

a hospital is forced to halt, it's not just the patients who are evacuated.

Everyone is justly proud of the remarkable feat that occurred during the hurricane. The selfless and seamless cooperation among clinicians, administrators, staff members, facilities workers, National Guard troops, and emergency of-

ficials was nothing short of extraordinary. Every single patient was safely and smoothly transferred. Repair crews are working feverishly to repair the damage, and we expect to have some of the Bellevue clinics running within a few weeks. But it is hard to restrain our heartache at seeing this grande dame of hospitals

drained of its lifeblood of medical activity.

Disclosure forms provided by the author are available with the full text of this article at NEJM.org.

From New York University School of Medicine and Bellevue Hospital, New York.

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Facing Uncertainty — Dispatch from Beth Israel Medical Center, Manhattan

Sushrut Jangi, M.D.

Around 9 p.m. on October 29, 2012, the bright lights at Manhattan's Beth Israel Medical Center flickered and went out. Dr. Harris Nagler, hospital president, stepped out onto 16th Street to find every building around him in shadow. "I remember feeling a kind of awe," he says, "that despite all of the complex variables, meteorologists predicted this almost to the minute, and there it was in front of us, happening." Hurricane Sandy, one of the largest Atlantic hurricanes on record, had arrived. A few blocks away, New York Downtown Hospital and the Manhattan VA Medical Center had been evacuated, and New York University (NYU) Langone Medical Center and Bellevue Hospital were on high alert.

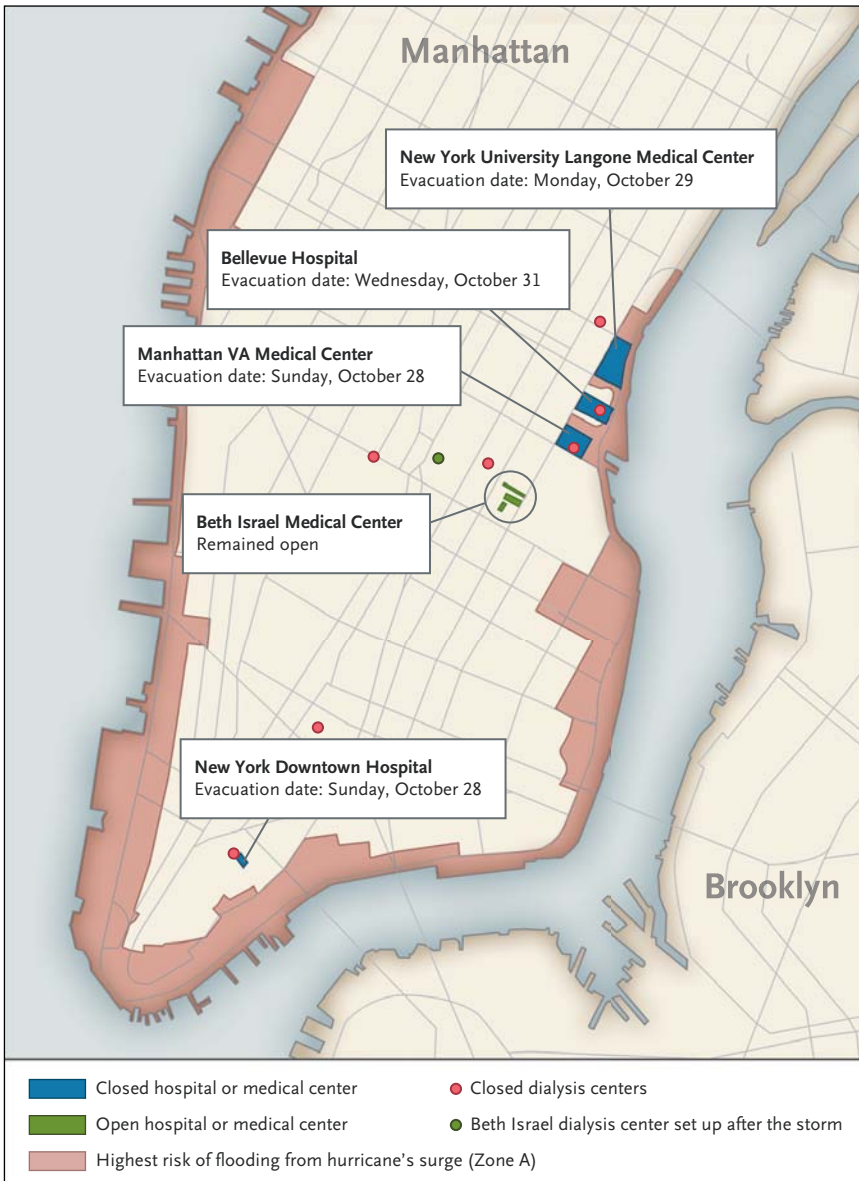
Coming back inside, Nagler found the corridors dim. Like the other hospitals nearby, Beth Israel had fallen off the electrical grid. Fortunately, the generators had come online. "We were outside of Zone A, farther away from the river than everyone else" (see map). Ordinarily, Beth Israel was a 900-bed teaching hospital serving the West and East Village and parts of Gramercy, Chelsea, and China-

town. Now, communications from the Greater New York Hospital Association brought troubling news: NYU Langone and Bellevue were likely to evacuate. Beth Israel had become Lower Manhattan's only running major hospital.

In the emergency department (ED) downstairs, ED chairman Gregory Husk was unsettled. One of Beth Israel's towers had lost generator power; the building housed a maternity ward and a geriatric psychiatric facility, and transfers to St. Luke's were being considered. The emergency bays, for now, were quiet. But Husk knew that the sicker patients always came later. He had worked in this ED through a litany of disasters — the first World Trade Center attack, September 11, a 2003 blackout, Hurricane Irene, and now this. "We learn something from each disaster," he says, "but no two are ever the same." Each event has its own moving parts, requiring fresh ingenuity. "At first, patients couldn't get here," he said. "Landlines and cell phones were out, so they couldn't call 911." A flooded subway and an off-line bus fleet meant the transportation network had vanished. But by Halloween

night, nearly all ambulances serving Lower Manhattan were dispatched to Beth Israel.

Husk was unsure what kinds of patients he would see. On September 11, he remembers an ED with enough staff to trip over — but the anticipated flood of patients never came. This time, on October 31, the ED reached double its normal volume. One hundred more ambulances than usual began arriving each day. "Bellevue is a Level 1 trauma center, but mysteriously, even with Bellevue closed, traumas didn't increase," Husk said. What they saw, in large numbers, were patients who had lost power and relied on electricity for essential health services. "Folks had run out of oxygen, failed nebulization, were ventilator-dependent, or had missed multiple dialysis sessions." Lacking these services, patients presented with shortness of breath, asthma exacerbations, and life-threatening hyperkalemia (see graph). Others presented with carbon monoxide poisoning from trying to heat their homes with kitchen stoves. Elderly patients stranded in apartments on high floors with no functioning elevators or who had lost access to



Hospitals and Dialysis Centers in Lower Manhattan.

their home health aides were carried down darkened stairwells on stretchers and brought to the ED. With nearby pharmacies closed and refrigeration capacity lost, many patients arrived seeking prescriptions for essential medicines. At one point, with 27 patients in the ED awaiting dialysis, Husk knew it was time to innovate.

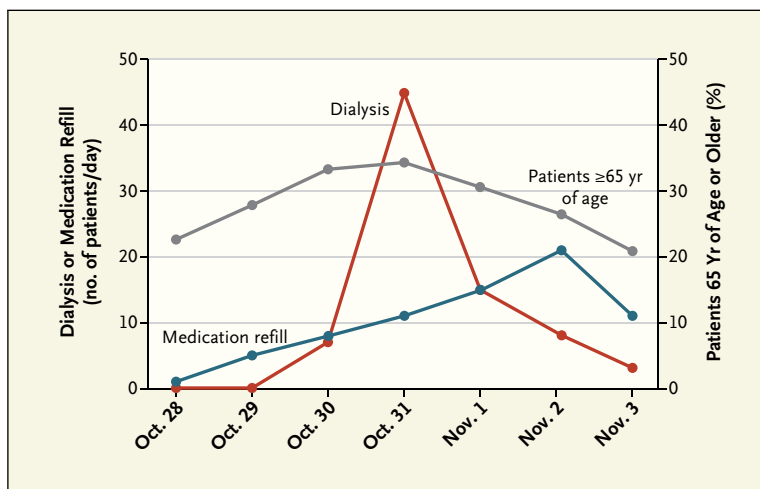
He called in nephrologist James Winchester and his team to pur-

sue an unusual plan. All seven dialysis units in Lower Manhattan had lost power; they had no light, no working phones, and no way to run reverse-osmosis units. "These patients were very frightened," said Winchester. "For the first time in their lives, they couldn't turn on dialysis." So Beth Israel transformed its ED. A medical student stationed near triage collected stat potassiums with a blood gas machine. A physician

assistant shuttled results to the nephrology team. "Patients who had potassiums above 5.8 got immediate Kayexalate, insulin, and glucose," said Winchester. "If [their potassium] didn't come down, they were triaged into the hospital for dialysis." To save time, patients in renal failure were pulled in groups into the "grieving room," where emergency physicians usually give bad news. The staff conducted group interviews to ensure that patients with critically elevated lab values were safely triaged. Meanwhile, two generators inched through gridlocked streets, taking 4 hours to come from 88th Street to the outpatient dialysis unit nearby. A lack of medical records, language interpreters, and information on patients' viral status complicated matters. At one point, dialysis patients were coming into the ED every 3 minutes. Amazingly, the cadre of nephrologists camped in the ED, a makeshift triage protocol, and the salvaged dialysis unit turned the hospital into an effective dialysis provider for all of Lower Manhattan.

On the wards, chief medical resident Reza Samad was also improvising. The command center had opened a new medical ward, and housestaff on ambulatory rotations were called in to help. "We had psychiatry residents serving as medical interns," Samad said. Housestaff were everywhere, answering phones, doubling as custodians, secretaries, and cooks. Surgeons were transformed into medicine ward attendings, managing asthma exacerbations. Primary care physicians who hadn't been on the wards in years were running teams.

"Then we went off the grid. We lost the paging system and the intercom," Samad said. "So we came up with a spontaneous



Distribution of Patients in Beth Israel's Emergency Department after Hurricane Sandy.

network.” Since the Wi-Fi was still working, residents downloaded a telephony app onto their phones and used it to send urgent text messages. At one point, the system brought several residents together for a code in a dark room. By the glow of headlamps and bobbing flashlights, a resident began resuscitation while others prepared to place a central catheter. While Samad tried to sustain morale, duty-hour limits were no longer top priority — though the influx of outpatient providers helped residents get some rest. Like the boundaries defining a resident, a medicine ward attending, a housekeeper, a surgeon, and a social worker, the lines defining work shifts had blurred.

Nagler recalls that when he first became Beth Israel's president, he “got on the subway one morning and was thrust against the front of the subway car, pushed against the window by the crowd, and the view in front of me was pitch black except for the gleam of the tracks.” He remembers this image every time he faces the unexpected, hopeful he will find a path forward. When I visited the hospital 5 days after Sandy, the lights were back on, but in a sense Nagler still felt like he was on that subway, hurtling toward an uncertain destination. Many nearby hospitals remain closed, and high volumes continue. And even after this crisis ends, another unpredictable event is bound to occur, and whether

it's a hurricane, a terrorist attack, or an infectious disease outbreak, it will pose its own obstacles.

As Manhattan works to repair itself, local clinicians find that part of their job is to evolve under duress, trying to provide good care under dynamic circumstances. One NYU hospitalist, lacking patients in her own hospital, visits evacuated patients at their new facilities, bridging gaps in the medical record. She is navigating a foreign landscape, but most health care professionals will encounter such unfamiliar terrain sometime during their careers.

Nagler returns to his musing on meteorology. The weather and medicine are similar in many ways, he remarks, both full of complex variables that produce unpredictable outcomes. But the hospital managed to meet such outcomes with creative and rapid solutions. Nagler looks out the window onto 16th Street. The sun has emerged, briefly, over Manhattan, and somewhere nearby an ambulance siren wails.

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Lessons from Sandy — Preparing Health Systems for Future Disasters

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Within hours after Hurricane Sandy's landfall, doctors and staff at one of New York City's premier medical centers realized that something was go-

ing terribly wrong. Lights were flickering, critical devices essential to life support for more than 200 patients, many in intensive care units, were malfunctioning.

A decision had to be made by hospital leaders, senior public health officials, and emergency responders: tough it out in a hospital without power or attempt a perilous