GLOBAL CHALLENGES
EBOLA OUTBREAK

INNOVATIONS FOR
SUCCESSFUL SOCIETIES

FILLING SKILLS GAPS: MOBILIZING HUMAN RESOURCES IN THE FIGHT AGAINST EBOLA, 2014–2015

David Paterson and Jennifer Widner drafted this case study with advice from Béatrice Godefroy.

SYNOPSIS

At the end of March 2014, the nongovernmental organization Médecins Sans Frontières warned that an Ebola virus disease outbreak on the border between Guinea and Liberia could unleash an epidemic of unprecedented scale. Its capacity still limited after a 14-year civil war, Liberia's government was struggling to mobilize and coordinate the extra assistance its health ministry needed to respond. How to recruit, train, protect, and pay a labor force that included government employees, temporary workers, and many international volunteers were central concerns. In the best of times, coordinating this kind of skills supply chain would be challenging. But from June to the end of August, conditions became increasingly difficult. As the infection spread, many health workers died. In the absence of facilities and equipment that could provide protection, fear slowed recruitment—a problem made worse by severely constrained medical evacuation services and reduced airline access. Mobilizing personnel to respond raised questions about how to fulfill a duty of care toward employees, adhere to commitments to equality, and promote longer-term institutional sustainability. The Liberian government, UN agencies, and a wide variety of other organizations worked together to identify and deploy essential skills, develop shared practices, and find ways to pay Liberian temporary workers whose support was essential. UN organizations alone recruited and deployed 19,367 staff during the crisis, including Liberians, but questions remained about how to best meet the ethical and practical challenges that arose.

INTRODUCTION

On March 24, 2014, Liberia's chief medical officer, Dr. Bernice Dahn, publicly confirmed her country's first deaths from an outbreak of Ebola virus disease. Previously unknown in West Africa, Ebola presented as a hemorrhagic fever, and the fatality rate among those infected ranged from 58 to 71% depending on the level of treatment and other circumstances.[1] Transmitted through contact with even a droplet of blood or other body fluid, the virus was highly infectious. Because the disease had no cure, blocking its spread was the only way to stop it.

Liberian health workers initially responded in partnership with a team from the World Health Organization (WHO) and the US Centers for Disease Control and Prevention (CDC), and after a month and a half, the disease seemed to have disappeared. But then small outbreaks began to show up in scattered locations in May and June. Across the border in Guinea, the number of cases rose above 100. Médecins Sans Frontières (MSF) began to warn of an epidemic of unprecedented geographic scale.[2]

Already engaged in Guinea and Sierra Leone, MSF had sent personnel and supplies to support two treatment centers in Liberia in April. The United States sent disease specialists to improve testing capacity and to assess the situation. The WHO provided 21 people to assist, including consultants from its roster of international experts, the Global Outbreak Alert and Response Network. But except for doctors and nurses with Samaritan's Purse and a few other nongovernmental organizations (NGOs) that had long assisted at some of the clinics, the first international responders on the ground were mainly epidemiologists and logistics specialists, who were critical to the response but who were not clinicians.

From his office at the WHO in Geneva, Dr. Bruce Aylward worried about whether that assistance was adequate. Aylward, a Canadian physician who had led polio eradication, directed WHO's work on preparedness, readiness, and response to humanitarian emergencies. Because he sometimes filled in for Dr. Keiji Fukuda, who was in charge of infectious diseases, Aylward had asked to be on the e-mail list for Ebola news in case WHO decided to scale up its deployment of people and his office would have to assist. Within the world of humanitarian emergencies, as Health Cluster Lead Agency, the WHO was also the health service provider of last resort if others could not or would not step in effectively. But its capacity to play that role was limited.

In June, Aylward spoke at the opening of a WHO-convened meeting of the Global Outbreak Alert and Response Network but stayed for the next session—on Ebola. He left the meeting deeply worried. The disease had reached the crowded neighborhoods of Monrovia, Liberia's capital city, as well as cities and towns in Sierra Leone and Guinea. And the number of people infected had risen sharply.

Aylward was not alone. Dr. Ian Norton, a veteran of Haiti's 2010 cholera epidemic, was working on emergency response quality assurance at WHO when he first heard of the Ebola outbreak. As he watched the rising number of cases

in West Africa during April and May, he recommended contacting WHO's emergency medical teams, made up of volunteers from member states, "asking them to adapt to the response for Ebola." But some of the senior leaders said they thought the situation was under control and would not reach disaster status.

Liberia's health system was ill-equipped to handle an Ebola outbreak on its own. A 14-year civil war had forced many Liberian professionals to flee. Ten years after the end of the conflict, the country had one physician for every 35,000 people,[3] compared with one for every 5,000 in Kenya and one for every 408 in the United States.[4] Most of the public health facilities that existed before the war had collapsed by the end of the conflict in 2003.[5] After a decade of recovery, the country had 657 clinics and hospitals—some of them managed in partnership with international organizations—but in rural areas, the facilities were often nothing more than small rooms, staffed intermittently and provisioned with only basic supplies.

Containing and treating Ebola would require not only more doctors and nurses but also ambulance drivers to transport patients, hygienists to disinfect equipment with chlorinated water, burial teams to collect and isolate the dead, and many others to conduct tests, identify contacts, and manage logistics. The only lab for testing of samples for the Ebola virus was the Liberia Institute for Biomedical Research, established in the 1970s, which had limited capacity. After an infusion of support from the CDC and other US agencies, the institute started to process 100 samples a day by the end of May,[6] but health-care centers sometimes had to send samples to a larger laboratory in neighboring Sierra Leone.

Liberia's health ministry struggled to manage and protect its workers in the field. Doctors, nurses, midwives, clinic staff, and family members who cared for infected patients were among the epidemic's first casualties. Because the clinics where they worked had no isolation units, they faced high risks of infection and possible death. In July, the Ebola-related deaths of a lead doctor and 11 colleagues at Redemption Hospital in Monrovia, the country's main free public health center, underscored the vulnerability of health workers on the front lines. The hospital closed in August.

As underprepared health workers died or abandoned their posts, more clinics and hospitals closed, and the bodies of victims accumulated in the streets. Angry citizens sometimes attacked those who tried to do their jobs, believing that health workers had spread the disease.

President Ellen Sirleaf declared a national emergency on August 6, reducing most public institutions to essential staff. Three days afterward, she apologized to national health workers for not doing enough to protect them.[7] She appointed her assistant minister of health, Tolbert Nyenswah, to lead the newly created Incident Management System, designed to help government agencies and international partners coordinate their efforts. J. Dorbor Jallah, former deputy minister of planning who led logistics for the government, was second in command.[8]

The question was how to mobilize an emergency workforce, drawing on both Liberians and international volunteers when it was impossible to guarantee safety and even difficult to pay people for their service.

THE CHALLENGE

At one level, staffing a multipronged response to an Ebola outbreak was similar to managing supply chains for medicines, protective clothing, and other goods. Human resources managers had to forecast needs for specific services, identify and contract with people with the right skills, create a roster of substitute sources, deliver workers to their destinations, and organize everyone on the ground so that there would be no gaps in disease surveillance, case management, medical treatment centers, or other aspects of the response.

But building and managing an emergency workforce to contain an infectious disease in a country with little infrastructure was immensely complicated.

Health-care facilities were unsafe because they were not physically set up to handle potentially deadly infectious diseases.

Training in infection prevention and control, or IPC—including triage, disinfection procedures, use of protective clothing, and safe disposal of waste—was limited. And although most of the clinics run by international nongovernmental organizations adhered to international standards, IPC policies were less well-known among the many nonclinical staff members who helped run the government's rural clinics and even the major public hospitals in the capital.

Lack of adequate supplies aggravated the situation. Although Liberia's 2007 National Health Plan had authorized basic health services focused on infectious disease and maternal health, most clinics still had only limited quantities of protective clothing and other items crucial for managing Ebola cases. Further, nonstandard equipment increased risk by forcing health workers to constantly relearn safety procedures.

At the time, health workers who contracted Ebola had no place to receive specialized care and no possibility of evacuation to a treatment center overseas. At the time, only one airplane was equipped to carry the kind of isolation unit required: a Gulfstream III N173PA fitted with an Airborne Biomedical Containment System the CDC had funded. Phoenix Air, based near CDC headquarters in Georgia, owned and operated the plane.

These practical constraints raised at least three ethical challenges. First, morally and legally, the government, NGOs, and international organizations all owed a duty of care to those who worked for them. That is, they had to take steps to preserve the health, safety, and well-being of employees and volunteers. Although such a requirement underlay many aspects of employment practice throughout the world, Liberia's situation at the time impeded employers' ability to fulfill that duty. Without adequate workplace protection and with no vaccine, cure, or treatment facilities, those who volunteered would be at risk.

Terms of use and citation format appear at the end of this document and at successfulsocieties.princeton.edu/about/terms-conditions.   **4**

Second, promoting equity among foreign and Liberian health-care workers was important for strengthening a vital partnership. Liberians bore the brunt of the outbreak by having to deal with a new disease whose initial symptoms sometimes mimicked malaria—often without the training and equipment available to foreign volunteers. Gaps in systems infection protection and other procedures affected everyone but more so Liberians, who handled everything from ambulance services to medical treatment and burial. Nationality—or the nationality of one's employer—influenced many of the things that affected risk levels, including access to protective equipment, the length of shifts, time off, medical evacuation options, eligibility for experimental Ebola treatments, and insurance—in addition to pay levels.

"There are indeed operational and logistical difficulties, but I'll be honest: A significant challenge in this setting is thinking through how to support our brothers and sisters with whom we work," said Ross Feehan, an operations specialist at Last Mile Health, a Boston-based public health nonprofit that managed the delivery of supplies to rural treatment centers and remote communities. "Our team has a responsibility to both equip and protect our colleagues in Liberia's remote districts. My job is to care—not only about patients and their communities, but also about every single person in this organization."

Third, there were differences of opinion about whether to take the crisis as an opportunity to invest in long-term sustainability—often termed *resilience*. Although saving lives was a shared goal, some organizations favored a strong, parallel commitment of money and people to strengthen Liberian skills and institutions, whereas others perceived that goal as a separate endeavor.

During the early months of the outbreak, partners had dealt with the practical and ethical challenges in their own ways. Some stipulated exacting standards for the protective equipment their staff used, and they defined stringent infection prevention measures within the Ebola treatment centers they set up, even if the steps slowed their treatment of patients. A few, including MSF, insisted on total operational control over their treatment centers as a condition of their participation. Others coped as they could, improvising protections and policies, or they withdrew and closed their facilities.

FRAMING A RESPONSE

On August 8, two days after Sirleaf closed nonessential public institutions, WHO declared the Ebola epidemic a public health emergency of international concern. The declaration marked a turning point in the battle against Ebola. During the early months of the epidemic, external participation had lagged because WHO, which had the mandate to lead in global public health emergencies, had declined to activate critical services. Its leaders initially maintained that a declaration of public health emergency was unnecessary and could have severe economic consequences for a country like Liberia by inhibiting cross-border trade.

Combined with the creation of the new Incident Management System that Nyenswah and Jallah led, the UN declaration helped the government, NGOs, and the international community begin to coordinate human resource planning.

A few days after the WHO declaration, Norton huddled with David Nabarro, the UN's new special envoy (senior coordinator) for Ebola; Rick Brennan, director of WHO's Department of Emergency Risk Management and Humanitarian Response; and other officials, including Jallah.

The group defined its task as figuring out how to deliver the four S's: staff (recruiting and training Liberian and international workers), stuff (supplying appropriate equipment), space (ensuring safe and effective treatment centers), and systems (coordinating all of those things).

Staff, stuff, space, and systems all affected safety and the duty of care, as well as equality. Norton originally envisioned space as preceding staff and stuff because carefully designed facilities could reduce the risk of infection and thereby protect people. But building facilities to isolate patients exposed to the disease and to facilitate the safe treatment of those who were ill would take time, especially during the rainy season. The quickest way to improve conditions and reduce risks for health workers of all types was to increase the availability of essential supplies and establish IPC practices, including clear procedures for five things: triage, the use protective equipment, clinic layout, treatment of suspected cases, and disposal of materials. Together all of those things—enhanced supplies, systems, and space—were expected to facilitate staff recruitment, which was proving very difficult.

Toward the end of August, WHO published an Ebola response road map strategy that outlined specific objectives and listed indicators for evaluating

---

Box 1. WHO Ebola Road Map

The WHO's road map strategy, published in late August 2014, listed several priorities to help ensure there were adequate personnel to meet the emergency's demands.

- Governments of affected countries must rapidly create compensation packages that define the salary, hazard pay, and insurance and death benefits available to each category of worker.
- Accelerate training of health workers from affected countries and that of supplementary international experts.
- Ensure access to appropriate personal protective clothing for all workers.
- Establish intensive outreach to international medical NGOs and create the capacity to deploy rapid response teams within 72 hours of a call for support.
- Specialized medical centers in affected countries must care for exposed health workers and have medical evacuation capacity when appropriate.
- Improve the security of Ebola facilities and health-care workers.

See WHO, "Ebola Response Roadmap," August 28, 2014, accessible at
http://apps.who.int/iris/bitstream/10665/131596/1/EbolaResponseRoadmap.pdf.

---

progress, although the guideline the plan was short on detail with respect to staffing.[9] (See text box 1.)

The scale and difficulty of the management challenge intensified rapidly, however. While Liberia's government and outside organizations to put new systems in place, two things happened. First, concerns about global contagion began to limit international travel to and from Liberia and other West African countries. Some governments banned travelers from the Ebola-affected region unless the travelers had first spent at least 21 days (the disease's incubation period) somewhere else and not shown signs of illness. And many airlines halted service, making it harder to attract volunteers—who feared they would be stranded abroad—or to support ill health workers. By the end of August, only two national carriers, Brussels Airlines and Morocco's Royal Air Maroc, operated regular service into the country. People began to pull out, afraid they would not be able to return home and concerned that the capacity to fight the epidemic effectively was not going to improve fast enough.

GETTING DOWN TO WORK

In August, the facts were brutal: it would take time to train and deploy people and communities would have to take their own counter-measures to control the spread of infection in the meantime. Among the skills most immediately in demand were teams to conduct safe burials, because people were often most infectious at death and funerals were superspreaders. One expert sketched a three-phase strategy on a notepad: Phase 1 was "burial, beds, and behavior change"; phase 2 was about contact tracing, case management, and community engagement; and phase 3 focused on finding and testing survivors and honing rapid-response capacity to target new infections. The personnel needed would vary from one phase to another.

From August through November, improvisation and enhanced coordination capacity slowly helped bring stuff, space, systems, and staff together. And as in most emergencies, action proceeded on several fronts simultaneously.

Recruiting

The task of assembling a large and diverse workforce of health-care professionals and others was largely a piecemeal effort that reflected the number of organizations involved in the Ebola response and the changing face of the crisis. MSF had been on the ground for months. Within three days of the president's declaration of a national emergency United States–based NGO International Medical Corps, a humanitarian nonprofit with substantial experience in medical crises, was in the country, building two treatment units. The CDC had provided small teams since March, and it scaled up. Others joined later.

Liberian health workers were central to the response. Not only were they on the scene, but also they knew the terrain and the customs. Although some had

left the clinics they had worked in during July and August, when many facilities closed, many later returned to work for the health ministry, the UN, or NGOs. Others had remained on the job, often unpaid, as government operations slowed. The pool of available Liberians expanded in August, when the president's declaration of emergency shut down nonessential parts of government. "Because of that, many young people who otherwise would have been engaged became available," Jallah said—and those people were already on the government payroll.

The few specialized treatment centers that NGOs had constructed in the preceding months were in counties outside Monrovia, near the Guinea border, where Ebola had first appeared. To attract people to work at those facilities, the NGO partners offered relocation bonuses, said Josh Balser of Global Communities, a United States–based development and humanitarian aid organization. "Just like expatriate staff get additional benefits for being relocated and for getting there, we flowed that process down to our national staff," he said.

Despite the reallocation of many existing workers, still too few Liberians had the skills needed, and outside support was crucial. But international partners, also struggled to meet the growing demands of the response. Most of them used volunteers: either staff members who responded to the call to for help or professionals who offered their services. Typically, organizations covered only the cost of travel and living expenses for staff during their deployment, which was generally one to four weeks but could last as long as six months. [10] Those who volunteered requested paid leave from their usual employers, which bore the salary costs.

At WHO, Aylward estimated he would have to figure out how to supply 2,000 to 3,000 medical, technical, and management personnel across the three countries—an undertaking that could take months given existing capacities. Earlier, WHO had mobilized the Global Outbreak Alert and Response Network, but that assistance fell far short of the need. To augment human resources, the WHO would have to deploy emergency medical teams and call up people from its lists of potential volunteers.

Aylward's deputy, Jennifer Linkins, took a lead role in orchestrating the effort.

Norton assumed responsibility for mobilizing the emergency teams. Although WHO medical teams normally did not fight epidemics, some had experience in dealing with infectious diseases, such as the cholera outbreak that followed the Haitian earthquake in 2010. The WHO also deployed staff from other regional or country offices and contracted with consultants the organization had used in the past to fill short-term needs.

Meanwhile, MSF managers e-mailed people they knew had experience in fighting Ebola and urged them to return for another mission. In order to accelerate the recruitment process, some organizations cut steps from their normal vetting process. For instance, MSF shortened its recruitment process to

by-pass the usual "first assessment" step for new recruits, said William Vannier, a supply chain manager at MSF in Belgium.

People were slow to volunteer. Norton recalled the silence at conferences after he asked for commitments to staff new Ebola treatment units with doctors and nurses. "There was fear among the responders, fear among the agencies," he said. "There was no guarantee of medevac. All those things were unknown at the time." Royal Air Maroc flights into the country were only about 10% full.[11]

Norton realized that damping fear was his most immediate challenge in trying to recruit Ebola workers and that achieving this step would require reducing the perceived risks. To provide reassurance, it was crucial to (1) build special treatment units that could improve safety and (2) provide special facilities that could care for health-care workers who fell ill. It was also important to improve the availability of protective clothing and implement more-rigorous infection and control measures.

Many organizations also began to reduce the length of service so as to minimize burnout and risk caused by fatigue. The UN standard was two months, and some humanitarian organizations, including MSF, offered their staff members the same arrangement. Global Communities cut its usual placement time to 8 months from 12 to ease stress on its volunteers, said Balser, the NGO's acting country director.

Despite those initial steps, the supply of skilled labor still fell short of needs by the end of August, when the number of new infections each week began to increase still more rapidly and the number of confirmed Ebola cases exceeded 1,000. Given the personnel needs associated with the Ebola response, WHO began to offer financial support to partner institutions within its networks in order to help speed deployment and defray the institutional costs of extended employee absences.[12] WHO also hired people on contract. And the African Union began to deploy waves of skilled health-care workers, some of whom had Ebola expertise and played crucial roles beginning in mid September.[13]

As the personnel deployments swung into high gear, a bombshell exploded, however. On September 23, the CDC said that if the response did not pick up steam, its epidemic model put the number of cases at about 550,000 by January—1.4 million if corrected for underreporting.[14] In early October, WHO epidemiologists projected that without intervention, the number of people who contracted Ebola would within a month likely reach 20,000—a somewhat more modest estimate but very bad news nonetheless.[15] Although many of the people close to the center of decision making said the CDC estimate was too high, the numbers captured attention and deepened the sense of alarm. The need for volunteers for all types of work—from burials to contact tracing and medical care—seemed greater than ever.

Improving international mobility

The border closures and traveler quarantines imposed in August grew out of an incident in which an ill traveler entered Nigeria in late July, potentially exposing the people he encountered to the risk of Ebola infection. Nineteen

Nigerians who came in contact with the traveler fell ill and seven died, including the doctor who first recognized that the traveler had the disease.

When the number of international volunteers started to rise in September and October, transportation into and out of the region was difficult.[16]

To help alleviate the bottleneck, the World Food Programme (WFP) agreed to use its fleet of planes—which normally transported food and supplies—to carry passengers. That air bridge moved more than 400 specialists to Liberia by the end of September. Later, the UN Mission for Ebola Emergency Response (UNMEER), which was set up in mid September to coordinate all UN activities related to the West African Ebola outbreak, took over this program and expanded its reach.

A second obstacle appeared at about the same time, when countries began closing their borders to travelers from the area unless the travelers had spent at least 21 days (Ebola's incubation period) in quarantine elsewhere. The questions were where to send volunteers affected by those policies and how to persuade countries to keep their borders open. The UN and its partners began finding it hard to move personnel between locations.

The UN pressured member countries to cooperate. Wolfgang Herbinger, former WFP worldwide director of logistics, recalled how he "was really shocked when we had a high-level government official from a European country coming to Rome and saying anybody coming out of the three Ebola-affected countries cannot come into our country before 21 days are over. . . . If everybody had that attitude, it would have been impossible for us to act."

The WFP persuaded the Italian government to allow WFP personnel of any nationality to spend quarantine periods in Rome until employees' original countries authorized repatriation. Trust levels between the WFP and the Italian government were high, partly because WFP leaders conveyed accurate risk assessments to Italian officials and explained how to manage those risks, Herbinger said. The WFP prioritized "quickly developing reasonable protocols so that we monitor and ensure safety," Herbinger said. "These protocols were maybe the most important effort we made in the very beginning."

Some of the countries that had not banned travelers outright imposed 21-day home quarantines after travelers landed. Governors of several US states, such as New York and New Jersey, and African countries that supplied some of the skilled medical personnel were among those that introduced such policies.[17] Canada required quarantine at home on a case-by-case basis.

Those rules continued to create difficulties well into November and beyond—after the rate of new infections declined. "The impact on air travel became a huge headache and a source of additional stress," recalled Amanda Tiffany of Epicentre, MSF's research and training hub. "We worked so hard— and then, at the end of a mission, it was hard to get home or we were placed under guard." Researchers like Tiffany were later disinvited to the American Society of Tropical Medicine and Hygiene annual meeting in New Orleans when Louisiana health officials told them they were not welcome and would be

quarantined in their hotel rooms without food and with no access to public transportation.[18]

A third constraint, the inability to guarantee quick evacuation if a health worker contracted the disease, hindered external recruitment and became one of the most difficult obstacles for those trying to build an effective workforce to combat Ebola. As part of the duty of care owed to volunteers in the event of injury or serious illness, international NGOs and other organizations usually promised emergency workers medical evacuation to their home countries or to places with comparable facilities. But at the time of the outbreak, only the one Phoenix Air plane was based near Atlanta, to handle medevac.

In response to growing concerns about how to bring ill US workers back home safely, in September 2014 Phoenix Air began retooling two more jets with specialized medevac capacity. .[19] Meanwhile, European nations like Italy, Spain, and the United Kingdom prepared to use retrofitted military aircraft to evacuate their citizens if they became ill on the job. In early November, Luxembourg provided two small jets from its air rescue fleet that were capable of transporting eight or so passengers, retrofitting the planes to Ebola standards and getting them ready for operation in mid January 2015.[20]

But those single-nation solutions would prove insufficient if the epidemic escalated further and, more important, the solutions provided no help for medical teams from other countries such as Uganda. Germany then partnered with carrier Lufthansa to convert an Airbus A340-300 passenger jet into a specialized Ebola evacuation aircraft[21] that could provide advanced intensive care well beyond the levels possible in the smaller, less sophisticated Phoenix Air planes.[22] All nationalities could use the plane, and donors funded its operation.

Outfitting the planes was only part of the problem. Because of the high cost of these services, commercial insurers that commonly provided SOS insurance (medevac insurance) declined to offer coverage for volunteers. Jago Salmon, head of the Development Solutions team of the United Nations Development Programme, said "Insurance companies could not guarantee coverage of costs of repatriation when it was not clear that countries would accept repatriated Ebola workers . . . [and they] couldn't guarantee coverage to new hires going into Ebola zones." As a result, whether a medevac option was available was contingent on whether the evacuee's government would cover the cost. At first, only the US government committed to paying those costs for its own citizens. Other European countries followed in October.

Organizations had to explain the limitations to prospective volunteers. Some, like WHO, committed to live up to the standards one way or another.

Private foundations pitched in to help relieve the medevac bottleneck. On October 23, the United States–based Paul G. Allen Family Foundation pledged $100 million, which was earmarked partly for an Ebola medevac fund.[23] The fund helped pay for evacuation in situations when insurance paid for only a portion of the service—or refused to pay outright. Later, the foundation financed two biocontainment units that military aircraft could carry to Ebola-

affected countries, thereby bolstering the ability of the United States to evacuate international health workers.[24]

Improving safety through systems

Rigorous adherence to infection prevention and control procedures was the main way to reduce health worker risk until new, safer facilities were in place. But Ebola took IPC to a whole different level, and the conventional curricula were inadequate.

During May and June, the early months of the epidemic in Liberia, Nyenswah and Dahn had worked with Rose Macauley, a senior official of John Snow, Inc. (JSI), to develop a basic Ebola infection prevention and control training program. A United States–based public health consulting firm that had supported Liberia since the civil war, JSI knew that most clinics' supplies were inadequate to provide workers significant protection. As a result, much of the standard criteria on infection prevention were impractical and required adaptation.

Toward the end of August, as more supplies became available and coordination improved, training became stronger and more standardized. Nyenswah, director of Liberia's Incident Management System, convened a National Infection Prevention and Control Task Force to help the health ministry and key international partners create new guidance and train health-care workers. The health ministry, backed by JSI, staffed the effort and created standard operating procedures that targeted care given by households, local health centers, and national hospitals.[25] The result was a new course called Keep Safe, Keep Serving, which built on a prior WHO curriculum and incorporated many ideas that Nyenswah, Macauley, and their colleagues had developed earlier.

To reach the 657 clinics in operation throughout the country and the thousands of nonmedical Ebola response workers, a team of 140 master trainers deployed across the country beginning in mid September. All organizations used this pool of trainers, said Deidre Rogers, a consultant at JSI. The health ministry officials also designated 21 technical assistants—physicians with IPC expertise[26]—deploying them at major health facilities in Liberia's 15 counties to make sure newly trained workers adhered to the infection prevention and control standards outlined in the new curriculum.[27]

The focus was on nonclinical Ebola workers—cleanup crews, ambulance drivers, and burial teams—because they were the least likely to know basic infection control procedures. Given the magnitude of the task, the trainers had to set priorities. They started with facilities that were open and operating. Rogers said, "We'd have liked to get to them all simultaneously, but that wasn't possible due to supply distribution and human resources capacity and logistical capacity."

During the same period, the preparation of international volunteers also ramped up. MSF had the most experience with Ebola because of its role in containing past outbreaks in Uganda and the Democratic Republic of the Congo. The WHO and others could help scale training that MSF designed.

Box 2. Infection Prevention and Control in an Ebola Treatment Center

To minimize the risk of Ebola transmission—both to health workers and between misdiagnosed patients—workers followed strict protocols when admitting, treating, and discharging patients at Ebola treatment centers.

At the entrance to a clinic, a nurse in protective clothing triaged arriving patients based on their symptoms and histories of exposure, referring non-Ebola patients to a standard health facility.

To maintain strict infection control, responders divided each center into low- and high-risk zones. The high-risk zones had separate wards for people with suspected Ebola infections or confirmed Ebola diagnoses.

Only essential staff wearing full protective suits entered the high-risk zone. Caregivers first donned the equipment—a process that could take 30 minutes and that required two people to double-check for exposed skin. Next, they doused their suits with chlorinated water, which was lethal to the virus. Then they proceeded along marked routes, dunking their boots in chlorinated footbaths positioned at ward entries, exits, and intersecting paths to prevent tracking infectious fluids into safe areas. In Liberia's tropical climate, the suits were sweltering, and they constrained caregivers time in them, often limiting treatment to only 60 minutes.

Caregivers always moved against the gradient of infection—from suspected to confirmed wards—to avoid contaminating misdiagnosed patients.

Because Ebola had no cure, doctors and nurses focused on keeping patients comfortable, hydrated, and free of secondary infections until patients either recovered or passed away. The clinicians first administered medications to minimize patients' pain and fever. Then they cleaned patients, administered medications to slow vomiting and diarrhea, and provided water with oral rehydration salts. In extreme cases and when possible, clinicians administered intravenous fluids. And they dispensed antimalarials and antibiotics.

When exiting the high-risk zone, health workers stepped again through basins of chlorinated water, sprayed themselves with chlorinated water, and washed their hands as they removed each piece of equipment. Responders submerged reusable equipment in a chlorine solution and incinerated the rest.

Discharged survivors took antiseptic showers, put on clean clothes, and stepped through decontamination basins before leaving the treatment center.

In what MSF described as the largest knowledge transfer in its history, officials from its Belgian operations taught volunteers from the CDC, WHO, and other organizations, including the International Medical Corps.[28] The demand for MSF's experience exceeded the organization's capacity, however, so MSF gave priority to the training of staff from groups with which it had previously worked, such as the French Red Cross). During 2014–15, across all three Ebola-affected countries, MSF trained more than 1,000 people in Europe[29] as well as 4,000 Liberians and international responders in the field, concentrating on infection prevention and control measures.

With that curriculum, WHO then went on to prepare others, including a Cuban team that planned to assist. The US military also contributed to the effort, teaching 1,500 health-care workers and support staff in Liberia. (See text box 2.)

In addition to both improving the effectiveness of the response and supporting the duty of care owed to volunteers, education contributed to equality by narrowing the risk gap between Liberian health workers and their international counterparts.

Building safer spaces

From the beginning, all partners recognized the need for treatment centers to meet the special safety needs of Ebola health-care workers and patients. Concentrating Ebola-related services in specific locations made it possible to train effectively, ensure the availability of protective equipment in the proper quantities, and operate an effective triage system, thereby reducing risk. The special units could not only make the best use of stuff and systems but also help attract staff. But because the disease could flare up suddenly in locations where it had not appeared before, flexibility was also important.

At the time of the WHO's international declaration of emergency in early August, only two Ebola treatment units were in operation. MSF had created one in Foya, the town where the first cases had been detected. NGO Samaritan's Purse had set up a second unit in the ELWA (Eternal Love Winning Africa) Hospital chapel. After Samaritan's Purse health workers fell ill, MSF took over ELWA1 and moved patients to a second location nearby: ELWA2.

Together with the health ministry, MSF converted a cholera ward at John F. Kennedy Medical Center in Monrovia into a third, 120-bed unit, which opened in mid August but filled to capacity almost immediately. [30] Firestone Liberia, a unit of Japan's Bridgestone Corp., opened a small facility on company grounds as well. The previous March, the company's health unit had treated an employee's spouse who was one of the first Liberians to become ill with Ebola. The company had acted quickly to create a makeshift isolation unit, and in August, it built a 23-bed facility as new cases appeared among its employees and in surrounding areas.[31]

Opening new treatment units took varying amounts of time depending on the type of construction and on the ability to win community agreement on location. In rural areas with emergency need for capacity, MSF advocated building temporary structures by using wooden pallets covered with plastic sheeting for flooring and more plastic sheeting for the walls and roof—an approach that had worked well in the past. Others pursued more-substantial construction. WHO and the WFP had committed to building five treatment centers, and Norton recommended that the UN use concrete for the flooring. That decision lengthened construction times but made the floors less likely to rot in Liberia's humid climate and in areas with high water tables. Moreover, the facilities could be converted to other medical uses later, thereby enhancing sustainability.

The US government agreed to build 18 treatment centers, including a specialized Monrovia Medical Unit, which would treat only health-care workers and help ease concerns that frontline medical personnel might have about volunteering. UNMEER's David Nabarro and WHO pushed the United States to build that additional capacity as rapidly as possible, anticipating that it would be sufficient to meet worst-case forecasts for future needs. Other organizations, such as International Search and Rescue Advisory Group, the International Medical Corps, and Save the Children collaborated to create capacity as well. All told, 25 treatment centers were constructed during the epidemic.

Determining the locations of new centers was a highly sensitive undertaking. Medical teams wanted the centers adjacent to existing health facilities in order to conduct triage more effectively. That kind of arrangement would enable them to assess the symptoms of incoming patients and send those who did not have Ebola to standard treatment centers. But Liberian officials often wanted the Ebola treatment facilities to be out of public view and removed from communities. In Bong County, for example, officials had to build a center on the site of a former leper colony rather than next to a hospital.

It was especially hard to win agreement on locations of sites in densely populated areas. An episode in Monrovia in mid August had raised deep concern. At the time, residents of the impoverished West Point neighborhood in Monrovia had protested the creation of an Ebola treatment center in its midst, claiming that the facility had imported the disease by admitting strangers. The residents looted the clinic, spreading contaminated materials and increasing the risk of infection. Norton of WHO said people would become alarmed if his organization put up a treatment center near them because it would mean that Ebola patients would be "in their backyard."

Those fears had some foundation, Norton added, because confused patients who were near death sometimes wandered into noninfected areas. Construction plans began to incorporate double fences. At the same time, though, responders did not want the centers to resemble prison camps, which would scare away sick people and dehumanize the ill. "The population needed to be able to see what was going on inside and not be scared," Norton stressed.

As a result, officials built the centers on government land when possible, designed them to be as open as possible, and surrounded them with fences through which community members could observe some clinic operations while feeling protected from infection.

Nonetheless, those facilities represented only a partial answer to the space challenge. Timing was an issue. Facilities built to US Army Corps of Engineers standards took longer to construct than MSF's centers did. The gravel required to provide a firm base had only a limited number of local suppliers, and when a supplier's crusher broke down, construction halted until repairs were complete. In August and September, before most centers were open, the demand for beds exceeded the supply.

The first new emergency treatment units became operational only after September, and by the end of the first week in November, nine were

functioning.[32] By that point, however, the rate of new infections had slowed, and most of the units went unused. Because no one could be sure the outbreak was contained, however, construction of partly finished sites continued. But as demand slackened, the US Defense Department, which had agreed to build 15 units and then raised the number to 17, dropped to 11 the number it completed.[33] Of the 25 treatment centers constructed, 3 never opened because there was no need for them.[34]

Temporary community-based care facilities,[35] run jointly by health ministry and international organization staff, also played an important role. Although those basic facilities met the urgent need for case isolation, they offered only limited care until an ambulance could transport a patient to a designated Ebola treatment center. Of the 80 planned community-care clinics, fewer than 10 became operational.[36]

Despite initial problems related to location and construction, the new centers helped convince potential volunteers that they could deploy more safely and be effective in their work.

Creating compensation systems

In early August, when Sirleaf apologized to national health workers for not doing enough to protect them, she also acknowledged that the government was struggling with a fundamental problem with regard to how to pay the many Liberians who served as temporary workers but who were not on the government payroll and had no life insurance.

Those issues had serious implications for equality because government employees and contractors worked alongside Liberian employees of international organizations, who were paid regularly and comparatively well. Volunteers from other countries were usually on leave from other jobs, and their employers continued to pay their salaries, too.

The workers' continuing frustration about terms of service, including lack of adequate protection, triggered a series of protests and work stoppages through August and September.[37] Government pledges to improve conditions, coupled with citizens' pleas for people to remain on the job, kept many working,[38] but solving the problem was essential.

Health ministry officials estimated that 20,000 people were involved in the Liberia Ebola outbreak response, of whom 11,000 were working in some way for the government, whether as paid employees or as volunteers. Some of those people were ambulance drivers or members of burial teams, and others provided care. Some were regular employees, and others were temporary workers or volunteers.

In its Ebola road map strategy published on August 20, WHO said the government of each affected country should find its own solution to the compensation problem.[39] The road map discussed hazard pay and insurance as part of the basic compensation package governments owed their employees. Anticipating that Liberia and other national governments might have to struggle to develop such systems on their own, WHO mandated other UN agencies to

assist, yet the process dragged until mid September. The Liberian government struggled (1) to get money where money was needed, (2) to determine who was on its payroll, and (3) to match payments to employees, some of whom lacked national identity documents. As a result, some of the Liberian responders went without compensation for months, although many remained on the job—in some cases, fearing that quitting would mean loss of back wages.

In early September, Douglas Webb, a UNDP expert on health finance, suggested his organization help the affected country governments. The strengthening of payment systems promoted resilience—a goal that was in line with UNDP's mandate. Moreover, UNDP had had experience with the many challenges that could arise. Webb was seconded to the UN's overall emergency response to Ebola, UNMEER, in mid September.

Salmon, who directed the effort with Webb, had to balance the need to address an emergency with the need to strengthen institutions so that future crises would prove easier to resolve. He focused on bolstering the existing payroll program, "making sure [the UNDP] wasn't destroying the systems of government in the response," he said. "It was really a development question." But he recognized the need to act swiftly. "We had to get the payments through to people to enable them to keep doing the jobs they were doing, because they were the people who saved all of us, essentially, from the epidemic—the national health-care workers and burial teams."

The first step was to finance hazard payments, because the Liberian government lacked resources to cover the projected costs. The outbreak had taken a heavy toll on business activity and tax revenue and reduced an already constrained government budget. The UNDP planned to draw on a new multidonor trust fund to support the supplements. The World Bank and the African Development Bank committed $6 million and $4.5 million, respectively, for that specific purpose.

Liberia's health ministry continued to pay salaries to civil servants and allowances to contract workers who had been on the government payroll before the Ebola outbreak. About 80% of all Ebola workers who were on the government payroll before the outbreak had bank accounts and could be paid by direct deposit. The UNDP filled gaps as needed and supplied hazard payments for regular, contract, and ad hoc volunteer workers, as well as the roughly 20% of regular employees who had no bank accounts. It also developed a contingency plan in case the government became suddenly unable to pay its staff members. (See text box 3.)

UNDP planners focused on three priorities: identifying and tracking payees and standardizing hazard (indemnity) payments, strengthening systems to disburse those payments, and establishing a contingency plan to keep workers on the front lines if the government–UNDP payment system failed. The UNDP set ambitious goals to link all workers to a payment system, to pay all of them on time (that is, within two months of service), and to do so by December 1, 2014.

The first step was to create an accurate list of people who delivered services as part of the Ebola outbreak response. NGOs involved in health care

---

Box 3. UNDP Contingency Plan

The UNDP developed a contingency plan in case the government became suddenly unable to transfer pay to health-care workers because of unrest or a complete collapse of operational capacity.

The plan was to channel payroll from the trust fund to workers through a private bank network. Salmon consulted with a Pan-African banking group called Ecobank Transnational Inc., which had previously worked with the UN. Ecobank had opened branches throughout much of West Africa in the previous five years and had broad reach. The arrangement came online in January 2015.

Although the contingency plan was never fully activated, UNDP officials did use it to correct certain imbalances in hazard pay that had emerged across institutions and that aggravated workplace tension.

---

also had struggled to identify workers and disburse pay accurately, given the conditions in the field. In the absence of official IDs, for example, some health organizations relied on village elders to vouch for the identities of some payees. Although Ebola workers were told they could register at their work locations, where colleagues could verify their identities, not all managers received that message, and difficulties persisted.

Officials wrote down the names of verified Ebola workers and carried the lists to the capital, where they entered the names into a computer spreadsheet. In difficult cases, the UNDP flew health ministry staff to verify Ebola response workers in person. Still, disputes over eligibility continued. The UNDP helped develop a complaint system, including a call center, but the system wasn't operational until May 2015.

As part of this project, Liberian colleagues worked with Salmon and his colleague Abdullah Alkulaib to improve the health ministry's human resources database. The system required Internet connectivity, which was spotty, and crashed early in the crisis. The UNDP helped bring the system back online and prepared a backup Excel spreadsheet that worked when connectivity failed but had to be synchronized manually. Officials then entered the names of all registered Ebola workers in those databases. However, coordinating the Excel spreadsheets was a big job.

With payment registration systems improved, the UNDP moved toward its second goal of assisting the health ministry to standardize salary and hazard pay for each job. In principle, Ebola workers were exposed to equal risks because of the nature of the disease, yet in practice, terms of service varied depending on employer. It was hard to streamline systems across NGOs, international organizations, and governments.

Balancing equity on the one hand with resilience on the other posed a serious challenge. Some NGOs paid their Liberian employees more than the country's prevailing wage for similar work. Paying government Ebola workers at that same rate would have bankrupted the government and distorted the labor

market, drawing people out of less well-compensated but vitally important occupations.

The UNDP worked with Liberian officials to compare proposed pay rates with local market rates as well as with prevailing wages in other affected countries. Next they published and circulated the list of rates to nongovernmental responders and encouraged all groups to harmonize their practices. The UNDP, UNMEER, and the health ministry prepared a website that provided information on payments to Ebola workers, including lists of recommended payment amounts that were based on regional norms and occupational skill levels. Although they could not force international NGOs to comply with the recommendations, they urged them to do so.

Tensions persisted, however. Despite the effort to harmonize pay, Liberians who worked for international NGOs often still received higher compensation than Liberian government employees who did similar jobs in the same facilities. "To handle the disparity," Jallah said, "the government decided it would commit to bringing government-employee salaries to the levels at which the NGOs were paying." However, because the government could not increase pay rates without making a long-term commitment, it decided to issue those payments as special hazard-pay packages through the UNDP, not through a permanent entitlement.

With a master list in place and agreed compensation rates, responders moved to the third priority: getting pay to those who had earned it. Poor mobile phone coverage meant that mobile payments, used in neighboring Sierra Leone, did not work in Liberia. (See text box 4.) However, banking was strong in Liberia: 80% of workers had bank accounts and could receive payments electronically. The UNDP encouraged the health ministry to pressure the remaining 20% to open accounts for direct deposits.

Providing cash payments for UNDP-supported workers who lacked bank accounts was especially problematic in Liberia's remote regions, where there were few secure institutions to store money. UNDP officials flew to payment hubs in the counties and then relied on county health teams to distribute the money to employees. Some money got lost to corruption; for example, some team coordinators asked for payments before handing over the cash. That it worked as well as it did was significant, however. Salmon said, "You're talking about injecting enormous amounts of cash into very weakly institutionalized environments."

Officials recognized the need to pay quickly, but doing so took time. Cash payments took months to disburse, in part because the UNDP had to clear a four-month backlog. The new system made its first payments in January 2015, but months later, some people were still waiting and most payments continued to lag behind due dates by two months.

At the first release of hazard pay on January 5, 2015, more than 5,000 people showed up and the health ministry closed its doors. Although there were no ongoing strikes at the time, there were many reports of confusion and anger.[40]

Box 4. Sierra Leone's RapidPro Mobile Payment System

In assembling its response teams, Sierra Leone employed people who were not on the government payroll—same as Liberia did. But the Sierra Leone leadership decided to create a completely new, temporary, and parallel pay system, trading longer-term resilience for speed. Sierra Leone's National Ebola Response Center, analogous to Liberia's Incident Management System, organized this pay process with the help of the UNDP, UNICEF, and the World Bank.

First, during an initial enrollment period, managers recorded biometric data for each Ebola worker, using mobile technology designed for this purpose. The data included fingerprints and iris scans—both of them unique identifiers. This approach overcame the identity problems that plagued the response in Liberia. (Salmon emphasized that preparing an accurate list of Ebola workers eligible for payment was the primary impediment to paying them—across all three Ebola-affected countries.)

Next, biometric data was uploaded into a national database, which a Sierra Leonean software developer had constructed. The software platform harmonized data, and all users could view updated information.

With these pieces in place, the remaining challenge was conveying wages to the people in the database. In Sierra Leone, 80% of workers already owned cell phones, and a method for sending money via cell networks already existed. At the UNDP and other UN organizations' request, Sierra Leone's three main mobile providers allowed international responders to use their coverage to create a mobile payments program. The system relied on a series of private sector kiosks across the nation that could disburse money because there were no bank branches in remote regions. A payer would send a text message to an Ebola worker's phone with a code the worker then exchanged for money at a kiosk the worker could easily reach. Alkulaib said, "It could be a supermarket, or it could be a small phone shop."

"In Sierra Leone, from December to January [2015], we switched from 100% cash payments to 90% mobile payments. . . . Our logistical and operations costs went down significantly," Alkulaib said.

Jago Salmon, "Payment of Ebola Response Workers - a moral imperative and a practical collaboration," United Nations Development Programme Blog, March 13, 2015, accessed January 21, 2016; http://www.undp.org/content/undp/en/home/blog/2015/3/13/Payment-of-Ebola-Response-Workers-a-moral-imperative-and-a-practical-collaboration-.html.

Nevertheless, the new payments program eventually reached most of its goals. By March 2015, at least 95% of registered workers across all three Ebola-affected countries—38,000 people—were linked to payment systems and got paid within two months of service 90% of the time.[41] The project cost $2.25 million overall.[42] Alkulaib noted: "Because there were no huge protests and [Ebola response workers] did not stop working, I would consider it [a] very successful project."

Salmon said the UNDP's guarantee of payment helped restore workers' trust despite delays in the system.

OVERCOMING OBSTACLES

High levels of public anxiety, especially in the early months of the outbreak when public trust was especially low, sometimes triggered a backlash against health-care workers. Some citizens blamed health workers for spreading death and disease, as they watched family members enter clinics and never return.

Burial workers, who had to collect and dispose of the dead, were a particular target for public disdain and anger. In Monrovia, which sprawled across the swampy Mensurado River delta, deep graves filled up with water while monsoon rains easily washed open shallow burial sites. . . Residents opposed most burial site proposals because they feared Ebola transmission from the graves to themselves, to groundwater, or to their crops.

Although initially small, the sizes of burial teams grew to as many as 10 people, some of whom removed bodies while others cleaned the premises with chlorine or counseled members of the household and neighbors. The government partnered with the Liberia National Red Cross Society, the international NGO Global Communities, and the International Rescue Committee to manage the teams—under the guidance of a working committee from the Incident Management System.

The job of removing the dead became more difficult in early August, when President Sirleaf ordered mandatory cremation for Ebola victims.[43] Cremation was anathema to Liberian burial traditions. Norton said he understood the feelings. "It's scary. . . . You have to incinerate on-site, so you have these columns of black smoke coming out of these treatment centers," he said. "And the patients go in and the black smoke comes out. You can just imagine what they're thinking is going on in there." People also feared it made marked graves impossible. The country's memorial day or decoration day, observed in March, was a public holiday when families visited the graves of loved ones who had died. Rumors circulated that cremation would annul that gesture of respect.

After violent protests in Monrovia against government handling of the Ebola response, policies began to change. To diffuse escalating tension, officials met with community leaders to build a shared understanding of problems and establish new guidelines for implementing policy. Although military or police officials continued to escort burial teams after the West Point violence, officials de-emphasized the threat of force. The military shifted to logistical support, Jallah said. "After the experience in West Point, . . . we didn't bring police people or military people to barricade your home. We would talk to the communities."

In response to the depth of citizens' concerns, the government ramped up community messaging on the dangers of Ebola, how it spread, and Ebola workers' roles to contain it. "It is really better to talk to people and convince people so they take responsibility for their safety . . . [building] the cooperation of the people," Jallah said. "That is what actually helped us."

The government also expanded treatment for health conditions unrelated to Ebola in order to increase the credibility of the institutions and groups involved in dealing with the crisis.

When the government sought a viable cemetery location to serve Monrovia, officials relied on community leaders to find a site. Community leaders presented several options to Nyenswah and his team, which had responsibility for oversight and policy. In December 2014, Nyenswah and Jallah selected one of the proposals: a site called Disco Hill, just outside the capital. Following that agreement, Sirleaf lifted her mandatory cremation order, thereby easing the challenges the burial teams faced. Families knew where their loved ones were going, could attend the burials, and had access to marked graves.

As in rural areas, the teams took pains to communicate with families about safe practices and involved community members in the burial process. Balser of Global Communities said that inviting people to be part of burial preparation was a major part of burial teams' new strategy: "So, mix the chlorine solution in front of people. Ask the community to bring the water from their water source . . . build up trust between the burial team and the community." Cultivating and preserving trust made it become easier and safer to help contain the spread of disease.

ASSESSING RESULTS

By January 2016, Ebola had infected 10,675 Liberians and killed 4,809, with most infections and deaths occurring in the period of August through October.[44]

Common metrics for evaluating the management of skilled workers included determining whether there was enough manpower—of the right type, in the right place, at the right time—to do the job. But the duty of care and interests in equality and resilience pinpointed the additional need to weigh how well the system performed in preserving the welfare of personnel, in limiting differences in terms of service, and in building for the future.

There was no question that the response came late and failed the right-time criterion. The World Health Organization, whose voice mattered most in the activation of emergency systems, was by its own admission slow to act. By the time WHO's four S's—staff, stuff, space, and systems—were in place, the epidemic had peaked. Staffing increases coincided with the collapse in the rate of new cases.[45] By the end of October, the spread of infection had slowed, making it easier for health workers to do their jobs safely and reducing the number of people needed. However, at the time, no one knew for sure that the outbreak had been contained, and Ebola may have resumed its spread if fewer people had heeded the call to serve. Building safe facilities as well as specialized treatment centers for health workers was part of the implicit bargain that persuaded skilled personnel to heed the call for help.

Responding organizations showed that, given time, they were able to call up sufficient people to meet the need. In addition to the many small organizations that placed international health workers in health facilities across Liberia's 15 counties, UN organizations recruited and deployed 19,367 staff, including the Liberian colleagues on their payrolls.[46] Norton said that the doctors and nurses on the emergency medical teams, who usually worked for four weeks at a time,

accounted for 12,000 to 13,000 of that number. Overall, the UN organizations exceeded their goal of deploying 18,482 people to contain the outbreak in Liberia. The CDC sent approximately 1,000 people, also on relatively short rotations, with about 170 in the country at any given time.

For some services, such as burial, one of the measures of manpower adequacy was response time. Balser of NGO Global Communities said he measured progress by how long it took to answer a call for a burial team. The grim work of retrieving and burying bodies was among the most important because infectivity peaked after death. In August, Balser said, 36% of callers received a pickup within 24 hours. Within two months, the rate increased to 90%, eventually rising to 98%. Ebola did not infect a single burial team member, according to a report by Global Communities.[47] Balser said the greatest contributor to the faster response times was the "increase in the number of vehicles and teams available for pickups," paired with overall increases in coordination and resources.

Keeping health workers safe was an important element of the duty of care. Initially, health worker deaths had closed Liberia's main hospitals and led many to walk off the job. By 2015, all workers had received training in infection prevention and control. Of the 166 health workers exposed to the virus in 2015 after receiving proper training, only one became infected.[48] In contrast, from March 2014 to mid August 2014, 97 of all 810 Ebola casualties (12%) were health workers.[49] A lower number of sick people also made the jobs of skilled personnel less dangerous after 2014. Between the beginning of the outbreak and May 2015, Ebola killed 83 of Liberia's doctors, nurses, and midwives.[50]

Sometimes the practices used for preserving safety and improving terms of service imposed trade-offs that reduced effectiveness. International organizations' staff rotation policies attracted particular criticism. Often people departed just after they had learned the ropes and started to make a serious contribution. Rotations "were more or less effective depending on how long people had been in the country," said Rogers, the consultant from JSI. "Just when they'd start to get effective, they'd leave. It makes sense for MSF to do that for its front-line clinical staff so they don't get physically tired and burned out and increase the risk for themselves and others . . . but I wonder about the model for the more-administrative and coordination staff. Everyone [was] constantly introducing themselves and figuring out who you are."

"A month was a long time in the circumstances," said Tiffany, the Epicentre epidemiologist who worked in all three affected countries. "But every time someone new came, they thought they had the next great idea. What they didn't know was that the same idea had already failed twice. There was a lot of reinventing the wheel."

The main approaches to improving equality included increasing levels of safety at all facilities, creating access to specialized care units in the event of infection, and providing timely compensation, hazard pay, and insurance. By the end of the outbreak, on-the-job safety protections were equal for Liberian workers and foreign counterparts at treatment centers. But safety standards

differed at community care centers and triage points, where the Liberian staff had basic personal protective equipment such as face shields, gowns, and gloves, but not the enhanced protection—masks, hoods, aprons, and second pairs of gloves—in use at the treatment centers. Although the differences were related to degrees of risk, some health workers at community care centers remained worried.

Equity in access to treatment in the event of illness had also improved by the end of the outbreak. Liberian health workers had access to specialized treatment facilities if they contracted the virus.

By the end of the outbreak, almost all Liberians serving in positions related to the Ebola crisis had received back hazard pay, although some disputes remained. (Because of the impact that paying all volunteers the same amount for the same work would have on resilience—the ability of the Liberian government to pay—differences in compensation levels between national and foreign workers inevitably persisted.)

Box 5: Humanitarian Response versus Development?

Nyenswah expressed gratitude for the international mobilization but expressed reservations about Liberia's ability to deal with future crises, because a humanitarian response was by its nature intense but temporary. "I don't know what would have happened [without external support], but it is not sufficient . . . to send these supports during a crisis and then the next day they have vanished," he said.

The question of how to improve resilience in the middle of a crisis fed an undercurrent of discord during the Ebola outbreak response. The problem was not an easy one to solve. At the UNDP, Salmon and Alkulaib expressed the need to pair humanitarian interventions with measures to improve future resilience. "The humanitarian model is based on crisis response," Salmon said at UNDP headquarters in New York. "And I think that as we look forward, we need to look much more at shock-absorbing, insurance system models . . . focused on the resilience of the governments."

Alkulaib said the debate sometimes reflected the competition for limited resources. "You can't do humanitarian [work] and then forget the development side," he said. "You have to combine both sides of the houses and not have a firewall between them . . . and that usually happens because of resource competition. . . . The humanitarians say, 'Well, do you want to save a child? Or would you rather build resilience?' . . . But there shouldn't have to be a choice between the two. Both should happen, hand in hand. . . . The extent of how successful we are is [in] the systems we build."

MSF's Jonathan Whittall urged greater investment in thinking through exactly what those concerns entailed. In an opinion piece, he wrote, "But when a response becomes a mixture of 'all things to everybody'—about saving lives, building capacity, reducing vulnerability and ensuring sustainability—often the basics are overlooked, and there is a danger that 'building resilience' becomes an excuse for inaction on the basics of saving lives and alleviating suffering."[1]

[1]Jonathan Whittall, "Opinion and debate: Building resilience by deconstructing humanitarian aid," *The Front Line*, February 6, 2014; http://www.msf.org.uk/article/opinion-and-debate-building-resilience-deconstructing-humanitarian-aid.

With respect to sustainability or resilience, the response performed less well, because containing the outbreak took precedence. Training potentially had a long-term impact on the strength of the health system. By the end of 2014, the Keep Safe, Keep Serving program had trained more than 4,000 Liberian Ebola workers from more than 350 health facilities across the country in basic infection prevention.[51] But the impact on health system strength was likely to prove limited. Other diseases required different infection prevention and control protocols, so the Ebola program was just the beginning of a longer-term effort to strengthen IPC in the country. Because the program was associated with Ebola, managers also feared that health workers might stop adhering to IPC practices when the outbreak ended, believing the uncomfortable clothing and time-consuming practices were no longer necessary.

Liberia needed a new curriculum suitable to train workers in a post-Ebola context. In early 2015, the health ministry partnered with WHO and nongovernmental organizations to develop a revised curriculum called Safe and Quality Health Services.[52] The package included broad IPC training to prevent infectious disease transmission, along with basics in emergency medicine, disease surveillance, and psychosocial support. It targeted both clinical and nonclinical health workers, with a shorter curriculum for the latter. By February 2016, almost 8,500 health workers had received the training, as the new curriculum was passed along.[53] The program also recruited 300 people to act as mentors because they had excelled in the program, which would facilitate continued peer compliance with the technical standards of the curriculum.[54]

Jallah said that that effort to build capacity could have gone further. If he could do it over again, he said, he "would match a young local person with each international person, so that after it all, there would be some level of knowledge transfer and some experience so that if it were to happen again. . . . [But] we missed out on that completely. We still need that even in our peacetime development work, and we just don't have it." (See text box 5.)

Salmon of the UNDP said: "The massive progress that had been made in these three countries [Liberia, Sierra Leone, and Guinea] in terms of securing their own futures was profoundly tested by Ebola but . . . they were resilient. And it was quite remarkable that Liberia led this process—under enormous pressure and with a lot of resources—but they did lead."

REFLECTIONS

As infection rates fell to zero, the question was, what lessons should be drawn about how to improve the supply of skilled personnel in a subsequent outbreak with limited infrastructure and weakened institutional capacity. In particular, the policy makers focused on how to strengthen the skill supply chain in the future and on how to enhance resilience, the duty of care, and equality.

Laying the policy groundwork

In October 2015, the health ministers from the seven major industrialized nations supported establishing a global health emergency workforce[55]—an idea

the European Union and WHO echoed soon after.[56,57] But the clearest recommendations on how to do so came from two independent reports: one from a panel of experts convened by Harvard University and the London School of Hygiene and Tropical Medicine, published in November 2015,[58] and the other from the US National Academy of Medicine, an independent health advisory organization, published in January 2016.[59]

The first report outlined improvements to prevention, response, information sharing, and governance. The initial recommendation called for incentivizing early reporting of outbreaks and discouraging panic-driven travel bans; WHO could publish lists of countries that failed to comply with best practices. The panel also advocated improved financing and industry codes of conduct to maintain private transportation services.[60] It recommended creating a new Center for Emergency Preparedness and Response within WHO and merging the Global Outbreak Alert and Response Network with the humanitarian medical teams. And it proposed tasking the new center with responsibility to develop rapid-response and coordination capacities, including establishing protocols and arranging agreements with a wide variety of organizations in order to mobilize personnel quickly.[61]

The panel also suggested reframing health as a security issue in order to maintain the UN Security Council's attention to infectious diseases.[62]

The second independent report, published two months later, made similar recommendations.[63] It noted that WHO's mobilization of outside personnel, resources, and funding was slow and insufficient despite evidence that the outbreak had overwhelmed Liberia's capacity to control it.[64] Like the first report, the second one recommended expanding the global response network—coordinated by a new WHO unit—and improving pandemic financing to facilitate rapid deployment of equipment, medications, and human resources.[65] The second report also recommended expanding national public-health training programs worldwide, such as the CDC's Field Epidemiology Training Program.

In January 2016, the United Nations published its own proposals.[66] The ideas included increasing the use of community health workers (e.g., Liberia's ancillary Ebola response workers), maintaining rosters of medical experts and response staff available for rapid deployment at the regional level, and improving response coordination, emergency financing, and health system strength.[67]

Putting palaver into practice

The published recommendations and lessons produced concrete steps to strengthen international and Liberian personnel recruitment, deployment, training, and human resources management.

A planned World Bank financing facility would purchase insurance coverage from the private sector and disburse funds to developing countries based on preagreed triggers. The insurance policies would cover the cost of containing outbreaks, and the premiums would depend on the level of risk of another outbreak in a given region. The model was African Risk Capacity, an

arrangement created in 2012 by 26 African Union countries and donor governments to provide support after natural disasters that threatened agricultural production and food supply. In a report by British newspaper *The Guardian* in October 2015, well before the UN answered an appeal for aid, African Risk Capacity said it had paid out more than $25 million to mitigate the effects of drought.

The proposed World Bank–led facility also would include a second component to provide financial support even before a crisis triggered the insurance mechanism. In the event of an infectious-disease emergency, it could pay for equipment, medications, and human resources based on expected income from the pledges donor countries had made. The donors would repay the funds over time.

On May 3, 2016, the World Bank's board of executive directors approved the concept, and the bank announced the launch later that month.[68]

Immediate steps

It was possible to undertake some of the improvements immediately. For example, both of the UN's systems to mobilize and deploy clinical and nonclinical skills improved after the outbreak, and additional reforms were on the horizon. David Nolan, a WHO human resources specialist, said the Global Outbreak Alert and Response Network had developed a master roster of nonclinical professionals from which to draw, whereas it had previously relied on a list of organizations only. Nolan's colleague Norton also pointed to improvements to medical teams' preparedness and quality standards.

In July 2015, Norton and his colleagues created a medical team quality-assurance program. As Norton pointed out, in the same way as a Liberian medical license certified a certain skill set, governments needed to know what skills they could expect from international medical teams. Teams received rigorous training to meet WHO benchmarks and were subject to peer review by more-experienced teams. Norton said that by January 2016, 57 teams had undergone quality assurance at a cost of about $10,000 per team.
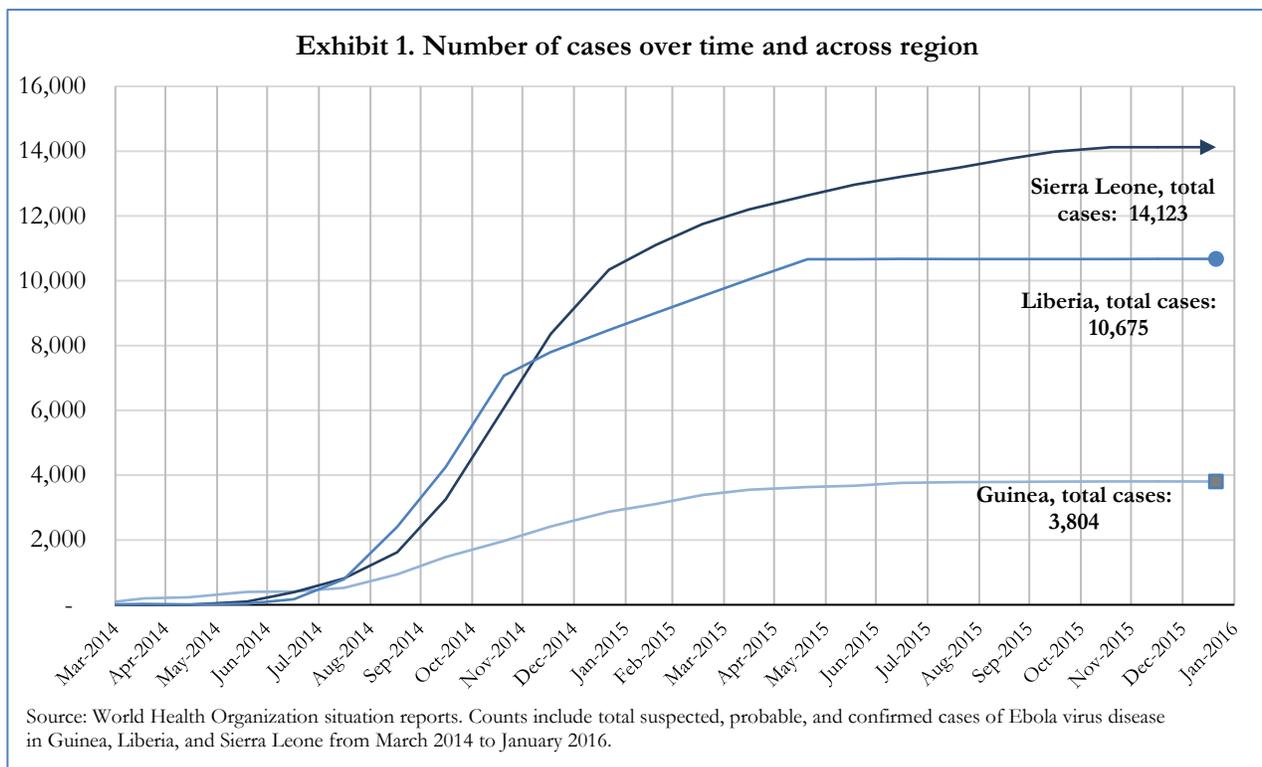
As part of the same project, Norton and his colleagues developed a registration system called the Global Emergency Medical Teams Registry,[69] through which qualified teams, validated by his program, detailed their skills and services. Norton and his team published the registry on a website that would enable governments to select skilled medical teams based on those governments' unique needs.[70]

Because the registry's medical teams met quality benchmarks, governments could be sure that those they selected had the skills they needed. Similarly, donors could be confident that the teams they financed would meet the needs of the government when in crisis and would provide needed support.

WHO intended the registry to enable a surge of skilled workers, pre-organized into teams, into infectious-disease outbreaks and other health crises. The next steps were to train health ministries in countries likely to experience such emergencies on how best to employ the medical teams, to pre-establish

arrangements for receiving and coordinating teams, and to develop best-practices guidelines that would help teams support high-risk patients, such as children, people with disabilities, or older people.[71]

In February 2015, the European Commission announced a new medical corps to improve the European Union's ability to mobilize medical and public health personnel and equipment in a crisis, including international emergencies.[72] The European Union's existing civil protection program coordinated the corps. Per the model of WHO's emergency medical teams, corps candidates underwent certification to ensure quality and received specific training in international-response operations. Once certified, corps members were available for rapid deployment. Although plans called for the commission to handle initial deployment, the affected government or a UN coordination system would take over management of the corps teams on the ground.[73]

Exhibit 1. Number of cases over time and across region

Sierra Leone, total cases: 14,123

Liberia, total cases: 10,675

Guinea, total cases: 3,804

Source: World Health Organization situation reports. Counts include total suspected, probable, and confirmed cases of Ebola virus disease in Guinea, Liberia, and Sierra Leone from March 2014 to January 2016.

References

[1] *Ebola Situation Report*, World Health Organization, December 31, 2014, accessed May 9, 2016; http://apps.who.int/ebola/en/status-outbreak/situation-reports/ebola-situation-report-31-december-2014.

[2] See http://www.cbc.ca/news/world/scale-of-ebola-epidemic-in-guinea-unprecedented-1.2594222.

[3] *Liberia WHO Country Office*, World Health Organization Regional Office for Africa, accessed January 5, 2016; http://www.afro.who.int/en/liberia/who-country-office-liberia.html.

[4] "Ebola in Africa: the end of a tragedy?" *The Economist*, January 14, 2016, accessed January 18, 2016; http://www.economist.com/blogs/graphicdetail/2016/01/daily-chart-12. Kenya data come from World Bank data site "Physicians (per 1,000 people)," accessed May 2, 2016; http://data.worldbank.org/indicator/SH.MED.PHYS.ZS?page=1.

[5] "Availability of essential health services in post-conflict Liberia," *Bulletin of the World Health Organization* 88(7), July 7, 2010, accessed January 3, 2016; http://www.who.int/bulletin/volumes/88/7/09-071068/en/.

[6] Carol Han, "The Fight on Ebola Continues in the Lab," October 7, 2014, accessed May 3, 2016; https://blog.usaid.gov/2014/10/the-fight-on-ebola-continues-in-the-lab/.

[7] "Liberian President Apologizes to Health Care Workers for Ebola Deaths," NBC News, August 9, 2014, accessed January 12, 2016; http://www.nbcnews.com/storyline/ebola-virus-outbreak/liberian-president-apologizes-health-care-workers-ebola-deaths-n177056.

[8] "Developing an Incident Management System to Support Ebola Response – Liberia, July-August 2014," *Morbidity and Mortality Weekly Report* 63(41), US Centers for Disease Control and Prevention, October 17, 2014, accessed January 13, 2016; http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6341a4.htm.

[9] WHO Ebola Response Roadmap, accessed February 23, 2016; http://apps.who.int/iris/bitstream/10665/131596/1/EbolaResponseRoadmap.pdf.

[10] John S. Mackenzie et al. "The Global Outbreak Alert and Response Network," *Global Public Health* 2014:9(9), accessed February 28, 2016; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4205922/.

[11] Guillaume Klein, "Morocco keeps flying to Ebola-hit states in 'solidarity,'" Yahoo! News, August 30, 2014, accessed May 4, 2016; https://www.yahoo.com/news/morocco-keeps-flying-ebola-hit-states-solidarity-114520016.html?ref=gs.

[12] *Global Outbreak and Response Network Request for Assistance: Ebola Virus Outbreak in West Africa,* World Health Organization, February 23, 2015, accessed May 9, 2016; http://www.crto.on.ca/pdf/Pandemic/Ebola2014/2015-02-23_GOARN_Ebola_Request.pdf.

[13] See Timeline of African Union Response to the Ebola Outbreak, http://www.un.org/en/ecosoc/ebola1/pdf/au_ebola_timeline.pdf.

[14] "Estimating the Future Number of Cases in the Ebola Epidemic — Liberia and Sierra Leone, 2014–2015, *Morbidity and Mortality Weekly Report* 63(3), US Centers for Disease Control and Prevention, September 26, 2014, accessed January 9, 2016; http://www.cdc.gov/mmwr/preview/mmwrhtml/su6303a1.htm.

[15] WHO Ebola Response Team, "Ebola Virus Disease in West Africa—The First 9 Months of the Epidemic and Forward Projections," *New England Journal of Medicine* 371, October 16, 2014, accessed November 22, 2015; http://www.nejm.org/doi/full/10.1056/NEJMoa1411100.

[16] Catherine Mayer, "Halting Flights to Ebola Regions Could Threaten Relief Efforts, Experts Warn," *Time*, October 8, 2014, accessed May 4, 2016, http://time.com/3481373/ebola-transport-flight-plane-liberia/.

[17] Nick Thompson and Inez Torre, "Ebola virus: Countries with travel restrictions in place: What countries have Ebola-related restrictions in place?" CNN, November 4, 2014, accessed May 3, 2016, http://www.cnn.com/2014/11/04/world/ebola-virus-restrictions-map/.
[18] Jason Beaubien, "Ebola Researchers Banned from Medical Meeting in New Orleans," National Public Radio, October 30, 2014, accessed April 24, 2017. http://www.npr.org/sections/health-shots/2014/10/30/360179428/ebola-researchers-banned-from-medical-meeting-in-new-orleans.
[19] Robert Roos, "Very few aircraft equipped to evacuate Ebola patients," Center for Infectious Disease Research and Policy, September 16, 2014, accessed November 18, 2015; http://www.cidrap.umn.edu/news-perspective/2014/09/very-few-aircraft-equipped-evacuate-ebola-patients.
[20] "Ebola virus prevention plan: Luxembourg prepared for the worst," *Luxemburger Wort*, November 7, 2014, accessed December 29, 2015; http://www.wort.lu/en/luxembourg/ebola-virus-prevention-plan-luxembourg-prepared-for-the-worst-545c7671b9b3988708083d14.
[21] "Ebola-ready jet prepared for take off," *The Local*, November 27, 2014, accessed December 29, 2015; http://www.thelocal.de/20141127/ebola-ready-jet-prepared-for-take-off.
[22] "Lufthansa hands over 'Robert Koch' evacuation aircraft," Lufthansa Group, November 27, 2014, accessed December 29, 2015; https://www.lufthansagroup.com/en/press/news-releases/singleview/archive/2014/november/27/article/3360.html.
[23] Paul G. Allen, "Tackling Ebola: The Next Move Is up to Us," Paul G. Allen Family Foundation, October 23, 2014, accessed January 2, 2016; https://www.paulallen.com/tackling-ebola-the-next-move-is-up-to-us/.
[24] The Editors, "Next-Generation Medevac Biocontainment Units Will Protect Healthcare Workers," Paul G. Allen Family Foundation, August 11, 2015, accessed January 2, 2016; http://www.paulallen.com/news/news-articles/medevac-units.
[25] *Ebola Response Roadmap (Advance Copy),* World Health Organization, August 20, 2014, accessed May 9, 2016; http://sgh.org.sa/Portals/0/Articles/WHO_EBOLA%20RESPONSE%20ROADMAP_advance%20copy%2020AUG14.pdf.
[26] Benjamin J. Park, *Efforts to Build Infection Control Capacity in Liberia, Guinea, and Sierra Leone during the Ongoing Ebola Outbreak*, US Centers for Disease Control and Prevention, July 16, 2015, accessed May 9, 2016; https://c.ymcdn.com/sites/www.cste.org/resource/dynamic/forums/20150727_150946_30847.pdf.
[27] Catherine Cooper et al. "Infection prevention and control of the Ebola outbreak in Liberia, 2014–2015: key challenges and successes," *BMC Medicine* 14(1), January 5, 2016, accessed January 6, 2016; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4702360/.
[28] MSF, *Pushed to the Limit and Beyond: A year into the largest ever Ebola outbreak*, no date, p. 4, accessed May 4, 2016; https://www.doctorswithoutbordrs.org/sites/usa/files/msf143061.pdf.
[29] MSF, *Pushed to the Limit and Beyond: A year into the largest ever Ebola outbreak*, no date, p. 4, accessed May 4, 2016; https://www.doctorswithoutbordrs.org/sites/usa/files/msf143061.pdf; and Armand Sprecher, *The MSF Response to the West African Ebola Outbreak*, Médecins Sans Frontières Operational Center of Brussels, https://iom.nationalacademies.org/~/media/Files/Activity%20Files/PublicHealth/MicrobialThreats/2015-MAR-24/March%202015%20Presentations/12_Sprecher.pdf.
[30] Zoom Dosso, "World's largest Ebola unit dismantled as outbreak retreats," Yahoo! News, accessed May 5, 2016; https://www.yahoo.com/news/worlds-largest-ebola-unit-dismantled-outbreak-retreats-142258740.html?ref=gs.
[31] Erik J. Reaves et al., "Control of Ebola Virus Disease — Firestone District, Liberia, 2014," *Morbidity and Mortality Weekly Report*, accessed May 6, 2016; http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6342a6.htm.

[32] Tolbert Nyenswah et al., "Ebola Epidemic — Liberia, March–October 2014," *Morbidity and Mortality Weekly Report*, accessed May 5, 2016;
http://www.cdc.gov/mmwr/preview/mmwrhtml/mm63e1114a4.htm.
[33] Norimitsu Onishi, "Empty Ebola Clinics in Liberia Are Seen as Misstep in U.S. Relief Effort," *New York Times,* April 11, 2015, accessed May 5, 2015;
http://www.nytimes.com/2015/04/12/world/africa/idle-ebola-clinics-in-liberia-are-seen-as-misstep-in-us-relief-effort.html?_r=0.
[34] Tolbert Nyenswah et al., "Ebola and Its Control in Liberia, 2014-2015," *Emerging Infectious Diseases* 22(2), February 2016, accessed January 9, 2016;
http://wwwnc.cdc.gov/eid/article/22/2/15-1456_article.
[35] Catherine Cooper et. al. "Infection prevention and control of the Ebola outbreak in Liberia, 2014-2015: key challenges and successes" *BMC Medicine* 14(2), January 5, 2016, accessed February 26, 2016;
https://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-015-0548-4.
[36] Tolbert Nyenswah et al., "Ebola and Its Control in Liberia, 2014-2015," *Emerging Infectious Diseases*.
[37] "Ebola: Liberian nurses strike over lack of protective equipment," *The Guardian*, September 2, 2014, accessed January 1, 2016;
http://www.theguardian.com/world/2014/sep/02/ebola-liberian-nurses-strike-lack-protective-equipment.
[38] James Harding Giahyue, "Many Liberian healthcare workers ignore Ebola strike call," Reuters, October 13, 2014, accessed December 22, 2015;
http://www.reuters.com/article/us-health-ebola-liberia-idUSKCN0I21GU20141013.
[39] *Ebola Response Roadmap (Advance Copy),* World Health Organization.
[40] "700 Liberian Ebola workers protest for hazard pay," *Daily Mail*, April 18, 2015, accessed May 9, 2016; http://www.dailymail.co.uk/wires/afp/article-3044825/700-Liberian-Ebola-workers-protest-hazard-pay.html.
[41] Jago Salmon, "Payment of Ebola Response Workers - a moral imperative and a practical collaboration," United Nations Development Programme Blog, March 13, 2015, accessed January 21, 2016;
http://www.undp.org/content/undp/en/home/blog/2015/3/13/Payment-of-Ebola-Response-Workers-a-moral-imperative-and-a-practical-collaboration-.html.
[42] *Secretary-General's UN Ebola Response Multi-Partner Trust Fund Interim Report for the Period October 2014 to January 2015*, United Nations Development Programme, no date, accessed May 9, 2016;
https://ebolaresponse.un.org/sites/default/files/mptf_report20022015final_0.pdf.
[43] Harriet Alexander, "Ebola victims must be cremated, Liberian government says," *The Telegraph*, August 4, 2014, accessed January 13, 2016;
http://www.telegraph.co.uk/news/worldnews/africaandindianocean/liberia/11010857/Ebola-victims-must-be-cremated-Liberian-government-says.html.
[44] "2014 Ebola Outbreak in West Africa – Case Counts," US Centers for Disease Control and Prevention, April 13, 2016, accessed May 9, 2016;
http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html.
[45] 2014 Ebola Outbreak in West Africa – Reported Cases Graphs, US Centers for Disease Control and Prevention, February 17, 2016, accessed April 24, 2017.
http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/cumulative-cases-graphs.html.
[46] UN Ebola Response Multi-Partner Trust Fund Fact Sheet, UNMEER, no date, accessed April 24, 2017;
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=0ahUKEwi1g5Hyi_vKAhUJWz4KHaQyDMsQFgg7MAM&url=http%3A%2F%2Fmptf.undp.org%2Fdocument%2Fdownload%2F15002&usg=AFQjCNEQiCw2GkgDwZvrGGpmW8Im75q06Q.
[47] Global Communities' Ebola Response, Global Communities, no date, accessed May 9, 2016; http://www.globalcommunities.org/ebola-response.
[48] Tolbert Nyenswah et al., "Ebola and Its Control in Liberia, 2014-2015," *Emerging Infectious Diseases*.

[49] Tolbert Nyenswah et al., "Ebola and Its Control in Liberia, 2014-2015," *Emerging Infectious Diseases*.

[50] David K. Evans, Markus Goldstein, and Anna Popova, "Health-care worker mortality and the legacy of the Ebola epidemic," *The Lancet Global Health* 3(8), July 8, 2015, accessed January 1, 2016; http://www.thelancet.com/journals/langlo/article/PIIS2214-109X(15)00065-0/.

[51] Tolbert Nyenswah et al., "Ebola and Its Control in Liberia, 2014-2015," *Emerging Infectious Diseases*.

[52] "The Liberian Ministry of Health and WHO Launch Training on Safe and Quality Health Services, World Health Organization, August 14, 2014, accessed May 9, 2016; http://www.afro.who.int/en/liberia/press-materials/item/7933-the-liberian-ministry-of-health-and-who-launch-training-on-safe-and-quality-health-services.html.

[53] "Training Health Workers to Deliver Safe and Quality Health Services in Liberia," World Health Organization, February 25, 2016, accessed May 9, 2016; http://www.afro.who.int/en/liberia/press-materials/item/8369-training-health-workers-to-deliver-safe-and-quality-health-services-in-liberia.html.

[54] "Training Health Workers to Deliver Safe and Quality Health Services in Liberia," World Health Organization, February 25, 2016.

[55] *Declaration of the G7 Health Ministers, G7 Germany,* October 8–9, 2015, accessed May 9, 2016; http://www.bmg.bund.de/fileadmin/dateien/Downloads/G/G7-Ges.Minister_2015/G7_Health_Ministers_Declaration_AMR_and_EBOLA.pdf.

[56] *Ebola Crisis: Long-term Lessons*, European Parliament, October 27, 2015, accessed May 9, 2016; http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML+TA+P8-TA-2015-0374+0+DOC+PDF+V0//EN.

[57] *Advisory Group on Reform of WHO's Work in Outbreaks and Emergencies: First Report*, World Health Organization, November 15, 2015, accessed May 9, 2016; http://www.who.int/about/who_reform/emergency-capacities/advisory-group/first-report.pdf?ua=1.

[58] Suerie Moon et al., "Will Ebola change the game? Ten essential reforms before the next pandemic. The report of the Harvard-LSHTM Independent Panel on the Global Response to Ebola," *The Lancet* 386(10009), November 28, 2015, accessed January 3, 2016; http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(15)00946-0/abstract.

[59] Secretariat, National Academy of Medicine; and Commission on a Global Health Risk Framework for the Future, *The Neglected Dimension of Global Security: A Framework to Counter Infectious Disease Crises*, https://nam.edu/initiatives/global-health-risk-framework/ (doi: 10.17226/21891.

[60] Suerie Moon et al., "Will Ebola change the game? Ten essential reforms before the next pandemic. The report of the Harvard-LSHTM Independent Panel on the Global Response to Ebola."

[61] Suerie Moon et al., "Will Ebola change the game? Ten essential reforms before the next pandemic. The report of the Harvard-LSHTM Independent Panel on the Global Response to Ebola."

[62] Suerie Moon et al., "Will Ebola change the game? Ten essential reforms before the next pandemic. The report of the Harvard-LSHTM Independent Panel on the Global Response to Ebola."

[63] Secretariat, National Academy of Medicine; and Commission on a Global Health Risk Framework for the Future, *The Neglected Dimension of Global Security: A Framework to Counter Infectious Disease Crises*.

[64] Secretariat, National Academy of Medicine; and Commission on a Global Health Risk Framework for the Future, *The Neglected Dimension of Global Security: A Framework to Counter Infectious Disease Crises*.

[65] Secretariat, National Academy of Medicine; and Commission on a Global Health Risk Framework for the Future, *The Neglected Dimension of Global Security: A Framework to Counter Infectious Disease Crises*.

[66] UN report: http://www.un.org/News/dh/infocus/HLP/2016-02-05_Final_Report_Global_Response_to_Health_Crises.pdf.

[67] UN report: http://www.un.org/News/dh/infocus/HLP/2016-02-05_Final_Report_Global_Response_to_Health_Crises.pdf.

[68] See the World Bank Pandemics website http://www.worldbank.org/en/topic/pandemics for updates and Pandemic Emergency Facility: Frequently Asked Questions, World Bank, May 3, 2016, accessed April 24, 2017 http://www.worldbank.org/en/topic/pandemics/brief/pandemic-emergency-facility-frequently-asked-questions.

[69] "Emergency Medical Teams and World Health Organization," World Health Organization, no date, accessed May 9, 2016; http://www.who.int/hac/techguidance/preparedness/foreign_medical_teams/en/.

[70] See the website at https://extranet.who.int/emt/page/home.

[71] "Emergency Medical Teams and World Health Organization," World Health Organization.

[72] European Commission press release, EU launches new European Medical Corps to respond faster to emergencies, February 15, 2016, accessed May 9, 2016; http://europa.eu/rapid/press-release_IP-16-263_en.htm.

[73] European Commission fact sheet, EU launches new European Medical Corps to respond faster to emergencies, February 15, 2016, accessed May 9, 2016; http://europa.eu/rapid/press-release_MEMO-16-276_en.htm.

Innovations for Successful Societies makes its case studies and other publications available to all at no cost under the guidelines of the Terms of Use listed below. The ISS Web repository is intended to serve as an idea bank, enabling practitioners and scholars to evaluate the pros and cons of different reform strategies and weigh the effects of context. ISS welcomes readers' feedback, including suggestions of additional topics and questions to be considered, corrections, and how case studies are being used: iss@princeton.edu.

Terms of Use

Before using any materials downloaded from the Innovations for Successful Societies website, users must read and accept the terms on which we make these items available. The terms constitute a legal agreement between any person who seeks to use information available at successfulsocieties.princeton.edu and Princeton University.

In downloading or otherwise employing this information, users indicate that:

a. They understand that the materials downloaded from the website are protected under United States Copyright Law (Title 17, United States Code). This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view a copy of this license, visit http://creativecommons.org/licenses/by-nc-nd/4.0/.

b. They will use the material only for educational, scholarly, and other noncommercial purposes.

c. They will not sell, transfer, assign, license, lease, or otherwise convey any portion of this information to any third party. Republication or display on a third party's website requires the express written permission of the Princeton University Innovations for Successful Societies program or the Princeton University Library.

d. They understand that the quotations used in the case study reflect the interviewees' personal points of view. Although all efforts have been made to ensure the accuracy of the information collected, Princeton University does not warrant the accuracy, completeness, timeliness, or other characteristics of any material available online.

e. They acknowledge that the content and/or format of the archive and the site may be revised, updated, or otherwise modified from time to time.

f. They accept that access to and use of the archive are at their own risk. They shall not hold Princeton University liable for any loss or damages resulting from the use of information in the archive. Princeton University assumes no liability for any errors or omissions with respect to the functioning of the archive.

g. In all publications, presentations, or other communications that incorporate or otherwise rely on information from this archive, they will acknowledge that such information was obtained through the Innovations for Successful Societies website. Our status and that of any identified contributors as the authors of material must always be acknowledged and a full credit given as follows:

> Author(s) or Editor(s) if listed, Full title, Year of publication, Innovations for Successful Societies, Princeton University, http://successfulsocieties.princeton.edu/.