. "Just the pain of watching the suffering of another is a pretty good motivation to be creative."

One area of focus has been preventing and controlling the spread of the virus. In some hospitals, nurses have trained staff on safe ways to don and doff PPE. They have done this by appointing a safety officer who watches staff putting on and taking off protective gear on COVID wards. "Their job is to make sure that not only do you place it correctly when you're still in the clean space before you enter the COVID ward," says Jason Farley, a professor of nursing at Johns Hopkins, "but when you're contaminated and you're removing everything and you're coming out a different exit of that ward, that you remove it in such a way as to protect yourself and to protect the environment into which you're moving back—either clean spaces or other parts of the hospital."

Farley has been working on innovations that can protect nurses, but he is keenly aware of nurses' need to build and maintain connections to patients. He recently designed and built a portable testing booth in partnership with the University of Maryland's School of Engineering. The pod uses

positive pressure ventilation (similar to the mechanism that was employed inside iron lungs to help polio patients breathe) so that air exhaled by the patient does not come into the booth, minimizing the risk of transmission to the tester. And the booth is built of plexiglass so that the patient can see the health care worker's unmasked face. It seems minor, he explains, but it's invaluable for lip-reading, and "being able to see a person's face helps calm someone when they're nervous."

As he designed the booth, Farley wrestled with a familiar contradiction between facilitating connection and keeping the nurse and patient safe by separating them. The trick, he says, is to remove emotional barriers between patient and caregiver. Cultivating transparent personal relationships, Farley says, is something nurses excel at. And that drives patients' willingness to both accept potentially uncomfortable care and change their own behaviors. "It's one of the reasons why nursing is consistently voted the most trusted profession of all," he says.

Farley's invention brings up a larger truth: as much as the booth may be seen as a "hard" technology, its use is inseparable from the nurses who operate it. The time lag between when health research occurs and when its lessons become standard medical practice takes an average of 17 years, explains Heather Ross, who holds a joint appointment as an assistant professor at Arizona State University's School for the Future of Innovation in Society and ASU's Edson College of Nursing and Health Innovation. Nurses are key to the process of convincing people that the change is worthwhile. "You have to talk about diffusion of innovation and uptake of innovation whenever you talk about innovation," Ross says. "And that diffusion of innovation and uptake—you can't extract it from talking about trust. It's all tied together."

Easing friction between patients and the machines around them helps build some of that trust, says Lisa Wolf, the director of the Institute of Emergency Nursing Research at the Emergency Nurses Association and an adjunct professor at the University of Massachusetts Amherst College of Nursing. She calls this the "midwifery aspect" of the profession, which has its own remedies for managing the machines of care. She lists a few: pouring a bit of ginger ale into a patient's nasogastric tube to unclog it; using hot packs on a patient's hand to dilate the veins ahead of inserting an IV (as opposed to directly inserting the needle); putting the tip of a nasogastric tube in ice water so it doesn't curl as it slides down a patient's throat—all of the "little things" that make people feel more comfortable.

But ultimately, it may be the fact that nurses are often the first to touch a newborn baby and the last to touch a dying person that makes the technology they use sometimes seem secondary, compared with their

prominent social and spiritual role in medicine. "Because Americans are so afraid of death and utterly unprepared for it," Wolf says, "the thing that gives them peace is to have somebody there talking to them, holding their hand. To have a nurse with you in those last moments I think is the central focus of nursing—assisting people to health or to a dignified death."

Accordingly, the stress of the pandemic has given nurses space to innovate in death too. "We hold people's hands and we tell them that we're going to convey their messages. We sit there and are their family in their last minutes," says Andrade, the critical care nurse who worked to rearrange the pumps at Maimonides Medical Center. Hoping to ease families' suffering, Andrade used her personal phone to connect dying patients and their families. Sometimes she left voice messages for the families. Around the country, other nurses performed the same ritual, wrapping their phones in plastic.

This has since become more standardized, with some ICU units installing iPads in wards in anticipation of more COVID deaths. "We were trying to find innovative ways to make things happen, and technologies have improved a lot," Andrade says. "But I hope nobody will ever get used to it. It's still not close to the warm touch—somebody holding your hand, kissing you, and saying what they wanted to say in person. I hope there will be a lot of research to understand and navigate feelings about how we can do it better next time."

### The possibilities of telemedicine

One innovation accelerated by the pandemic that is likely to persist is telemedicine, where medical professionals consult with patients over phones or computers. Although some insurers had previously offered telehealth services, it wasn't widely available before late February, when the US Centers for Disease Control and Prevention recommended that health care providers offer clinical services through virtual means, and Medicare and Medicaid moved rapidly to broaden access: by the last week of March, teleconsults had risen by 154% over the previous year. Telemedicine has many advantages: expanding access to care when patients can't be seen at the hospital, preserving PPE, and limiting exposure. Accordingly, 2020 has seen billions of dollars in investment flowing toward telehealth, which is seen as an area ripe for both rapid growth and high profits.

For nurses, this new mode of care brings up old concerns: will they be allowed to engineer the experience to increase the trust and comfort of patients, or will it be a way for companies to turn the health care experience over to poorly paid contractors reading from customer service scripts? By introducing distance into an intimate examination, telehealth could remove agency from nurses, says Michelle Mahon, the assistant director of nursing

practice at National Nurses United. “The industrial model of health care is facilitated by telehealth,” she says, adding that it plays into the hands of an industry keen on making money and “reversing the trend” toward nurses’ professionalization.

But some nurses have found rich new possibilities in telemedicine to create vastly more engaged care, reaching patients who are currently disconnected from the medical system, and rallying a supportive community around them. In the right hands, telemedicine can use technology to break down barriers, allowing nurses to practice medicine outside the confines of clinics and hospitals—at patients’ homes or other places that may be more conducive to healing, or, by contrast, to a good death.

Whitney Fear is a psychiatric mental health nurse practitioner at Family HealthCare in Fargo, North Dakota, a federally qualified community health center that houses the state’s only health clinic for the homeless. Though the pandemic has been devastating to health workers in North Dakota—the governor has encouraged nurses with COVID who were asymptomatic to report for work—Fear explains that it has also necessitated and opened up a space for new services and partnerships.

medications. By phone and tablet, Fear did intake interviews with patients to gain their consent, with the understanding that drugs to ease withdrawal would be made available only under the terms of quarantine in the hotel. Via the virtual connection, Fear, who is a member of the Oglala Sioux Tribe, also worked with Native American patients to treat their anxiety with meditation and prayer and mailed them herbs such as sage that she had previously gathered. “I tell them, obviously, you can’t burn this in the hotel; it’s going to set the fire alarms off,” she says, “but you can do dry smudging where you rub the plant on the skin.”

Fear points to another workaround spurred by the pandemic that now connects her Native American patients to a much larger community. Since March, some have joined a Facebook group called Social Distance Powwow. Today, its more than 200,000 members share stories of survival and healing: COVID patients have asked for support from their ICU beds; members have offered encouragement to people struggling with sobriety; and dancers submit videos of themselves performing the Jingle Dress dance, which dates to the trauma of the 1918 Spanish flu pandemic. Where people were once isolated, they now

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In March, Fear was able to quickly move to using computers and phones to consult with patients at the clinic, when she was quarantining at home after her husband had been exposed. In early April, she received a text from the director of a local homeless shelter, relaying concerns that quarantine might put some of its homeless residents into alcohol withdrawal without any medical support. Withdrawal could induce hallucinations, and even trigger seizures.

Jan Eliassen, the director of harm reduction programs at Fargo Cass Public Health, wondered if Fear could help throw together “fly by the seat of your pants” detox services. “Come Monday we’re going to have to figure out a protocol,” she texted.

“Do you want me to come up with one this weekend? I’m happy to do that for you guys,” Fear texted back.

Within a week, Fear says, the clinic, the shelter, and the state created a program to assist homeless patients through withdrawal in quarantine. Patients stayed in temporary hotel rooms provided by the state, and nurses from the North Dakota Medical Reserve Corps and Family HealthCare visited them to take vitals and distribute

find themselves among a large and vibrant community. Fear says this new practice “lifts spirits,” reminding her of Nightingale’s admonition to “give pleasure to the sick” by sharing news of life outside the hospital.

Fear sees her work at Family Healthcare as part of a larger push to create a more holistic health care system for the future—a process she has compared to building a “home,” staffed by people with similar life experiences to patients’, and grounded in community. In November, Fargo Cass Public Health opened a more permanent facility to provide access to the virtual detox program—a “silver lining” of the pandemic, Eliassen says. Partnerships enabled by technology, such as those that facilitated the detox program, are a model for how to find a sense of renewal in times of upheaval, Fear says. Innovation is an ongoing necessity, she adds: “you have to figure out how to make it work.”

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