FEVERS, FEUDS, AND DIAMONDS

EBOLA AND THE RAVAGES OF HISTORY

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PICADOR

To Humarr and Martin, who didn't make it; to Ibrahim and Yabom, who did; to all the caregivers; and to Ronda and Bill, who helped us join them

There's a thread you follow. It goes among
things that change. But it doesn't change.
People wonder about what you are pursuing.
You have to explain about the thread.
But it is hard for others to see.
While you hold it you can't get lost.
Tragedies happen; people get hurt
or die; and you suffer and get old.
Nothing you do can stop time's unfolding.
You don't ever let go of the thread.

—William Stafford, "The Way It Is," 1993

Preface: The Caregivers' Disease

In October 2014, having signed up to help respond to an explosive Ebola epidemic, I traveled to West Africa in the company of colleagues. The disease had spread from the eaves of a shrinking forest, where the eastern reaches of Sierra Leone, Liberia, and Guinea meet in a narrow firth of land. By the time we arrived, all three countries faced an increasingly urban epidemic with no end in sight. There are no hard borders, and for months the afflicted had crossed watery ones, or traversed frontiers along hidden paths, in search of care. It hadn't taken long for Ebola, hidden in human hosts, to reach capital cities on the Atlantic—about as far west as the virus could go without boarding a boat or a plane.

Across the region, many medical facilities had been shuttered by October. That's because Ebola spreads easily in hospitals, clinics, and other places where the sick seek care; indeed, a significant fraction of the stricken had been health professionals, already in short supply when the virus struck. Its westward surge had just taken out the health-care systems of Liberia and Sierra Leone. Since then, those suffering from injuries or illnesses unrelated to Ebola were denied even the most basic medical services. This was a replay of the mortal drama of the previous decade, when civil war shut down or destroyed what clinics and hospitals there were in these countries. The forested region of Guinea, as it's termed, was spared some of this violence, but had received hundreds of thousands of war refugees from its neighbors.

We knew little of this when we touched down in Monrovia, Liberia's capital, in mid-October. A few days earlier, in Sierra Leone, we'd been assigned to reopen several idle clinics and hospitals and were awaiting a similar assignment in Liberia. But we had yet to lay eyes on the interior of a functioning Ebola treatment unit—an ETU—much less provide medical care for a single victim of the disease. We couldn't have known what we were in for. Though many had been assigned to *contain* the outbreak, fewer had signed up for the messy and dangerous work of *caring for*, rather than quarantining or isolating, the already afflicted. In order to learn more about how to provide care without becoming casualties ourselves, three friends and I were invited to spend an afternoon in an ETU in Monrovia, just then overrun by Ebola.

The facility had been erected on the campus of a mission hospital, which earlier that summer had prepared for the viral assault on the city by converting its chapel into an Ebola ward. In short order, several working there—including a couple of missionaries—had themselves fallen ill. Much of the campus had since been overhauled by the world's largest, and most Ebola-savvy, medical humanitarian organization. The ETU was by the time of our visit an impressive operation, with new open-air wards laid out under canvas awnings. These design features could not reduce the baking heat, which verged on intolerable for staff obliged

to wear biohazard suits. I kept thinking, "How on earth is it possible to last more than fifteen minutes here in protective gear?"

Hazmat suits were only the most visible reminders of the ETU's sharp focus on infection control. The facility was divided into two zones, separated by flimsy waist-high orange mesh barriers: a red zone for patients confirmed to have Ebola and a green zone for patients deemed Ebola-free. Visitors were steered away from the barriers and instructed not to touch any surfaces, even on the "safe" side of the mesh.[1] Having known a couple of the nurses and doctors who'd fallen ill in previous weeks, the four of us welcomed the general climate of caution that prevailed within the unit. It wasn't long, however, before its basic premise—that the primary purpose of the ETU was isolation, rather than treatment—began to make the two of us who were clinicians feel uncomfortable. There was too little *T* in the ETU.

Our delegation broke into smaller groups shortly after the tour began. My doctor friend (an Italian infectious-disease specialist) and I stuck tight to our guide (also a compassionate and knowledgeable Italian physician). Both of us hoped our host might answer the questions we had about how best to care for the sickest subset of the Ebola-afflicted. Most of them were termed "wet" patients, because their gastrointestinal symptoms usually included vomiting and diarrhea. (Contrary to received wisdom, Ebola's clinical course is highly variable, with patients regularly reclassified as wet or dry during their illness.) These contaminated body fluids posed a great risk to those who had to clean up after the sick, but their loss posed an immediate threat to the afflicted: both fluids and electrolytes need to be replaced in order for patients to survive. Such replacement therapy, which is prescribed for pathologies ranging from gastroenteritis to gunshot wounds, has likely saved more lives than any other.

Replacement therapy requires estimating the volume of what comes out as liquid stool, vomit, urine, blood, and even sweat. In the United States, health professionals refer to what's replaced and lost as "ins" and "outs"—I's and O's, for short. Nurses and nursing aides are usually the ones measuring losses in order to replace them, but doctors all learn the basics. There are several ways to replace fluids and electrolytes, including their infusion into the abdomen or even through the marrow of the body's bigger bones. For almost a century, however, the most important methods of replacing the O's have been by mouth and by vein. The oral approach is preferred for all patients old enough and awake enough to drink what's called ORS, short for "oral rehydration salts." You probably call it Pedialyte.

As any mother knows, even thirsty, dehydrated children don't—or can't—always take ORS as instructed. It's not only small kids who have that problem: my friend and our host knew several professional caregivers stricken by Ebola who'd been unable to keep down ORS. I had two of them on my mind that day, both of them doctors who had become wet patients. The first was a Sierra Leonean physician, a much-lauded researcher and colleague whom I admired greatly. He'd died on July 29 in an ETU that had been set up and run by the same group now hosting us in Monrovia. No one in that unit had charted the precise volume of his losses to diarrhea, vomiting, and fever, but I'd heard they'd been substantial.

The second person on my mind that day was an American doctor who'd fallen ill after he had taken over for my deceased friend. We knew a lot more about the American's clinical course, as he'd been airlifted to Atlanta and was still a patient there on the day we inspected the Monrovia unit. He had been about as sick as you can get, losing up to ten liters of fluid per day, but a colleague caring for him at Emory University Hospital had just let me know they thought he'd make it. If he did, it would be in part because the team in Atlanta was carefully replacing the fluids and electrolytes he lost during the wet phase of the disease, which in some cases was accompanied by kidney failure. The doctor-patient had required renal dialysis, which permitted even more carefully calibrated replacement of his losses. He'd also required a breathing machine. In essence, these basic interventions allowed him to live long enough for his immune system to launch a counterassault on this virus.

Two other Americans—a missionary doctor and one of his assistants—had also survived Ebola after being airlifted to Atlanta from the same campus we were visiting that day. A handful of Europeans who'd fallen ill elsewhere in West Africa had been medevacked and survived. This was good news, not only for their friends and family but for clinicians hesitating to step up to the plate because they'd been informed by public-health experts that Ebola was untreatable. But good news from the United States and Europe seemed to make little difference to patients in West African ETUs, who were being provided with the bare minimum—right then and there, only cups of ORS, which many were unable to keep down. Most were dying.

Admittedly, it wasn't crystal-clear why. My Italian colleague and I had stored up several clinical questions that we hoped to discuss with our guide as we made our way through the green zone. Before either of us could pose our questions, we encountered two brothers who were leaving the triage area, just a few yards from where we stood.

Tall and thin, the brothers were inside the red zone but not yet patients: they still had to reach their beds, but could barely walk and looked disoriented. The older one, retching uncontrollably as watery stool ran down his legs, was the first Ebola patient my friend and I had seen shrivel up before us. His sunken eyes and withered skin made him look elderly, but I guessed him to be in his early thirties, maybe younger. We saw him sink into a squat while his brother struggled to hoist him back to his feet. The younger man, who couldn't have been much more than twenty, was covered with vomit, which I'd assumed was his brother's. But then he, too, began to gag and heave, even as he tried to steady his trembling, stumbling sibling. As we watched, paralyzed, the sicker man collapsed on a chlorine-scorched patch of grass and gravel outside one of the tents. His brother squatted beside him, weeping loudly but tearlessly—probably because he was too dehydrated to make tears.

Our guide called loudly for assistance from within the red zone, exchanging a few words with someone on the other side of the barrier. A few minutes later (it seemed like forever) the prostrate man was clumsily hoisted up by three staff in protective gear and hauled over to a "bed"—a flat slab without a pillow positioned under the white canvas and dark green mesh covering the confirmed-cases ward. The younger brother followed, swaying unsteadily as a fourth similarly outfitted person walked over with a cup of ORS. I thought this was a nurse's aide or a nurse but couldn't be sure. The space-suited Samaritans were Liberian, we surmised, but we couldn't make out what they were saying. The brothers, for their part, didn't say a thing; the one on the slab probably couldn't. He lifted his head while the presumed nurse tried to get him to drink some ORS. He gagged and sprayed it on them and on himself, moaning loudly enough that we could hear him.

I turned from this spectacle to look for my friends in the other group. With equal horror, they were watching a girl of about six years being hauled kicking and screaming into the confirmed ward by two women in protective garb. But the man we'd just seen collapse had no fight left in him. Without replacement of lost fluids and electrolytes, he would likely die of hypovolemic shock; his brother might be right behind him if he kept vomiting. The whole scene was excruciating for us and our guide to watch, because we knew that the treatment for the brothers' immediate emergency—the loss of fluids and electrolytes—had been worked out during the world war that had started exactly a century previously. We looked on, fearing that yet another early twenty-first-century family was being undone by a failure to deliver early twentieth-century therapies.

At first, I said nothing; my coworker was also uncharacteristically silent. What could we add? Surely this failure to deliver would be regarded as such by all involved, including our guide? Watching the young Liberians collapse while standing at his side challenged our camaraderie. It seemed somehow indelicate to ask questions about the spectacle. But hadn't that been the point of matching us with a fellow clinician for an informational tour?

Both of us turned away from the drama in the tent and toward the Virgil leading us through this inferno, a doctor whose life's work we knew well. All three of us had long been engaged in treating AIDS and drug-resistant tuberculosis in southern Africa and other places where treatment of these afflictions had once been declared impossible, impracticable, unsustainable, and (in the jargon of the day) not cost-effective. Those pilot projects, as they were termed, had brought our organizations closer together. We'd jointly published papers in medical journals and were then poised to launch a major new effort to provide novel antituberculous drugs—the first developed in over forty years—to thousands of patients sick from highly drug-resistant strains of the disease. With so much connecting us, we felt we knew each other well. In fact, we'd just met in person that day.

I knew that I had to say something about the dying man in front of us, and struggled to find just the right tone. "How long has he been sick like that?" I asked, pointing to the inert man. "He looks like a patient with really bad cholera." All three of us had extensive experience treating that disease.

"Three days," our Italian guide replied, "according to the intake team."

I braced myself to launch a couple of rhetorical questions. "Surely he's headed toward hypovolemic shock? If he's been doing that for three days, he's lost half his bodily fluids, right?"

Although shock isn't the only way to die of Ebola, it's one of them. The desperately ill man might have already lost more than twenty liters of electrolyte-rich effluent—not only from vomiting and diarrhea but also from what are termed "insensate losses" due to sweating and fever. These had been hastened and heightened by Monrovia's torrid heat.

All three of us knew that the sicker of the two brothers might not live long unless he received rapid fluid resuscitation. Usually provided through intravenous lines, fluid resuscitation is typically thought of as basic supportive care. During the West African Ebola epidemic, however, putting in an intravenous line had become controversial, primarily because any therapies involving needles or sustained contact with the afflicted increased the risks of accidental transmission to nurses and other caregivers. It was a tough situation, because Ebola was by then already the number one killer of health professionals in this part of West Africa. But regardless of who was afflicted, a smallish number of questions would matter. Chief among them: How will I, or my loved ones, fare?

This was surely the primary question running through the minds of the stricken brothers, but it couldn't be answered without laboratory data. Just a bit of routine information could steer anxious and imperiled clinicians to the sickest patients—and the right balance of fluid and electrolytes. As my colleague strained to watch the hazmat-suited workers continue to press one brother to drink, and to get the other onto his cot, I pulled closer to our guide: "Do we have any labs on the critically ill patients? What about electrolytes? Liver or renal function?" He stiffly replied that the headquarters of his organization had announced there would be no blood draws and no laboratory tests except for one: a polymerase chain reaction, or "PCR," test for the Zaire species of Ebola. (That was the species on the loose in West Africa and long alleged to be the most lethal.) "But if you're going to draw blood for one test," I protested mildly, "why not use part of the sample for basic labs—electrolytes, say, or lactic acid, to give you a sense of who needs more supportive care?"

He hesitated, then replied, "It's not in the protocol."

Our guide offered this in a tone that suggested the protocol was wrong, an order issued by generals too far from the front lines. The doctor then fell silent, looking at me with what I judged to be pain tinged by shame.

That look alone suggested that there was, already, a deep internal rift within his organization, one of a few that had committed to helping victims of the West African outbreak and with experience doing so elsewhere on the continent. Our host had sacrificed his vacation time to take up a dangerous post, but the organization he worked for had felt so overwhelmed

and isolated that it had decided against trying to rehydrate patients with intravenous fluids and electrolytes. Since our guide was a superb and principled doctor, I didn't want to make him uncomfortable. Besides, we had similar feelings of pain and shame: by the second week of October, our team had yet to treat anyone with Ebola, even though we should have been at it for weeks.

My own Italian colleague and friend remained quiet as the three of us turned away from the mortal dramas unfolding in the red zone and rejoined the others. I stopped asking questions about clinical management and returned to infection control, the safe topic of the day. We watched the complex decontamination proceedings and marveled at how many people it took to run the unit—our hosts reckoned they'd soon have seven hundred employees, mostly Liberians—and how smoothly much of it worked. We beamed at one sturdy young man who was clearly going to recover. He lifted his hands up in a hearty if mistaken tribute to us visitors, rather than to the valiant staff who'd seen him through his illness. He looked as healthy as any of the young employees. We felt like cheering, and probably did.

The three of us rejoined our colleagues, and the tour continued for a couple more hours. The sun began to set, and the oppressive heat abated. A welcome breeze hit our sweaty backs, wafting the smell of shit and vomit away from us, along with the sting of chlorine. As the light dwindled, the medical campus briefly seemed an orderly haven, though the crematorium's stench lingered. I tried to keep my mind on all we were learning and to express my appreciation for our guide and for the woman who'd organized the visit, a friend who'd also worked for years in southern Africa. We'd taken up their time with questions they'd surely heard a hundred times before. We left the ETU grateful for the hospitality shown us, and for the courage of our hosts.

That night, however, I couldn't get the young brothers out of my head. I kept seeing images of the sicker one, a man whose life might have been saved with a few liters of the right intravenous solution.

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I wrote this book before the coronavirus pandemic of 2020. A novel pathogen's rapid diffusion has suddenly made many of the dilemmas discussed in these pages familiar around the world; in a brief epilogue, I consider the implications of West Africa's Ebola crisis for today, as we confront another disease that disproportionately afflicts caregivers. For although there are many differences between this strictly regional epidemic and a truly global pandemic—for starters, one pathogen is spread through direct contact while the other is a respiratory virus—there are many lessons to be learned from Ebola, and obvious implications for our response to COVID-19.

The Ebola epidemic that this book examines—the longest and largest in recorded history—began in southeastern Guinea in 2013. The book is part memoir, since I was often in this part of West Africa during the epidemic and thereafter, and wrote most of it in Sierra Leone. It's part biography, with a couple of long chapters about the lives of two former patients now counted as friends. There are also shorter inserted narratives about a handful of professional caregivers from Sierra Leone who didn't survive Ebola, and some who did. All told, close to a thousand professional health-care workers from Liberia, Sierra Leone, and Guinea fell ill with Ebola. More than half of them died.

Whether health professionals or not, tens of thousands contracted Ebola in the course of caring for the sick or carrying out caregiving's final act, preparing the dead for burial. They did so without the safeguards and assistance—pragmatic measures that can stop the spread of Ebola once the virus has been introduced into the human family—that most of us take for granted. But as the epidemic erupted into global consciousness, often in the form of breathless journalistic accounts, few in the public conversation mentioned the link between the epidemic and the dearth of trained and equipped medical professionals in the affected regions. Nor was

there much mention of the absence of undertakers, morticians, or others to whom the last act of caregiving is outsourced by those affluent enough to pay for their services.

As with COVID-19, the disease caused by a novel coronavirus, a lot of published or broadcast Ebola commentary did, however, discuss where the epidemic had originated and hypothesized about how it had spread. The latter was never a mystery: for centuries, footpaths and river crossings, along with shared languages and cultures and family ties, have bound the eastern reaches of Sierra Leone, Liberia, and Guinea into a single ecological and social zone sometimes termed "Upper West Africa." The epidemic was fueled and sustained within this three-country region by everyday acts of caregiving, the mundane yet sacred obligations people felt to nurse the sick and bury the dead—without the PPE, or personal protective equipment, that such duties often require. But many commentators couldn't resist titillating diverse audiences with exotic explanations, alleging that Ebola's spread was hastened by bizarre healing and sexual practices, arcane funerary rituals, "secret societies" practicing scarification and all sorts of weird juju, and—especially—the consumption of "bushmeat." You call it game.

Like COVID-19, Ebola is a zoonosis, meaning it's caused by a pathogen that jumps from animals to humans. This is termed, in the jargon of epidemiology, a "spillover event." The natural hosts of both viruses are believed to be bats, but even that's uncertain. Humans living in or near what remains of equatorial Africa's once-great forests are bound to bump into, and sometimes eat, animals that are the hosts of Ebola and related pathogens. But that doesn't mean that human–animal contact defines epidemics, which occur among and between people.[2]

You wouldn't know it from much of what I heard on both sides of the Atlantic, where the animal part of the connection enthralled. One anthropologist summed up views commonly held in the United States in the latter half of 2014, as Ebola's toll mounted on the far side of the pond:

> The formula had become predictable by August: Ebola is contained in exotic animals + West Africans eat these animals = a pandemic that kills its victims by causing their internal organs to liquefy. The oft-cited clichés of people bleeding from every orifice, a 90% mortality rate, and reality TV-style examples of "they eat *that*?!" gave the story the added sensational punch.[3]

Perhaps the most outrageous claims staked in those early months of the epidemic were that the afflicted and their caregivers obstinately refused to follow sound advice or accept modern medical care. People who should have known better—public-health authorities, humanitarians, and journalists—kept making variants of this claim. But few received sound advice, and almost nobody was offered modern care.

This book is thus also a reflection on how erroneous and misleading claims about Ebola echo across an increasingly fragmented media ecosystem—among alt-right Internet trolls and purveyors of fake news, as you might expect, but also among urban elites, politicians, and public authorities from all three nations, and many others. These entitled speakers, purporting to explain Ebola's sudden West African debut, invoked a host of exotic practices and beliefs held to be common in this part of the world. But variations of these practices (eating game, having babies, nursing the sick, respecting and transmitting traditions about last rites and burial) are encountered across the world, and Ebola's putative natural host or hosts also have a wide distribution zone. As a result, explanations that underline the deficiencies of the victims' culture didn't throw much light on the particulars of the disease's catastrophic spread across Upper West Africa. Too rarely was it noted that similar outbreaks elsewhere in Africa have typically occurred near shrinking forests and in the aftermath of armed conflict—problems of our own making that more closely approach the nature of an explanation.

The claim that Ebola's spread was hastened by "traditional" burial practices did have some merit. But it's absurd to characterize those practices—family members washing the bodies of

their loved ones, laying them out for burial, and interring them with religious rites—as exotic. Until very recently, these practices were almost universal in human society, and they're still practiced in much of the world. In her caustic 1963 book, *The American Way of Death*, Jessica Mitford reminds us that this was long the way of it in the United States: "Simplicity to the point of starkness, the plain pine box, the laying out of the dead by friends and family who also bore the coffin to the grave—these were the hallmarks of the traditional funeral until the end of the nineteenth century."[4]

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What happened in previous centuries is not irrelevant to the study of today's epidemics and social responses to them. Discussions of epidemic disease in Africa make frequent use of the colonial era's exoticizing language: game becomes "bushmeat," burials become "funerary rituals," and the terms "traditional" and "native" appear regularly, in proximity to each other, as code for "primitive." Many of these myths and mystifications, much of the vocabulary, and a good deal of armed conflict were brought to West Africa by colonial rule; so were martial disease-control efforts. What European colonialism didn't bring to the region was health care.

The game-eating, caregiving natives of this part of West Africa might not be acquainted with modern medical care, but they are quite familiar with colonialism's primary purpose: to rip riches from the earth and export them for profit. That's because West Africans have endured the extractive trades, and the many myths that obscured them, for so long. For centuries, a stream of commerce has moved commodities—initially, slaves and gold, and then rubber, iron ore, oil, bauxite, hardwoods, diamonds, and more—from West Africa to the Americas and Europe. It doesn't take much digging to learn that the natives, especially in the three most Ebola-affected countries, are still caught up in the aftermath of extractive colonialism.

Not that much effort is invested in hiding the ongoing project of extraction. A single visit to the eastern Sierra Leonean town of Koidu, a place discussed often in this book, suffices to remind even the casual observer that artisanal mining of alluvial diamonds turns once verdant rice paddies into a landscape pockmarked by pools of standing orange water—inhospitable to fish or plant life, but luxury resorts for mosquitoes and other vectors of disease. And that's before visitors note numerous giant slag heaps bordering the war-torn town or the vast funnels of the industrial diamond pits a few miles away.

The precipitate extraction of wealth from earth and forest profoundly disrupted the region's ecology, and in ways that have contributed acutely to the Ebola crisis. Whether by panning or river dredging or excavations that rival the visuals of Mordor, mining spells ecological ruin. It has sparked the rapid, hazardous development of cities and towns where once tiny villages and small farms stood. But mining, urbanization, and deforestation occur across Africa, and indeed the world. So why was this particular Ebola epidemic so much larger than any other yet described? How and why did it spread to cities? And why should such a readily transmitted and lethal pathogen have confined its toll almost exclusively to three countries among more than a dozen in close proximity?

The legacy of violence offers at least a part of the answer. When readily portable diamonds were the object of panning and dredging and digging, mining fueled armed conflict before and long after the end of colonial rule. Only a few years before Ebola erupted from the forest districts of eastern Guinea, civil war in Liberia and Sierra Leone pushed millions of refugees into camps, most of them in eastern Guinea or in crowded slums of the three capitals. As the fires of war depleted the hamlets and gardens that once fed these nations, flight and hunger created fertile terrain for explosive epidemics, of which Ebola is only the latest. Accordingly, this study of Ebola can't be only about recent events; West Africa has long been ground zero for stripping, feuds, and fevers.[5] Nor can this book sidestep a more remote history of armed conflict; at least a third of it seeks to record some of the spectacular mayhem that invariably

followed in the wake of pillage: centuries of conflict and epidemics on both sides of the Atlantic.

I wasn't around for any of these events, or for the recent civil strife that rolled out the red carpet for Ebola's rapid spread from the forest villages of Upper West Africa to its coastal cities. During the region's recent spate of wars—or the long continuous war, depending on your views—I was splitting my time between Haiti, Peru, and Harvard Medical School. I knew next to nothing about the cultures and everyday lives of those inhabiting the areas where Ebola took its toll, although by the time it erupted I'd spent much of the previous decade in Rwanda. Once we began working to reopen West African clinics and hospitals, and to care for Ebola patients, I didn't learn any of the two dozen or so local languages spoken in the region. Nor did I have the time or inclination to conduct ethnographic research in the midst of a medical emergency. To learn more about the social complexity of this region, I relied on the published work of others—anthropologists and historians who came by this sort of deep knowledge the hard way.

Formal training in infectious disease and anthropology did, however, help me write this book. By directly providing clinical care and other pragmatic assistance to victims of the Ebola epidemic, and by engaging on other fronts in the fight against a host of other pathogens and pathogenic forces, I got to know many Ebola survivors—and what was left of their families—well enough to write about them. Partners In Health, a nongovernmental organization founded more than thirty years ago in order to directly address the needs of the destitute sick, afforded me this type of engagement. Anthropology, for its part, taught me to distrust confident claims about local culture as *the* chief determinant of recurrent suffering and early death, even as it taught me that culture and context are always and everywhere important in facing unequally distributed misfortune; whatever the fates deal out, culture invariably shapes social responses to it.

Writing this book also required an understanding of how this virus and other microbes kill some while sparing others. The relative explanatory importance of varied factors—from biological susceptibility to newly introduced pathogens to the impact of conquest, extractive colonialism, and the inequalities and conflicts that ensued—has for centuries triggered debates about health disparities, many of them registered between the descendants of the conquerors and conquered. Understanding such disparities, along with holistic and historical understanding of human affliction and responses to it, is the goal of social medicine, a regrettably obscure branch of the profession. It's in this tradition that I offer this account.

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Much of this book is, in other words, a synthesis of other people's knowledge and an account of other people's suffering. But it's a synthesis informed by direct service to the afflicted. This account is also informed by years of friendship with several people who have survived Ebola.

Previous books about the disease written for the general reader have made it sound as if there would be few survivors left to befriend. Richard Preston's *The Hot Zone*, the best-known and bestselling such book, set the tone—and widespread expectations—over the past couple of decades:

> As Ebola sweeps through you, your immune system fails, and you seem to lose your ability to respond to viral attack. Your body becomes a city under siege, with its gates thrown open and hostile armies pouring in, making camp in the public squares and setting everything on fire; and from the moment Ebola enters your bloodstream, the war is already lost; you are almost certainly doomed.[6]

I'm pleased to report that this is hyperbole. (Preston, I have no doubt, is pleased, too.) In the past few years, many thousands have survived infection with the species of Ebola that he

names the deadliest. As regards those who did not survive, two related questions must be raised. How many of these deaths were caused more by the virulence of social conditions than by the virulence of the pathogen? If it came down solely to the virulence of a particular strain or species, as is still commonly alleged, then why have mortality rates varied so widely among people infected with the same variants of Ebola? With the exception of one Liberian-born U.S. citizen, every American who fell ill from the strains circulating in West Africa survived. So did most Europeans.[7] That's because they were medevacked out of the clinical desert, fell ill shortly after returning from it, or were among the handful of professional caregivers infected beyond its borders.

Meanwhile, back in Upper West Africa, mortality rates at the close of the epidemic—when we should have had on hand more of the staff, stuff, and space needed to improve the quality of care—were unchanged from its early months. (The staff in question would include nurses, doctors, and other clinicians unambivalent about caregiving; the stuff includes everything from gowns and gloves to IV fluids; the space includes ETUs.) This high mortality rate was widely alleged to result from the population's deep distrust of authoritarian disease-control efforts and of authority in general. But it's also because what became the world's largest public-health endeavor always remained a clinically paltry one.

Overweening disease-control efforts that are clinically paltry are nothing new since the late nineteenth-century rise of germ theory and its application in an increasingly unequal world. But this rise and its colonial rollout happened simultaneously, and with peculiar force, in West Africa. I didn't know any of the details when I first traveled to Sierra Leone in June 2014. The historical chapters that constitute the middle of this book are also its heart, and they're meant to distill an unfolding astonishment I hope to share with the reader. There are several reasons for this foray into history, and into material that is unlikely to figure prominently in other first-person accounts of the Ebola epidemic.

First, West African epidemics and social responses to them can't be fully comprehended without knowledge of the region's long entanglement with Europe and the Americas. This is the story of how our world—the Atlantic world that's long been the nucleus of the global economy—came to be as it is. It's the story of the all-too-little-recognized precursors to Ebola: slavery and the extractive trades, the feuds they engendered or worsened in West Africa, and their links to diverse epidemics affecting this long-disrupted region.

Second, much of this story—the transatlantic slave trade, the late nineteenth-century European partition of Africa, the harsh colonial rule that endured until the early years of the Cold War, the diamond-fueled hot wars that ended in this century, the epidemics that erupted throughout—is simply startling. Again and again, as I learned more of the details, my reaction was, *How could I not have known this?* These epiphanies were humbling, in that I've long worked in and written about Haiti, peopled largely by descendants of those who passed through the Door of No Return on or near what was once called the Upper Guinea Coast.

A third reason is restorative. Down the oubliette had gone rich if confused colonial-era accounts of febrile disease, the famed fevers of the "fever coast," as it was termed before being redubbed the "White Man's Grave." These accounts represent a rich trove of victim-blaming and self-exculpation, shot through with self-serving sensationalism and old-school racism, a brand of history writing and storytelling that in many ways has defined what we tell ourselves about much of the formerly colonial world and its troubles today. They also presage a more material legacy. This includes, as noted, entrenched health disparities, explosive pandemics, weak health systems, and widespread lack of confidence in them. These, more than any specific disease, are the ranking public health problems of our times. Their roots, too, are to be found in the colonial era.

Also standard, at least in West Africa under European rule, were the punitive practices of public-health authorities. Once termed sanitarians or (as an homage to the French father of microbiology) Pasteurians, they were often the architects and implementers of the control-

over-care paradigm. Their twentieth-century endeavors—sometimes based on harebrained notions of epidemiology or microbiology, often racist, and rarely effective—met with resistance, often vigorous, from the populations they targeted. What motivated much resistance wasn't ignorance but the knowledge that disease-control efforts led by physicians in the colonial medical services were rarely linked to medical care: French and British Pasteurians pasteurized caregiving right out of their practice.

Many colonial health authorities surely had the best of intentions, but this is not a study of Pasteurian motivations; it's a study of their actions and inaction. It's absurd to assume that those who endured authoritarian public-health endeavors for over a century would have forgotten them—even though so many of Europe's African subjects were themselves forgotten by professional caregivers. Despite colonial boasts of a civilizing mission, and despite the presence of the sanitarians, care of the critically ill and injured in rural areas, like assistance during childbirth, remained the lonely and often terrifying responsibility of family members and of a diverse group of practitioners and diviners called "traditional healers." It was the same in Liberia, the only part of West Africa not subjected to European (meaning white) rule, and remained the case after civil war finished off its health system, and Sierra Leone's, while crippling Guinea's. Armed conflict left this part of West Africa both a public-health desert, which is why Ebola spread, and a clinical desert, which is why Ebola killed.

I'm not arguing that providing effective care for those sick with Ebola requires familiarity with the long and sorry history of the extractive trades and of armed conflict in West Africa. In preference to historical consciousness, that neglected task requires staff, stuff, space, and attention to infection control. But historical understanding can help us in many ways. It can help us decipher unfamiliar and often hostile responses to disease-control efforts. It can help us call out outlandish claims from experts and novices alike. Historical understanding can even help us show respect for people native to West Africa. And if history can enlighten us in these ways, we might do better the next time around. As regards the Ebola epidemic, there was never any doubt that there would be one. What recently unfolded in the eastern Congo—another conflict-ridden and parched patch of the postcolonial desert—is proof of that. But there will be, on our ecologically deranged planet, many other reminders of the need to look back on previous epidemics and social responses to them.

One of these reminders is the COVID-19 crisis that is currently roiling the world. This global pandemic now afflicts those living far from the medical desert, which will no doubt give rise to new cultural complexities and new challenges. Most of them, however, will be the same ones described in these pages.

PART I

EBOLA HITS HOME

Everybody knows that pestilences have a way of recurring in the world; yet somehow we find it hard to believe in ones that crash down on our heads from a blue sky. There have been as many plagues as wars in history; yet always plagues and wars take people equally by surprise.

—Albert Camus, *The Plague*, 1947

Outbreaks are inevitable. Pandemics are optional.

—Dr. Larry Brilliant on Ebola, 2014

1.

The Twenty-Fifth Epidemic?

This is the first time the disease has been detected in West Africa, and the outbreak has now spread to the American and European continents.

—World Health Organization, October 24, 2014

Serologic results provide evidence that ebolaviruses are circulating and infecting humans in West Africa. This extends the ebolavirus geographic region to Sierra Leone and the surrounding region.

—Dr. Humarr Khan and colleagues, in reference to blood samples collected in eastern Sierra Leone over the decade prior to 2014

The regions usually affected by the Ebola virus—in or near the receding forests of central and eastern Africa—have long been the theater of explosive if uncharted epidemics. When these plagues kill, as they're apt to do in a medical desert, surviving family don't receive any official report of cause of death. No labs or health systems have tracked the disease while treating it; nobody can say for sure what the culprit pathogens are. To echo Albert Camus, nobody knows what's come crashing down on them. Survivors and their families come up with their own explanations. So do epidemiologists, medical journalists, and public-health authorities of every stripe.

West Africa's Ebola outbreak, the largest in recorded history, is widely held by expert opinion to have its origins in the eastern reaches of Guinea, Liberia, and Sierra Leone, which converge in a bit of turf known as the Kissi Triangle. For centuries this "trizone" region—in which the virus, we're assured repeatedly, was unknown until 2013—was largely covered by a mosaic of forest and savannah, tended by a large and mobile population of farmers, traders, and hunters of diverse origins. (Guineans often call them *forestiers*.) In recent decades, commercial logging, small-scale charcoal production, mining, and war have greatly reduced the forest and its wildlife. From this disrupted real estate, Ebola snaked its tendrils into several other nations. But it was in Guinea, Liberia, and Sierra Leone, and really only there, that the epidemic blanketed the land.

Why? All documented Ebola outbreaks—the World Health Organization (WHO) pronounced this one the world's twenty-fifth—have been registered in settings of profound poverty. By most criteria, that's an apt description of what one finds in Guinea, Liberia, and Sierra Leone. But in terms of gross domestic product per capita, these three countries were growing faster than the United States or Europe throughout the decade prior to the outbreak. Measured only by this tired calculus, Sierra Leone boasted the world's highest rate of economic growth in 2013.[1]

The engines of this specious boom remain the extractive industries—logging, along with the quest for oil, minerals, precious metals, diamonds, and rubber latex. But profits from these industries rarely remained in the vicinity, and they were almost never invested in public goods,

such as robust health systems able to contain epidemics—or to flatten their curves and surges—while caring for the afflicted. Maybe in Norway, but not in West Africa: For all their natural wealth, Guinea, Liberia, and Sierra Leone rank among the most medically impoverished nations on the face of the earth; for all their rainfall, their citizens are stranded in the medical desert. In this desert, a diagnosis—and answers to the who-when-why-how questions—is more likely to come from a diviner or other traditional healer than from a laboratory, or is produced by authorities well after the fact and on a basis other than firsthand observations. This raises a corollary question. When an epidemic occurs in a public-health desert, who decides when and where it begins or ends?

To understand the how and the why of the West African Ebola epidemic, you have to turn first to the specifics of who, when, and where. Since Ebola is a zoonosis, a disease caused by a pathogen able to leap from its natural hosts to humans, the people posing these questions tend to search for an outbreak's first human victims. Epidemiologists, health authorities, and journalists look for "Patient Zero" and seek to trace subsequent paths of spread. But Ebola origin stories can rarely be confirmed, since most stricken by Ebola in the clinical desert die. Blood samples aren't often collected prior to death, nor are postmortem studies performed.

Here, with ready acknowledgment of uncertainty, is the dominant origin story of the Ebola epidemic believed to have begun at the close of 2013 in southeastern Guinea.

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In early December, or maybe a couple of weeks later, a toddler named Émile fell ill in the tiny upland village of Meliandou.[2] He's said to be one year old in some accounts, in others two, and usually somewhere in between. Émile's mother, then heavily pregnant, noted the boy was running a fever and had diarrhea. (In some versions of the story, this was black or bloody stool.) Although such signs and symptoms aren't rare occurrences in Meliandou, she was worried enough to move back to her own mother's house in the same village.

Recollections and reports are discrepant regarding not only Émile's age and symptoms but also what care he received, and from whom. One takedown of Meliandou origin stories insists that he was diagnosed with malaria by a "doctor" in the village's "community health clinic," but Guinean villages with a few hundred residents don't boast any of these, not in the sense implied by the terms.[3] The family's interventions, whatever they may have been, were in vain. When Émile died—on December 6 in early versions of the story and on December 28 in later ones—no red flags were raised beyond the village or beyond its families, which counted many scattered in towns and cities across the region. It's doubtful that health authorities in nearby Guéckédou, the district capital, were alerted. A toddler's death, exceedingly rare in the wealthier parts of the world, occurs all too often in rural Guinea, where malaria is the most common culprit. Nor was any official fuss made when Émile's four-year-old sister—sometimes said to be three, which would imply unusual fecundity if the boy was two and their mother eight months pregnant—perished eight days after he did.

Their mother was the next to mount a fever. In her case, it was accompanied by signs of early labor, including passage of blood clots. (Other iterations assert she'd received an injection for hip pain, which triggered hemorrhage from the injection site.) In the course of a stillbirth, the young woman began bleeding out. Her husband desperately sought help from a "village midwife," who wasn't formally trained as a midwife and certainly not supplied with the tools of the trade—gloves, aprons, sutures, pads and dressings, sterile razors, clamps, and blood for such emergencies. She and another birth attendant, who were related to Émile by marriage or blood, did their best. But Émile's mother died that night in her mother's home, or, according to some accounts, her own.

As if these losses weren't enough to make any family feel cursed, Émile's maternal grandmother was soon sick with fever, nausea, and abdominal pain. According to a report bearing the imprimatur of the World Health Organization, she hedged any bets on curses and

other supernatural etiologies by seeking care in Guéckédou, where she knew a nurse at its public hospital. Guéckédou, too, is all over the map in these origin stories: sometimes it's a forest village, sometimes a town, sometimes a city. It's in fact a small city and the capital of the district of the same name, and its ragged edges extend to a few miles away from an unpaved track leading to Meliandou. The village can be reached, as is clear from photographs illustrating scores of articles and reports about Patient Zero, by jeeps and the like.

Even critically ill or injured villagers didn't have ready access to such transport. When they made it to hospitals, it was on foot, by motorcycle taxi, or on handcrafted stretchers carried by kin. Émile's grandmother took a moto taxi to Guéckédou's district hospital, which, according to a hand-lettered billboard at the facility, had benefited from a "health-systems strengthening program" funded by a large international aid agency. But said health system hadn't been strengthened nearly enough: After a harried and rapid exchange, which didn't include more than a cursory examination, the forty-six-year-old grandmother was judged to have malaria or some other infection common on the outskirts of the forest. She went home and died there in mid-January 2014. Other kin were sickened at about the same time, and several perished.

The decimation of this extended family and several others was attributed to Ebola by a retrospective study of transmission chains leading from subsequent patients back to Meliandou, and back to Émile. But since Ebola is a zoonosis, another species must be implicated in the fevered quest for Patient Zero. Bats are likely culprits, and there were plenty of those flitting about Meliandou. The ones alleged (by some experts) to be Ebola's natural hosts have lovely names: Franquet's epauletted fruit bat, the hammer-headed fruit bat, the little-collared fruit bat, the little free-tailed bat. Generous helpings of speculation prop up the assertion that Émile had fallen ill a few days after eating a bat-gnawed mango, or maybe a plum, or the fruit of a palm tree well liked by bats.

Some experts reported that Meliandou's toddlers were pleased to snack on bats as well as fruit. The journalist Laurie Garrett offered up the following scenario (starring yet another bat species with different dietary habits) in the now-dominant origin story. It draws on scientific authority of the German variety:

> At the edge of a great rainforest where Guinea, Liberia, and Sierra Leone meet, a two-year-old boy named Émile crawled about a water-soaked tree stump with other toddlers and discovered a bunch of little, furry winged creatures. Grabbing at them and poking them with a stick, Émile reportedly played with the nest of *lolibelo*—the name locals use to describe musk-smelling, dark gray bats with bodies about the size of a child's open hand. Many months later, a team of German anthropologists and biologists would visit the Guinean village of Meliandou and determine that Émile's *lolibelo* were Angolan free-tailed bats or perhaps members of a similar species of mammal found across most of sub-Saharan Africa. Surviving children in the village told visiting scientists and reporters that youngsters had smoked *lolibelo* out of the tree, filled up sacks with the flying mammals, and eaten them.[4]

One problem with this sort of scientific authority is that the Germans' eight days in Meliandou didn't turn up much in the way of evidence to support such an origin story. None of the sacks of bats they sampled—including eighty-eight captured in the village—had evidence of Ebola infection.[5]

More classically defined monkey business also shows up in many Ebola origin stories. Nonhuman primates are sickened or killed by the viral strains that sicken humans and thus unlikely to be natural hosts, but they reliably play at least a part in these tales. As regards the spillover event in Guinea, the German team and local ones were unable to document a recent die-off of nonhuman primates or other fauna, as had been described during prior Ebola outbreaks in the Congo. None of this tempered the need for an authoritative origin story—and a Patient Zero—in the absence of solid evidence. That's why some of these stories allege that

villagers in Meliandou kept monkeys as pets or, in another trending version, that Émile's family was among those whose diets included monkey: even if the toddler was too young to chew on monkey meat, he might have been splashed by blood-spatter as it was being butchered or prepared for dinner.

More free-range speculation in the race to identify Patient Zero posited that Émile had received an injection with an unsterilized syringe. This marked an unconventional twist in an Ebola origin story, since he would no longer be a contender for the title unless he shared needles with another species. As babies are unlikely to hunt, gather, dress, smoke out, or poke at animals, or to eat them uncooked, Émile makes a less compelling Patient Zero than might older kids in Meliandou. His grieving father—likely weary of interrogation, impoverished by funeral expenses, and having concluded his family was cursed by more than German scientists and journalists—later said as much: "It wasn't Émile that started it. Émile was too young to eat bats, and he was too small to be playing in the bush all on his own. He was always with his mother."[6]

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A boy dies of an unknown fever, followed by his mother and other close kin: this is among the oldest, saddest, and most common stories of the fever coast and what remains of its brooding inland forest. In the year or so that followed, close to a third of Meliandou's inhabitants died, were sickened, or fled. But the tragedies in Meliandou, though investigated by local authorities and reported to national ones, did not announce the Ebola nightmare. That happened after the region's professional caregivers began to sicken and die.

Upper West Africa

Although Émile's immediate family was decimated within a month or two of his demise, the events in Meliandou might have gone unnoticed beyond Guinea's forest districts, or forgotten as quickly as his grandmother's miserable visit to a miserable outpatient clinic in a miserably staffed and stocked hospital. No international alarms were sounded when other kin and neighbors—those who'd cared for or cleaned up after the sick, or buried them—were felled in the first weeks of the new year. Casualties included the birth attendants who'd assisted Émile's mother the night she died, as well as another of their peers. By then, however, Guinea's local health authorities had taken note.

Shortly after Émile's grandmother perished, a doctor in a town not far away saw three patients die in the span of two days, laid low by diarrhea, vomiting, and severe dehydration. He suspected cholera. When the physician realized all three were from Meliandou, which counted fewer than forty households, he reported these deaths to his superiors in Guéckédou. They in turn reported them to provincial authorities in N'Zérékoré, another city in the Kissi Triangle. Along with Macenta, these cities and their surrounding districts had received the great majority of war refugees during the early years of the civil wars that wracked Liberia and

Sierra Leone; not long before the Ebola outbreak, there were more Liberian refugees than native *forestiers* living in Guinea's patch of the triangle. Health authorities in the Kissi Triangle were, in other words, accustomed to responding to transnational epidemics in the region.

When Guéckédou's health authorities kicked the report up to Conakry, the capital of Guinea, they also dispatched a small team to investigate the rash of unexplained febrile deaths in Meliandou and among folks from or visiting it. Members of this team knew there were clinical reasons to doubt the diagnosis of cholera: most deaths had followed high fevers, which would be an atypical presentation of the disease. But as cholera outbreaks weren't rare in the region, the team from Guéckédou settled on it as the likely culprit. At least its members allowed they were far from sure—a rare modesty in the crafting of outbreak narratives.

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Medical modesty is warranted in considering outbreaks of Ebola, since the disease is spread by acts of caregiving: it's when a patient or health professional is confirmed to have been stricken with Ebola *within* a health facility that the international containment whistle usually blows. That's what came to pass in Guinea. The alarm was sounded not long after the sudden death of a nurse within another forest-district hospital was revealed as a link in the chain leading to Meliandou.

This was the same nurse, a young man, who saw Émile's grandmother in Guéckédou's hospital. In early February 2014, he fell ill with fever, muscle aches, and profound weakness. When diarrhea and nausea kicked in, he sought care from a doctor friend living in the neighboring district of Macenta. By the time he reached its capital, the city of Macenta, the nurse was critically ill. The doctor urged him to report at once to the district hospital for laboratory tests. But as it was late and the lab was closed, he opened up his home to the stricken man, who shared a room with the doctor's son. It must have been a sleepless night: the nurse retched uncontrollably, and his diarrhea did not let up. The next day—February 10 in most reports—he died in the waiting room of the hospital's laboratory.

Shaken, and at a loss to identify the cause of his friend's demise, the physician from Macenta reported the death to regional authorities in the city of N'Zérékoré. A week or two later, he fell ill with a similar constellation of signs and symptoms and set off for Conakry, on the other side of the country, in search of more advanced care and a diagnosis. He received neither, dying on the road on March 7. In the Kissi Triangle, women and girls do most of the caregiving, nursing the sick and cleaning up after them, but men usually prepare men for last rites and interment. In the case of the fallen physician, his brothers prepared his body for burial in his hometown, the trizone city of Kissidougou. At least two of them then fell ill with similar symptoms. Both died in March, and so did the doctor's son and a lab worker from Macenta's hospital.

Within a couple months of Émile's death, Ebola had spread in a widening circle on at least two sides of the Kissi Triangle, from Meliandou to towns and cities across the forest districts. Widening circles are by definition not linear, which is why it was unsurprising to later learn that several of the Ebola-afflicted, in their quest for care or to give it, trod the soil of all three countries before dying or recovering. People in the Kissi Triangle, as elsewhere in this part of West Africa, move freely across frontiers, which often are marked only by rivers, or blazes on a footpath. These frontiers are so porous that hundreds of thousands of war refugees moved across them in recent decades.[7] Needless to say, the virus did the same.

By mid-February, Ebola had spread east through the forest to the town of Baladou, near the Liberian border. It had also spread west across four hundred miles of difficult terrain to Guinea's capital, a ramshackle coastal city of close to two million. Subsequent investigations of the Meliandou transmission chains suggested that a nephew of Émile's grandmother, moving back and forth between city and village to attend funerals, died in Conakry on February 5. Even before that, these links led to Sierra Leone, where at least two women in these chains perished

toward the close of January. None of these connections were made at the time, at least not by health authorities.

Who's to know who died, and how, in those first months of the epidemic? Even if intrepid contact tracers, journalists, and researchers had been able to identify all close contacts of the alleged Patient Zero and his caregivers, and to determine their whereabouts, on this earth or under it, it would be difficult to trace with certainty the fates of all those afflicted. The dimensions of the epidemic eventually prompted several high-profile assessments of what went wrong with an array of "outbreak warning systems" designed to contain lethal epidemics. But local warnings clearly did spread: that's why so many Meliandou residents cleared out. It was the *global* alarm that didn't sound early in the game.

Not that much would probably have changed if it had. When international alarms are sounded, it's rarely as a summons to international caregivers to rush in with medical supplies and relief. It's more like the grim peal of the leper's bell. Clinicians and other hospital staff fear these alarms, and not only because they themselves stand in harm's way: since person-to-person spread within clinics and hospitals is almost always implicated in Ebola outbreaks, such events trigger calls to shut down hospitals and clinics. No one wants to be blamed for "nosocomial spread"—transmission of disease within a health facility. In previous outbreaks of Ebola and of the closely related and similarly spread Marburg virus—the first identified member of the filovirus family—bad report cards regarding infection control had been issued but had little positive effect.

Bad marks didn't prompt more than cursory training of staff, when and if staff were even on hand to train; they often stigmatized health facilities, towns, and sometimes entire countries. What they didn't do was elicit sustained remedial efforts to improve supply chains and install and equip better labs. And when it came to ongoing protection for African caregivers, a failing grade didn't prompt much beyond exhortations to avoid contact with the sick—an impractical and unethical aspiration for health professionals in the absence of meaningful alternatives, and a socially untenable one for family caregivers. After previous outbreaks, a clean bill of health was issued only after an outbreak had, in the crass lingo of epidemiology, "burned itself out." What often didn't flame out quickly after documented outbreaks of Ebola and Marburg was the blame heaped on African caregivers and on the afflicted themselves.

Villagers in Meliandou had their own complex calculus of responsibility, which initially (it would seem) had little to do with doctors or health authorities, invoking instead curses, unpropitiated ancestors, vengeful neighbors, malign spirits, and (of course) microbes. As the outbreaks spread, the various parties concerning themselves with control of communicable disease tended to blame either refractory patients or one another. This, not surprisingly, fanned mistrust among the locals, which in turn led them to hide sick family members and to resist contact tracing, voluntary isolation, travel restrictions, and funeral bans. Uncontested, these measures might have made the epidemic easier to control. But they were vigorously contested, further compounding misguided attempts to blame patients and their caregivers—many of whom soon became patients themselves—for their affliction.

Other experts and pundits blamed the failure of early attempts to contain Ebola on its tardy identification. A stack of lessons-learned reports later bemoaned the fact that three months into the epidemic, no one suspected Ebola as the culprit. But health authorities based in Conakry knew by early March that something terrible was afoot in the forest districts and suspected that the events in Guéckédou and Macenta were part of a single outbreak. They just didn't know what might be causing it. Malaria, a parasitic affliction often causing similar symptoms, was omnipresent. The bacterial diseases cholera and typhoid were often invoked, since gastrointestinal symptoms were present, but the signs and symptoms seen in these outbreaks could have been provoked by a large number of viruses, bacteria, and parasites. Without the right lab facilities, it was impossible to say.

Since many infectious pathogens could trigger the nonspecific signs and symptoms registered in the first months of 2014, reasoned Guéckédou's health authorities, perhaps the pattern of spread might help identify the culprit? The outbreaks flared abruptly, always taking out kin. This strongly suggested transmission within households. Although household spread of malaria, like typhoid, was common enough, the unknown killer struck adults and teens more often than small children, malaria's chief victims; tests for malaria were usually negative among those stricken. When seven of nine new patients in Guéckédou tested positive for cholera—likely false positives—most Guinean health officials put their faith in these results.

It's not that deadly viruses weren't considered. The clinical course and high mortality, and the apparent nature of spread, were consistent with what are sometimes classed as "hemorrhagic fevers." Ebola and Marburg, the filoviruses, are considered two of these. ("Filovirus" was the name given to what would grow into a family of viruses that appeared filamentary, or stringlike, when viewed through an electron microscope.) Marburg, the first named filovirus, was identified after a lethal and unknown affliction in lab monkeys imported from Uganda caused human outbreaks in Germany and Yugoslavia in 1967.[8] Less than a decade later, in the course of a spectacularly lethal outbreak of acute febrile illness near Zaire's Ebola River, a related virus was given the name Ebola and added to the filovirus family.

The virus that causes another sometimes-hemorrhagic disease, Lassa, leaps to humans from a species of rat common in the neighborhood. That alone, in the view of critics of West African health authorities, should have brought Ebola to mind. But few of those afflicted during the expanding outbreak showed signs of hemorrhage, which was alleged to be typical of Ebola but isn't (one reason infectious disease doctors avoid the rubric of hemorrhagic fever). Some local authorities who missed the diagnosis later claimed to have been steered away from it by international health authorities and bona fide Ebola experts, who continued to insist that the virus was unknown in West Africa. This was false: a handful of medical studies from previous decades had suggested that the Ebola virus was already present in the region.[9]

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It's hard to fault beleaguered West African health professionals for missing these clues. Few—even those who'd helped conduct these studies—had access to the expensive scientific journals in which these surveys were published. Nor had local facilities been left with improved lab capacity for diagnosing the varied causes of febrile illness after expatriate researchers had returned to Europe.

When Ebola was recently loosed among humans living in Guinea, whenever and wherever that may have been, its rapid and accurate diagnosis wasn't possible even in Conakry, where neither public nor private institutions boasted the sort of labs that led to the initial 1976 identification of Ebola. Four decades after this discovery, Sierra Leone and Liberia also lacked the bulky and expensive tools of mid-twentieth-century virology that had permitted the identification of many new pathogens. Many villages and towns in the Kissi Triangle still lacked even the point-of-care tests used to distinguish one cause of febrile illness from a dozen others.

Bureaucratic obstacles also impeded a coordinated Ebola response. In mid-March, for example, a team assembled by Guinea's health ministry and the local offices of the World Health Organization left Conakry for the increasingly deforested forest region in order to investigate what was happening there. On the fifth day of its mission, the delegation interviewed the family of a thirty-seven-year-old woman who'd fallen ill in late February with fever, diarrhea, and vomiting, and who may have shown hemorrhagic signs as well. The woman died in southeastern Guinea on March 3, but the team learned that she had been visiting from Kailahun District—the Sierra Leonean patch of the Kissi Triangle. The team also learned that the deceased woman's daughter was sick and had fallen ill *within* Sierra Leone's borders. She

would survive, but one of her own children had died in Kailahun a few days before the team arrived.

Throughout late February and March, relatives of these women and their sundry caregivers fell ill, and at least one of them died in a hospital in Kailahun. (In some retrospective reports, this was on March 19; in others, ten days later.) This was all vital information. But nobody communicated it effectively across national borders and in local languages, jobs that many deemed the responsibility of the World Health Organization. The team did write a seventeen-page report upon returning to Conakry and insisted they'd sent it on to authorities in Freetown. But officials at Sierra's Leone health ministry—and the country's WHO representative—later claimed they never saw it.

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So how and where *was* Ebola identified as the culprit shortly after the investigations in southeastern Guinea? In Europe, and from samples shipped north from the medical desert. This story, too, begins in the Kissi Triangle.

In the early months of 2014, Doctors Without Borders, the world's largest medical humanitarian organization and its most Ebola-savvy one, had a small brigade in Guéckédou, where they were working to rein in malaria. Members of the MSF team—the organization is better known by its French acronym, for Médecins Sans Frontières—were as perplexed as others by the mysterious affliction spreading right in front of them, so they sought clues about its etiology by reviewing the signs and symptoms of the stricken. On March 14, they sent a summary of their findings to an MSF epidemiologist in Brussels. Paradoxically, the identification of Ebola as the culprit was based on two of its less common but best-known signs: when he noted that a number of the afflicted had hiccups and a few had signs of a bleeding disorder, the epidemiologist worried that they might be stricken by a filovirus. He sounded the alarm.

In response, one MSF team in Brussels packed for Guinea, and another was summoned from Sierra Leone to Guéckédou, where its members joined logistics experts hired to pack up blood samples from the sick and from survivors. The samples were sent north from Conakry on Air France's overnight flight to Paris, and from there to a lab in Lyon.[10] A team of virologists and lab technicians in full biosafety gear got to work at once. A few minutes after 7:00 p.m. on March 21, the MSF epidemiologist's hunch was confirmed: the samples teemed with the Zaire Ebola virus—the species identified as the cause of the 1976 outbreak, which had centered around a Belgian mission hospital, where almost 90 percent of those sickened had died. A day later, and along with the World Health Organization, health authorities in Guinea announced that their country was home to what was in all likelihood already a large and geographically diffuse Ebola outbreak.

These authorities acknowledged its spread to Conakry and expressed fears that the virus had already crossed Guinea's borders. Many outbreak watchers assumed the borders in question were those with Liberia, because the Sierra Leonean pieces of the puzzle hadn't yet been put together or communicated effectively. A week later, the Liberian health ministry confirmed cases of fatal Ebola in Lofa County, just south of the country's border with Guinea. That's when one high-ranking UN official based in Monrovia began pressing for a more aggressive response from the World Health Organization and the alphabet soup of humanitarian agencies associated with the United Nations. I knew this official and had clearance to read her dispatches, which make clear some of what happened—and didn't happen—within those institutions as Ebola continued to spread. In essence, she felt stonewalled by headquarters, and reached out to MSF and other nongovernmental agencies with experience in Ebola response. There weren't many of those, as MSF stalwarts often noted.

Bureaucratic sluggishness, infighting, and miscommunication—much discussed in subsequent studies and commentaries about what went wrong with the international Ebola

response—were the subject of heated debate in the midst of it. There were many open conflicts among various protagonists. On March 31, for example, MSF leaders correctly declared the epidemic to be "unprecedented" in scale and ample cause for an unprecedented and concerted response; they demanded the world pay attention. This demand was made, in typical MSF fashion, in a press release. (The organization issues an average of one press release per day.) The next day, the World Health Organization, in typical WHO fashion, cautioned against overreacting: the outbreak was not unprecedented, its chief spokesperson claimed from Geneva; it was quite similar to previous ones. An Ebola Twitter war ensued, the first of many.

At one level, a strong similarity between present and past did exist. As in previously documented Ebola outbreaks, the contagion pattern suggested human-to-human transmission in the course of caregiving and burying the dead. The West African epidemic had, however, reached the region's capital cities; this level of urban spread was new and should have worried the World Health Organization more than it did. There was, by then, a real risk of an Ebola surge overwhelming hospitals and health-care professionals, and abundant evidence that social distancing and other mitigation strategies might be materially impossible in these cities. During the civil conflicts that had recently ravaged the region, rural refugees had flooded into all three cities, trebling or quadrupling the size of their populations. They continued to grow after the conflicts ended.

The region's political and economic elites, most of them city dwellers, quickly developed concerns about the stigma associated with Ebola and the effect it might have on trade. (Tourism hadn't yet rebounded after civil war.) But the authorities didn't turn down early offers to help, either. Within two days of its announcement, the World Health Organization, not in the habit of issuing errata, dispatched an outbreak SWAT team to Guinea. In late March and early April, public-health agencies from around the affluent world followed suit. Among them was the largest of the lot, the U.S. Centers for Disease Control and Prevention (CDC). But the job at hand wasn't only disease control and prevention. Nor was it solely the study of transmission chains, contact tracing, the counting of the dead, or confirmation of cause of death. The people of the trizone region, and soon many others, were looking for something else: if Ebola has always been a caregivers' disease, it's because people always seek care when they're sick.

There's little evidence that stricken villagers and their urban kin, regardless of their own diverse notions of disease causation, were unwilling to seek care from doctors and nurses, even though national and international authorities and journalists soon made claims along the lines of a *New York Times* headline, "Fear of Ebola Breeds a Terror of Physicians."[11] The sick may have consulted traditional healers of all stripes, but they also sought care from doctors and nurses in public hospitals and private clinics, and in towns and cities; there just weren't a lot of physicians in the medical desert. What drove Ebola sufferers underground, and sparked or fanned conspiracy theories and overt resistance to health authorities, was not the arrival of doctors, nurses, and other professional caregivers. It was, rather, the arrival of a vast machinery of disease containment: once the global alarm sounded in late March, the control-over-care paradigm was officially ascendant.

To be clear, effective containment in the spring of 2014 would have prevented much of the suffering and death described in the pages that follow. The question raised in these pages is whether effective containment is possible without safe and effective care. From the start of the West African Ebola epidemic, the order of priorities advanced by international health officials was in view: the first order of business was to stop transmission, the second was to protect health professionals, and the third was to save the lives of those already afflicted. This was crystal-clear from the outset.

The SWAT teams dispatched by various national and international organizations, and soon enough by military forces from all over, counted fewer nurses than epidemiologists, researchers, managers, health educators, communication specialists, and soldiers. This April

influx also included a slew of short-term consultants focused on safe burials, health promotion, health security, infection control, the elaboration and enforcement of building and safety codes, the proper conduct of what's termed "incident management," and the cultivation of something else called "cultural resilience." These consultants began training thousands of locals (underpaid, of course) to be contact tracers tasked with identifying and surveilling all those in contact with each person confirmed to have Ebola. They trained a similarly numerous contingent of sprayers of chlorine, crowd controllers, town criers, and "burial boys." This last term may not have been introduced by Ebola SWAT teams, but it was of European origin.

So, too, was the colonial-style inversion of clinical priorities. Even those with clinical training were often directed to nonclinical tasks. The inversion of medicine's idealized social contract, with saving the sick the highest priority, required such redirection.

The tasks assumed by these teams, homegrown and expatriate, were of critical importance. But the personnel of the international disease-control machinery soon learned that the majority of locals, whether in villages or cities or moving between them, didn't wish to be contained, instructed, traced, controlled, managed, monitored, sprayed, isolated, quarantined, or buried safely—even in a culturally resilient manner. Nor did many desire to be guinea pigs. They did, however, want proper medical and nursing care and pragmatic assistance with food, water, and social services, especially when ordered to remain in place or formally quarantined.

People at risk of Ebola could also, surely, have used some reassurance regarding their chances, as opposed to lectures on the perils of bushmeat and brief workshops on faddish concepts like cultural resilience. The messages initially disseminated in 2014 by health-promotion and communication consultants—who relied on cues from the sort of scientific authority previously described—didn't help lessen the control-versus-care conflict, nor did they lessen growing fear. Radio spots, commissioned songs, and billboards showcased a confusing set of troubling, punitive, or contradictory messages and commands: Ebola is real, not caused by witchcraft or curses. It kills 90 percent of those afflicted. Don't eat bushmeat. Don't eat bats. Don't eat plums (which few West Africans seemed to fancy) gnawed on by bats. Don't play with or eat baboons (a species absent from the region in which the spillover event was held to occur) or monkeys of any sort. Don't touch your sick or bury your dead, or you'll be punished. Don't shake hands. Don't touch anyone at all, ever. Stay at home, or shelter in place. Go to a hospital. Don't go to a hospital, as there's no known treatment for Ebola. Go to an isolation center. Isolate yourself if you can't get to one of those because of travel bans. Practice social distancing.

Ham-fisted hectoring was not unfamiliar to the people of the forest districts, who like people everywhere had their own complex and discrepant notions of what caused the very real affliction spreading in their midst. Nor were the *forestiers*—as they've been termed from Conakry since it became the capital of French Guinea in 1904—unfamiliar with the inversion of medicine's social contract, with care replaced by containment as the sanctioned priority. They were, on the other hand, unaccustomed to a benevolent and effective health system able to care for them when ill or injured, regardless of the nature of affliction or of perceived etiologies.

In both Guéckédou and Macenta Districts, there was by early April evidence of what francophone Guineans called *réticence*—overt resistance to quarantine and isolation and hostility to powerful outsiders. In previous decades, influential outsiders had been associated with disease containment, the restriction of free movement, calls to abandon polytheism and other superstitions, and heavy-handed efforts to prevent the *forestiers* from cultivating forest gardens while industrial logging flourished. (In 1976, Conakry decreed felling a tree a capital crime, if it was those living among the trees doing the felling.) As efforts to ban funerals were followed by others forbidding home-based care in the absence of trusted alternatives, conflict erupted across the forest districts.

It's easy enough to understand both the mixed messages and the motivation behind these bans. Funerals and caregiving are the two main sources of contagion in Ebola outbreaks. But last rites and caregiving are deemed social obligations at least as important in the medical desert as anywhere else. Across Guinea, people fled disease-control campaigns or responded to them with violence. Contact tracing, and many contact tracers, were often met with open hostility. On April 4, a newly opened MSF isolation unit in Macenta was looted and shut down by an angry and fearful crowd. Ebola got real, all right.

As "Ebola is real" began trending as an official and expert response to fearful and distrustful local responses, ongoing spread was missed by seasoned Ebola hands. This was in part because, across the region, the machinery of containment was largely untethered from the delivery of effective care. Such was the conclusion, if not the language, of a two-month-long investigation of what transpired during April and May by medical reporters from *The New York Times*:

> Although conditions were ideal for the virus to go underground, some of the world's most experienced Ebola fighters convinced themselves that the sharp decline in newly reported cases in April and May was real. Tracing those exposed to Ebola and checking them for symptoms, the key to containing any outbreak, had been lacking in many areas. Health workers had been chased out of fearful neighborhoods. Ebola treatment centers had gained such reputations as deathtraps that even desperately ill patients devoted their waning strength to avoiding them.[12]

"Health workers" is, of course, an expansive rubric. It didn't include, during those early months, many nurses and doctors with expertise in caring for critically ill patients. Guinea's clinical desert remained arid as the control-over-care paradigm blossomed.

The same process unfolded in Liberia. By April 9, having isolated what they believed to be the last of twelve Ebola cases, Liberian authorities began counting the days without report of new ones. According to the World Health Organization, if Liberia reached forty-two consecutive days in their countdown without any new cases, the country could declare an end to its outbreak. Emergency responders from MSF and Samaritan's Purse, the missionary organization that had converted its Monrovia chapel into an ETU, declared an end to their Ebola work in Liberia, with the former pulling its team back to Guinea for the mopping-up phase. The disease-control and Ebola experts who'd shown up in late March also began winding down operations.

Meanwhile, officials and international authorities were still making the improbable claim that the epidemic had spared Sierra Leone entirely, even though the Guinean villages and towns hit early in the outbreak were a lot closer to Sierra Leone's Kailahun and Kono Districts than to Conakry. Given the region's porous borders and the nature of Ebola's human-to-human spread, the international teams dispatched to West Africa had ample reason to suspect the virus had already spread there.

And then there was the seventeen-page report that officials in Conakry had produced in March, which had revealed a number of cross-border Ebola introductions and the death in a Sierra Leonean hospital of a woman with ties to Guinea's epidemic. The authors of that report had linked the deceased woman to a friend described, in an unflattering and misleading epidemiological epithet, as a "superspreader." This was a locally famous traditional healer and diviner who for decades had helped diagnose and respond to diverse afflictions on both sides of the border. (Thrown cowries were this woman's medium, but she was also known to converse with the dead.) The alleged superspreader had visited her sick friend at home and in the hospital. By month's end, she herself was suffering from nausea, vomiting, diarrhea, and severe headaches. She soon died, sometime around April 8.

Hundreds attended the healer's funeral in Kailahun District. Within weeks her husband and a grandson had fallen ill. But there's little doubt that more than close family prepared her

for burial and helped to inter her: impoverished homes and understocked and understaffed clinics and hospitals were, along with an absence of well-provisioned undertakers or burial teams, the real Ebola superspreaders in the region. By the end of April, others who'd tended to her, including fellow healers, began to fall ill, and through their own caregiving (or receipt of it) helped forge new links in the chain of transmission. One of these was the healer's sister-in-law, whose blood sample—carried by a health-surveillance officer over rough roads between Kailahun and Kenema, a center of the diamond trade and capital of the district of the same name—yielded the first laboratory-confirmed case of Ebola in Sierra Leone on May 25.

The sample was logged shortly after many Ebola experts had returned to whatever tasks they'd been previously assigned, or had simply packed up and flown home to Geneva, Brussels, or Atlanta.

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Hard as it might be to believe, there were fewer health professionals in Sierra Leone than in Guinea. But one of the former was already knowledgeable about Ebola: Dr. Humarr Khan, the director of Kenema Government Hospital. Khan was born to a large family in the town of Lungi, home to Sierra Leone's international airport. He was among the first generation of Sierra Leoneans to graduate from the country's only medical school, which was opened well after the end of colonial rule in the 1960s.

By the time I met him, Humarr Khan was known as a collegial and hardworking physician-researcher with a particular interest in Lassa fever. He was compact, jovial, and an ardent soccer buff. As Ebola spread from nearby Meliandou to Conakry and Liberia, Khan was monitoring developments from the hospital and lab. Although the hospital was a decrepit mess, the lab was not. Khan and his American colleagues, including several from Tulane and Harvard, had long dreamed of creating a network of laboratories in West Africa that, using new diagnostic technologies and the tools of genomics, would help unravel the mysteries of Lassa's epidemiology and how it caused human disease. A few years prior to the outbreak in Meliandou, Khan had teamed up with Pardis Sabeti, who'd been a student of mine at Harvard Medical School and was now a colleague. He had the patients, she had the supercomputers, and together their teams sequenced the Lassa genome.

This work was supported by the American government, which, panicked by the homegrown anthrax attacks that had followed 9/11, had pumped up investments in research on pathogens that might conceivably be weaponized. As part of that effort, Lassa had been put on a new list of "Category A bioterrorism agents," in part because Soviet scientists and defense authorities had previously included it, and the filoviruses, on their roster of bioweapons.[13] After this new classification, a group of Sierra Leoneans, working with American colleagues and funding, was able to build a modern laboratory to study the virus on the war-battered campus of Kenema's district hospital. The U.S. Centers for Disease Control had pledged to help build and sustain another lab in N'Zérékoré, southern Guinea's regional capital. But armed conflict, dwindling enthusiasm, and bureaucratic Balkanization between multiple agencies from several nations ended that dream well before the Ebola nightmare began.[14]

When the boy branded Patient Zero fell ill, in other terms, Kenema was pretty much a clinical desert, but not a diagnostic one. Its hospital, where Khan directed the Lassa ward, was the only place in Upper West Africa that had the capacity to diagnose any kind of hemorrhagic fever. But Kenema's clinicians, who were mostly nurses, knew that no laboratory network could slow Ebola's spread unless it was embedded in a health system strong enough to deliver high-quality care—and that was lacking from the Kissi Triangle to the coast.

Unlike some of their colleagues in the world of disease control, Dr. Khan and his colleagues were seeking the causes of febrile illness not just to identify and contain them but also to treat them. They knew that diagnosis alone does not a health system make, so in doing his work Khan regularly called for investments in Sierra Leone's entire care-delivery system,

including its hospital infrastructure and network of nurse-run public clinics. All of them, Khan complained, lacked staff, stuff, and safe space in which to deliver care. Well after the war ended, the rebuilt Kenema Government Hospital and its Lassa ward were poorly supplied and worse than dilapidated, and remained so even after Kenema's shimmering new lab arose from the sands of the clinical desert. But, as would become tragically clear during the Ebola epidemic, even that lab lacked the meticulous infection-control practices required to handle dangerous infectious pathogens.

One of these was Ebola, supposedly new to Upper West Africa. Over the years, Khan and his coworkers had demonstrated that a substantial percentage of patients with signs and symptoms suggestive of Lassa fever, but without laboratory evidence of it, did show evidence of recent Ebola infection. One study put the number at more than 8 percent.[15] That meant the virus wasn't only present in eastern Sierra Leone; it wasn't rare. These findings had been presented in scientific meetings and in a manuscript submitted for publication in an academic journal months before Patient Zero fell ill. Improbably, the article was rejected, with at least one reviewer arguing he just didn't believe Ebola occurred in West Africa. It didn't appear in print until shortly before the Kenema facility's director and many of his nursing colleagues were dead of Ebola.

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On May 23, for the first time, Ebola reached the Kenema Government Hospital in a living human host. She was a twenty-year-old pregnant woman who hailed from a town in Kailahun District —from the same neighborhood, in fact, as the traditional healer tarred by epidemiologists as a "superspreader." The young woman arrived with a fever and was later found to have attended the superspreading funeral that took place in Kailahun in early April.[16] But all that she and others knew when she arrived at the hospital was that she had miscarried and was bleeding. The team in Kenema took her to the OR in an effort to save her.

Most physicians and nurse-midwives working in the region might have assumed the young woman's fever and miscarriage to be due to a peripartum infection caused by bacteria, or to a case of malaria. But lab tests did not support these diagnoses, and so Khan and his colleagues also tested her for Lassa. When it came back negative, they worried she had Ebola and requested that the lab perform the test the next day. By the time a blood sample from the alleged superspreader's sister-in-law arrived from a small health center in Kailahun. And so it came to pass that, on May 25, both the twenty-year-old and the healer's sister-in-law tested positive for Ebola. Both women would ultimately survive. Once within the hospital, the virus spread rapidly through its cramped and crowded wards, including the Lassa unit. The staff was overwhelmed and frightened, but the sick kept on coming.

At first, they came mostly from Kailahun District, with many linked one way or another to the nexus of healers and kin mentioned above. (As in Meliandou, the birth attendant looking after the pregnant woman from this nexus was among the first to die.) Then they came from Kenema and, after that, from across the country. As the crisis widened in June, Kenema Government Hospital was named the national Ebola referral center. Humarr Khan was suddenly Sierra Leone's Ebola czar. By the end of that month, with more than a hundred confirmed Ebola diagnoses, Khan and his team began admitting patients to a makeshift ETU erected on the campus. In the words of the Irish ambassador to Sierra Leone, a young diplomat who'd visited the hospital a dozen times before Ebola hit and was to become something of an Ebola czar herself, the unit was soon "operating very much on a wing and a prayer."[17]

Prayers did not suffice to conjure the staff, stuff, space, and systems needed in Kenema. On July 8, with fifty-three confirmed cases in the ETU, the campus ran out of chlorine. Stockouts of gloves and other PPE were also reported. Infection control was, in the word of a WHO physician dispatched to the hospital, "catastrophic."[18] International disease controllers called for the hospital's closure, even though there was no obvious alternative in the more heavily

populated west, where cases were mounting rapidly. Facilities in Freetown and Port Loko—a large town not far from the Atlantic coast and not far from Humarr Khan's hometown of Lungi—were already transferring critically ill patients east to the hospital in Kenema. Many didn't survive the jolting six-hour drive, especially patients with nausea and vomiting. Their lost fluids went unreplaced, a depletion worsened by the oppressive heat of a suffocating, fouled jeep. Since the rainy season was only half over, some vehicles didn't make it through the mud. It's not difficult to imagine what became of their passengers.

It wasn't difficult, in any case, for me to imagine, since I happened to be in Freetown just then. Before the outbreak began, I'd helped organize a medical conference on surgical care there in late June; it was my first time in the country. When we made plans to gather in Freetown for the conference, I knew only four Sierra Leoneans. One was Humarr Khan; the second and third, surgeons involved in the conference; the fourth, a student of mine at Harvard Medical School, who began telling me about the dread moving west over my first meal in Freetown. By November of that year, Khan and one of the surgeons were dead of Ebola, my student had taken a leave to work full-time on efforts to halt it, and the other surgeon was struggling to keep the nation's chief referral hospital from collapsing under the weight of Ebola's assault on Freetown.

Kenema's collapse, and Humarr Khan's, was not prevented by these or any other efforts. Over the course of June and July, Ebola picked off the hospital's brave but poorly provisioned nurses and other caregivers like a hidden sniper. Fear bordering on panic rippled through the staff, including its Lassa stalwarts; rumors and conspiracy theories and protests swirled around outside the hospital gates; some nursing aides and ancillary staff refused to show up for work. Khan watched as several of his closest friends died. Then, on July 19, after a day or so of weakness and malaise, he, too, mounted a fever. Like just about every other clinician feeling feverish at that time and in that place, Khan hoped it was "only malaria," a leading killer across the region. A couple of days later, when he learned it was Ebola, he asked to be driven east to Kailahun, where MSF had just opened a fifty-bed ETU.

Humarr Khan knew from begging for chlorine and other supplies that the MSF unit was better stocked than his facility in Kenema—and staffed by doctors and nurses who'd signed up for the job. He also worried that staying put might mean he'd die as a patient in his own hospital, which he feared would force its closure. Khan wasn't the only one who didn't want to see Kenema shut down, even though surviving staff were clearly unable to deliver care safely. The Lassa ward was, along with the new unit in Kailahun, the only place in the nation trying to pull these patients through. A purpose-built ETU had been promised for Kenema by the Red Cross but was delayed by controversy and bureaucratic haggling; a functioning unit in Freetown was still months away. Neither would come online quickly enough to prevent Kenema's ignominious downfall.

As one of a fairly small number of Sierra Leonean physicians with an international reputation, Dr. Khan was urged by friends and family to seek care elsewhere. He of course knew that his chances of survival would be better outside the country, but no one sick with Ebola in Upper West Africa had yet been allowed to leave the clinical desert. When he arrived in Kailahun, Khan still had reason for hope: he was young, only thirty-nine, and otherwise healthy. Cared for in an American hospital, say, most people Khan's age survive serious viral ailments, even those for which there are no specific therapies and that may cause death primarily through mechanisms other than fluid loss leading to shock. But Ebola is exceptionally virulent, and Kailahun was about as far from an intensive care unit (ICU) or emergency room as Khan could get.

There was one other ray of hope, called ZMapp, an experimental Ebola therapy developed by a Canadian research lab. Like promising Ebola vaccine candidates, ZMapp had gathered dust on the shelf for years, because few in the pharmaceutical industry had shown much interest in developing preventives or therapies for Ebola. The costs of developing them were high, and (in

the common calculus) the potential rewards too low. But, improbably, the only ZMapp doses on the continent were in three vials stored in a refrigerator at the MSF unit in Kailahun, a few hundred yards away from where Khan lay dying. The staff there debated whether or not to administer it to him.

The Khan-ZMapp debates played out during three days of international conference calls. These palavers, to use the term common in this part of West Africa, included a handful of Ebola experts from MSF headquarters in Paris and Brussels, WHO officials in Geneva, and health authorities representing Sierra Leone, the United States, and Canada. The calls became public and contentious. Every new incident of nosocomial transmission—Khan's was likely one, of course—pushed influential voices to argue that all patients should receive an oral solution of rehydration salts and, for most, nothing more, including ZMapp. MSF was calling the shots, and several of its physicians in Kailahun threatened to resign if a "medical VIP" were to receive treatment unavailable to all. But the real debate was less about favoritism or administering an experimental therapy than about what therapies would be administered within the Kailahun unit.

The government of Sierra Leone and others made emergency efforts to get Humarr Khan flown to Switzerland or Germany, engaging a medevac plane to await him in Lungi. But when pilots and crew learned that he was vomiting and had diarrhea, they refused to take him. Khan died in Kailahun on July 29.

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After Humarr Khan died, his friends, family, colleagues, and fellow citizens—and various pundits—argued about whether he had received adequate care in Kailahun and (if not) why he hadn't been flown to a safe haven. Newspaper and radio reports, as well as commentary on social media, made much of the fact that Khan had died without receiving ZMapp. But more tragically than dying without ZMapp, Khan died without receiving adequate—and nonexperimental—treatment for significant losses of fluids and electrolytes. An epidemic of mistrust had already been mounting. Now, in a climate of angry disagreement sparked by Khan's death, it took hold among the ranks of frightened and often disgruntled health-care workers.

The drama I would later witness in Monrovia in mid-October, when two young brothers with "wet" Ebola collapsed within the world's largest ETU, had by then been playing out for months. Not all Ebola patients die from, or with, dehydration, but prolonged vomiting, diarrhea, and fever were prominent early symptoms among many who fell ill in 2014. If a substantial proportion of the afflicted caregivers were dying of hypovolemic shock triggered in part by lost fluids and electrolytes, wasn't that a paradoxically reassuring detail for clinicians willing to replace them on the front lines? After all, there's therapy for that, and *someone* had to take care of wet patients, as families and traditional healers—Upper West Africa's primary caregivers—had already demonstrated. But by July it was being argued, usually by outside experts, that infection control within hospitals was so ineffective that the primary goal of an Ebola *treatment* unit was to isolate patients suspected or known to have Ebola and to encourage them to try to rehydrate themselves with oral rehydration salts—a goal met, in Khan's case.

What patients critically ill with Ebola needed was *supportive* and *critical* care, which is delivered primarily by skilled nurses. Supportive care doesn't mean handholding. It means fluid resuscitation together with the prompt treatment of intercurrent or secondary infections, many resulting from Ebola's attack on the immune system or from damage to the gastrointestinal tract. It means treatment of the malnutrition, anemia, and wasting that accompany serious illness. It might also mean transfusions of whole blood, plasma, or platelets, or administering drugs called vasopressors, which elevate blood pressure. Critical care requires more gadgetry—a breathing machine for ventilatory support, a dialysis unit for

renal failure, various monitors—but it's not rocket science, either. Both supportive and critical care are considered routine in any American hospital with an intensive care unit.

Critical care was perhaps out of reach in Sierra Leone—in the summer of 2014, there were no ICUs to speak of in Sierra Leone, not even in Freetown's chief referral hospital—but many hospitals and clinics still had the ability to offer supportive care. During the West African Ebola epidemic, however, such care was discouraged because the slightest breach of contact precautions could and did result in nosocomial spread. Even those in full protective gear (gowns, gloves, masks, and goggles) were often called to observe a "no-touch policy," meaning no physical contact at all. This approach was unlikely to save those unable to keep down orally administered therapies but was safer than anything that might involve needle sticks. Messy procedures like emergency cesarean sections, and even assisted vaginal deliveries, were of course casualties of this view and of the dread that underpinned it. Since most Sierra Leonean women delivered at home, they'd long endured a de facto no-touch policy from skilled professionals. But that didn't help the traditional birth attendants who were left holding the babies.

Medical personnel had ample cause for fear when the Ebola outbreak occurred. Ninety-two health professionals in the district of Kenema were stricken with the virus during the epidemic, of whom sixty-six were employees at the hospital. This was about a third of its clinical staff, and most died.[19] Many of these workers had been infected while providing care outside of the facility, sometimes within patients' homes, as part of a parallel fee-for-service health system that sprouts when and where nurses and nursing assistants are underpaid—or not salaried at all. The dangers were real, in other words. But many West Africans, including frightened clinicians, disliked having their fates decided by those advocating a standard of care that in many cases didn't resemble care at all.

The fraught debates fanned by Humarr Khan's death unfurled just as two American missionaries contracted Ebola in Liberia and were flown to the biocontainment unit at Emory University Hospital in Atlanta. They weren't medevacked to receive ZMapp or some other experimental therapy; they shared three vials of ZMapp, flown in for them from Kailahun, while still in Monrovia. No, the missionaries were evacuated so that they could receive supportive and (if necessary) critical care. Many involved in such triage believed that Humarr Khan and the nurses and allied health professionals in Kenema would have survived if they'd had similar access to such care.

When health workers across Sierra Leone went on strike after Khan's death, it was in part to protest work conditions and the failure to afford occupationally exposed West Africans the same sort of medical attention received by Americans and Europeans stricken with Ebola. But it was the debate about ZMapp, not the one about the quality of basic medical care, that went viral. Remonstrations about the Khan case—and about differential exposure to risk of Ebola and differential access to things that might save one from it—spread quickly. By mid-August, they were a staple of mainstream news across Africa and beyond. *The Onion*, a satirical weekly published in the United States, ran a story about Khan's death under the headline "Experts: Ebola Vaccine at Least 50 White People Away."[20]

International experts may have debated the question of access to experimental therapies, vaccines, and better-equipped isolation units, but they did so in the narrow terms of quandary ethics. Notably, should Humarr Khan, Sierra Leone's top expert on (allegedly) hemorrhagic fevers, have been given "special treatment"? One critical question, of course, was whether enough was being done to make basic supportive and critical care—nonspecial treatment—possible in Sierra Leone, Liberia, and Guinea. Many West African clinicians, especially those who were unable to charter a plane or count on their governments or sponsors to bring them to safety if need be, thought not. The no-touch policy didn't help, deepening anguish among clinicians and deepening resentment among patients and their families.

With international attention focused on containment, and in the absence of prompt and massive efforts to safely introduce supportive and clinical care, local clinicians began to fear that they and their patients were, to use the scholarly term, screwed.

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Roiling debates about the quality of care proceeded as if West African clinical deserts were somehow immutably arid and suddenly and forever cut off from the rest of the globe. This hermetic fiction was jarring when the international response, and much public discussion, focused largely on spread across national borders. But it was downright surreal from a historical point of view. The rest of the world has been connected to West Africa for centuries—and is still connected, as diamonds from Koidu and Kenema, and the weapons that more recently leveled those towns, attest.

The myth of hard borders became more difficult to sustain in the face of pressing need to break that seal. It didn't take long for Ebola to be exported beyond Upper West Africa. In late July, a sick Liberian-American businessman sought medical care in Lagos, the largest city in Africa. The patient and one of his doctors died in the attempt, along with six others, prompting Nigeria's president to call the doomed Liberian a "madman." But he hadn't been crazy at all. He'd gone to Nigeria because he knew that as an Ebola patient he could expect to receive better care, in better conditions—air-conditioning surely helped those in biosafety gear tend to patients without the minor distraction of drowning in sweat—than elsewhere in West Africa.

In the weeks that followed, a total of nineteen people were infected with Ebola in Lagos, and most survived. Global public-health authorities breathed a sigh of relief, but not because of the lower mortality: A major Ebola outbreak in Africa's largest city had been prevented—without hospital closures or hospital bans. This was not because Nigeria had invested its oil wealth in its public care-delivery system, but because Nigeria at the time was conducting a massive polio-eradication campaign. Once Ebola turned up in Lagos, the health authorities diverted the resources and know-how of this campaign, which calls for meticulous contact tracing, toward containing the new threat.[21] Caregivers then helped avert disaster by bravely providing supportive care to patients once they were in isolation.

By the time Ebola reached Nigeria, however, any notion that the West African epidemic was under control had long been dispelled. On August 8, the World Health Organization took the rare step of declaring Ebola in West Africa a "public health emergency of international concern." (COVID-19 was the next declared one, in January 2020.) But health authorities didn't use this announcement as an opportunity to radically and rapidly improve the quality of care offered to those ill with the disease. In the tyranny of the either-or, and as deaths mounted, officials remained focused on containment, as if prevention and care were competing tasks rather than complementary ones. Such views were common even after quarantine, travel bans, border closures, and martial law had already failed to control the epidemic, and even after it became clear that patients who received better supportive care, as they did in Lagos and Atlanta, had good odds of survival.

Réticence about the control-over-care paradigm among the general population remained fierce in Guinea. In mid-September, villagers in the south of the country killed eight members of a national "awareness team" trained by "social-mobilization experts" (to invoke two of the unwieldy neologisms of the international disease-control apparatus) and dumped their bodies in a latrine.[22] Such teams, referred to as "health workers" by many reporters, had been trained by the consultants who descended upon all three countries to lecture the locals about the reality of Ebola and the risks associated with caregiving, burials, and bushmeat. The Guinean Red Cross and its international partners would later report an average of ten attacks per month on its burial and infection-control teams.

The story was similar in Liberia, and not only in rural areas. On July 23, a man called (truly) Edward Delay set fire to a conference room in the Ministry of Health. The day before, and in

the same room, Delay informed Liberia's president, Ellen Johnson Sirleaf, that he was distraught over the recent death from Ebola of his teenage brother, who had been turned away from a Monrovia hospital. Sirleaf responded to this act of arson and to other developments by seeking to seal national borders and calling the army into the fray. When these measures proved ineffective, she requested, on September 9, assistance from the U.S. armed forces. Several other West African leaders, and some humanitarian organizations, also called for rich-world militaries to contribute to the Ebola response.

Within days of his Liberian peer's request, President Barack Obama committed to sending three thousand troops to Liberia. "If we move fast," he told the world, "even if imperfectly, that could mean the difference between 10,000, 20,000, 30,000 deaths versus hundreds of thousands or even a million deaths."[23] Donald Trump, not yet a presidential candidate but already with a Twitter following that exceeded that of many pop stars, responded with this tweet:

> Obama won't send troops to fight jihadists, yet sends them to Liberia to contract Ebola. He is a delusional failure.[24]

The American troops sent to Liberia actually stood little risk of contracting Ebola, because they weren't being sent to staff mobile army surgical hospital (MASH) units. Instead, their job (with the help of slow-motion civilian subcontractors) was to erect new Ebola treatment units, help coordinate logistics, and assist with transport—of disease controllers, clinicians, and other healthy personnel. U.S. troops weren't even permitted to transport properly packed blood samples.

American soldiers were also there to back up the Liberian army, a role they'd played during much of the twentieth century. Liberian armed forces certainly needed mentoring on crowd control: on August 20, they fired live ammunition into a crowd protesting the quarantine of West Point, a Monrovia slum that was home to some seventy-five thousand people. A teenager bled out on the spot. Some of the protesters then attacked and pillaged an Ebola isolation facility that had been recently erected in the neighborhood. Many in the crowd loudly dismissed Ebola as a fabrication or a plot, and the international media were soon reporting with alarm (and sometimes a mix of consternation and bemusement) that looters at the facility had carted off the center's soiled mattresses and linens.

Sirleaf called off the West Point quarantine after ten days.

★ ★ ★

The control-over-care paradigm clearly had scant popular appeal. It also had limited effectiveness. By September, the Ebola outbreak in West Africa was already ten times larger than any previously recorded, with no end in sight. Sierra Leone was then registering more than two hundred cases each week, leading even sober U.S. health authorities to issue doomsday scenarios.

The most notorious of these, which in September bore the august imprimatur of the U.S. Centers for Disease Control, predicted over a million cases by January if current trends were to continue.[25] Prior to 2014, the largest documented Ebola outbreak had been registered in 2000, in the war-torn clinical desert of northern Uganda, where an estimated 425 fell ill from a Sudan strain and 224 died. Now, predictions of worldwide spread from West Africa whipped up a parallel epidemic of journalistic and public hysteria that had already gone global. This emerging social pandemic was heightened at the close of September when Thomas Eric Duncan, a Liberian visiting his Liberia-born fiancée and their son in Dallas, became the first person ever diagnosed with Ebola in the United States.

Like others stricken with the disease, Duncan—who went by Eric—was a caregiver of sorts. He'd shared a taxi with a pregnant nineteen-year-old in distress as her family frantically sought

care in Monrovia. Ominously wracked with convulsions, the young woman was referred to an ETU, where treatment for her condition, likely eclampsia, might be available—had she been admitted. The staff there turned her away, as the unit was already filled to capacity. Duncan then helped carry her from the taxi back into her house, where she died a few hours later. This occurred at the time of our own team's first trip to Monrovia, when we'd seen a couple of sick people lying in its streets. Passersby gave them a wide berth, awaiting emergency personnel in hazmat suits. With some shame, we'd done the same.

Shortly after trying to help the dying teenager, Eric Duncan headed to Texas on a commercial airline. On September 25, a few days after his arrival, he went to the emergency room of a major Dallas hospital, complaining of a low-grade fever, headache, and abdominal pain. He was sent home with a typical emergency-room diagnosis—"sinusitis and abdominal pain"—even though he forthrightly stated that he'd just come from Liberia, then the most Ebola-affected country on earth.[26] Three days later, critically ill, Duncan returned to the same hospital in an ambulance, and on September 30, after reviewing test results, the Centers for Disease Control declared him an Ebola sufferer. Because of tardy diagnosis and inadequate infection-control measures within the hospital, two nurses caring for Duncan subsequently fell ill with the disease. These were the first cases of Ebola transmission ever recorded in the United States.

Print, television, and social media blew up, and little of its content reflected kindness or concern. Twitter, in particular, became a superspreader of Ebola hysteria and of meanness. On October 4, Donald Trump, leading the charge, demanded that Duncan be punished:

> This Ebola patient Thomas Duncan, who fraudulently entered the U.S. by signing false papers, is causing havoc. If he lives, prosecute![27]

Even Liberia's mild-mannered president invoked the possibility of legal action against Eric Duncan and offered her apologies to the American people for his care seeking. Although he and his family were tried in the Twitter court of popular opinion, there would be no legal action against him, even if he had committed a crime: Duncan died on October 8. The Texas shitshow was, however, echoed across the globe.

More countries declared travel bans and the like, just as Mr. Trump was recommending on Twitter and in other free forums granted him. In October, the Australian health minister imposed a travel ban on all visitors from the three most affected countries, suggesting that traditional funeral rites there made their welcome "an unacceptable risk."[28] The anthropologist Paul Richards, who'd worked in Sierra Leone for decades and had done more empirical research on the matter than the authorities Down Under, offered a tart reply:

> If it is stubborn to wash the dead then it is stubborn to nurse the sick. To insist otherwise blames the victim. Courageous refusal to abandon loved ones normally elicits admiration, not blame. So commentators on the Ebola epidemic, whether in Australia or elsewhere, ought to avoid stigmatizing West Africans for no other reason than that they care for their loved ones.[29]

Xenophobic and punitive reactions, terrifying to Eric Duncan's family and disturbing to many traveling West Africans, were dispiriting to the expatriate clinicians who'd responded to the call to serve in West Africa. To nurse the sick and to introduce supportive and critical care was what led us there in the first place.

We had begun to suspect we wouldn't always be welcomed home well before October 24, when Kaci Hickox, an American nurse volunteering in Sierra Leone, was detained in a holding unit near Newark's international airport on the orders of the governor of New Jersey. This happened just as Craig Spencer, an American emergency-room physician, fell ill with Ebola in New York City shortly after returning from a stint in Guinea with MSF. By then, Ebola hysteria

—fanned by the hot air of the upcoming American election season—had reached its peak in the (again) Ebola-free United States. We'd continue to feel its sting in the months to follow, but poor Spencer got a hornet's nest full of venom just when he most needed support. Rather than being praised for his service, he was pilloried in the tabloid press and on social media for trying to take his mind off what he'd just witnessed by going bowling—even though he promptly reported to Bellevue Hospital when he mounted a fever.

Bowlers and balls were unharmed, but Donald Trump didn't miss the chance to disparage Spencer's irrational wish to return home after his tour of duty in the clinical desert, and Obama's obvious lunacy in letting him do so. Just prior to the midterm elections, the future leader of the United States (if not the free world) leveled his Twitter guns at both the sick physician and the sitting president:

> If this doctor, who so recklessly flew into New York from West Africa, has Ebola, then Obama should apologize to the American people & resign!

Trump, a self-described germophobe, now used Twitter to shower disparagement on his allegedly Kenyan-born rival, on black and brown immigrants, and on returning clinicians. Dr. Spencer, Trump wrote with strangely poetic inaccuracy, had "touched many, bedlam!" Obama, on the other hand, was a "stubborn dope."

> I have been saying for weeks for President Obama to stop the flights from West Africa. So simple, but he refused. A TOTAL incompetent![30]

★ ★ ★

The surgeon Martin Salia, a native of Humarr Khan's adoptive city of Kenema, was the second of my Sierra Leonean acquaintances to die of Ebola. He, too, was the target of opprobrium during the madhouse season of American elections.

Humarr Khan and Martin Salia were friends with much in common. Both had the misfortune to begin their medical studies as war broke out in eastern Sierra Leone, and both became refugees when war reached Freetown. Upon his return, Salia took a junior position at the country's main teaching hospital—a battered colonial relic named Connaught—and later went on to graduate from the Pan-African Academy of Christian Surgeons after extensive training in Cameroon and Kenya. During the war, Salia's wife, a nurse, and two sons emigrated to Maryland, where they would eventually become U.S. citizens. Salia kept a green card. But like Khan, he wanted to focus his attentions on the medically underserved of Sierra Leone. This eventually led him to Kissy, a poor neighborhood in Freetown, where he served as chief medical officer of the United Methodist Hospital. As one of only a handful of surgeons practicing in a country of over seven million people, Salia also performed surgeries at Connaught, serving as the director of its emergency department. That's how I came to meet Salia a few months before he died.

Passionate about extending emergency surgical services to those who'd never known a safety net, which would have included almost all his fellow citizens when he finished medical school, Martin Salia attended the Freetown conference we helped organize in June. Although soft-spoken, he vigorously supported notions of progressive universalism (health care for all) and of social protection (health insurance for all), since these would in principle help remove barriers to life-saving surgical care. Shortly after the conference ended—and as Ebola brought most surgery to a halt within Sierra Leone—Salia went to Maryland for a brief respite with his family. His wife and sons hadn't wanted him to return to Sierra Leone. But Salia was a devout Catholic who felt it was his calling and his duty, and Humarr Khan's death had shaken him deeply. In August, after promising to return to the States if he fell ill, Salia flew back to Freetown.

Martin Salia surely knew the coming-home part would be easier said than done—harder, in any case, than tending to Connaught's trauma patients and performing emergency cesarean sections without coming in contact with Ebola. That said, it's not clear exactly how or where Salia contracted the disease. His hospital in Kissy had simply halted surgical services, and efforts to muster the staff, stuff, space, and systems necessary for treating surgical disease had largely petered out elsewhere by late October, by which time Freetown had supplanted Monrovia as the most Ebola-affected city on the face of the earth. All we know is that in the first days of November, he felt the onset of fever, muscle aches, and fatigue, at which point Salia called his wife to say he hadn't "knowingly made contact with an Ebola patient," but promised to get tested just in case.[31] He was probably soft-pedaling his fears, because the first place he sought care was a newly established British facility dedicated to the care of Ebola-stricken health professionals.

The British facility promised some real *T* in its ETU, but Martin Salia never received it. After some debate, the unit's gatekeepers turned him away. It had been set up to serve only those Sierra Leonean health professionals who were "directly involved in delivery of Ebola response programmes in U.K.-funded treatment facilities."[32] (Also ineligible for admission were Sierra Leonean caregivers stricken with Ebola in the course of working in what were termed community-care centers, most of them short on the middle *C*.) An initial discussion of Salia's merits as a patient meeting such admission criteria concluded with a no—even though, as director of Connaught's emergency services, he played a key role in U.K.-funded Ebola programs.

Martin Salia next went to the suburb of Hastings, where the national police academy had been converted into an Ebola treatment unit at the close of September. He was by then pretty sure he had Ebola, but an initial test came back negative. So he was sent home from there, too. This led to relief in Maryland—and to premature celebration among colleagues in Kissy and at Connaught. But Salia's fever persisted, and soon he was losing fluids to vomiting and diarrhea. The surgeon turned next to Connaught, where the doctor tasked with leading the hospital's Ebola response had recently perished, as had several nurses, a couple of them during the brutal overland transfer to Kenema. On or around November 10, about eight days after the onset of his symptoms, he finally got confirmation that Ebola was the cause of his rapidly worsening signs and symptoms.

At that point, Martin Salia's friends at Connaught, several of whom had attended our June surgical conference and at least two of whom were British, pressed him to return to the U.K. facility that had turned him away. Its medical director already had designated a bed for him. By then, however, the surgeon was critically ill: he was showing evidence of renal failure. This might have been caused by a viral attack on his kidneys, but it also might have been caused—or worsened—by the drop in blood pressure that accompanies severe dehydration. Salia returned to Hastings, knowing he needed fluids urgently.

For days, Martin Salia had been taking oral rehydration salts, which several international organizations continued to insist was the best care they could offer in such circumstances. A few even still touted oral rehydration as the standard of care for all patients. But, as every surgeon knows, intravenous replacement is the mainstay of therapy for hypovolemia in the face of inability to take fluids by mouth, and the doctors at Hastings put an IV in Salia in order to administer fluids and antibody-rich blood from an Ebola survivor. He also received antibiotics and antimalarials. But by then, only critical care, of the kind available in any operational ICU, was likely to be able to take the measures likely required for him to survive long enough for his own immune system to rein in the virus. Critical care remained unavailable in Sierra Leone, however, even in the British ETU.

Hoping he might receive the kind of care that had allowed other American victims of Ebola to survive, Salia's friends and family made heroic efforts to airlift him to the United States. Quickly—through the generosity of their local Catholic church, the Methodists who employed

Salia, and, it was rumored, the tech titan Paul Allen—they raised the promise of $200,000 in order to charter a biosecure plane to fly the surgeon to Omaha, where the University of Nebraska's biocontainment unit had agreed to take him in. Salia left for Nebraska on November 15, having boarded the plane on his own two feet, more than ten days after his symptoms had first appeared. By the time he reached the biocontainment unit, however, his kidneys had failed, he was agitated and in respiratory distress, and he had evidence of marked hypovolemia and liver dysfunction.[33] The clinicians running the unit did their best, initiating dialysis and mechanical ventilation shortly after his arrival. But it was too late. On November 17, Martin Salia, forty-four years old, was pronounced dead.

Several days later, Salia's wife returned home with his ashes, which had been sealed in a rubber box. She placed it on his side of the bed. She then organized a funeral mass in Hyattsville, Maryland, which was attended by hundreds, including Ron Klain, President Obama's Ebola czar. Months later, after another mass in her home parish, she placed the rubber box inside a wooden urn and then buried what remained of her husband.

★ ★ ★

Two questions in the tradition of social medicine: Why did Ebola spread so rapidly in some places and not in others? Why did it kill some of the afflicted while sparing others?

Conspiracy theorists raised these same questions throughout the epidemic, of course. But so did many local and national health authorities, who knew—in spite of the guesswork, hyperbole, and error that followed in the wake of Ebola—that the three countries heavily afflicted have some of the world's weakest health systems. Had they been more robust, it might have been possible for an acutely ill child like poor Émile from Meliandou, whether he was Patient Zero or not, to be seen by a well-trained village health worker. That worker, recognizing the urgency of the situation, might in turn have been able to summon a safe means of transporting the child to a hospital or clinic with proper infection-control capabilities and a clinical laboratory. Once at a decent hospital, a child like Émile might have received the care he needed to survive.

That kind of care requires emergency rooms, intensive care units, and operating rooms waiting at the end of an ambulance ride or referral—resources that rarely figure in the recommendations made by international health authorities and aid organizations promoting "health systems strengthening" in medical deserts like Upper West Africa. These systems, go the arguments, don't need such frills—the very ones we argued were essential investments during the Freetown surgery conference in June. Even after September 2014, when aid money began to trickle in to Guinea, Sierra Leone, and Liberia, there was never much evidence of the staff, stuff, or space that might have stopped the spread of the disease and saved those afflicted by it: Émile and his caregivers in Meliandou; Humarr Khan and the Kenema and Connaught nurses; Martin Salia; the convulsing pregnant teenager aided by Eric Duncan; and so many of the other victims whose names one never hears.

As for the second question—Why did some die while others were spared?—it's one always front and center in social medicine, which looks around (at social context) and back in time (at social history) in order to answer it. But the default explanation for significant differences in rates of mortality has long been a simple idea: different variants of Ebola kill differentially, with Zaire being the worst. Research such as that conducted by Pardis Sabeti and Humarr Khan may ultimately help reveal if specific mutations confer increased transmissibility and virulence. But the idea is simplistic as well as simple: many exclusively biological hypotheses about the variable virulence of pathogens are pretty quickly swamped by the variable virulence of the world we inhabit. Giving all the credit to the virus is dubious when we humans have been the architects of the stunning inequalities that characterize our shared world.

It's been the task of social medicine to sort out how multiple factors—ranging from nutritional status, age, comorbid disease, route of inoculation, relative lack (or absence) of the

staff and stuff required to deliver supportive and critical care—contribute to differential mortality among those sickened by Ebola. The Americans and Europeans who fell ill were infected, after all, by the same Zaire strain that killed 70 percent of their West African peers. The great majority of stricken expatriates survived because they were flown back to the United States or Europe for the kind of care that can only be delivered safely in a modern hospital with rigorous infection control. These survivors had the luck to be diagnosed earlier than Martin Salia and, with a few exceptions, evacuated more promptly. Others, like Craig Spencer, survived because they fell ill shortly after returning from service in West Africa and went straight to a well-equipped medical center. The nurses infected while caring for Eric Duncan also recovered promptly. It was a similar story for most European health professionals.

Most sickened Americans and Europeans had the fortune, it must be added, to be nursing or doctoring while white. Unless we believe (as some clearly do) that Africans, and those of African descent, are innately more susceptible to Ebola than others, it's difficult not to believe that more of our African colleagues might have survived with proper care. Humarr Khan and the Kenema nurses didn't die of blood loss. Nor did Martin Salia, although he suffered, at the end and along with renal failure and possibly a bowel perforation, hemorrhagic manifestations of the disease. There is a widespread belief that Ebola and other viral hemorrhagic fevers cause profuse and irreversible bleeding in the humans they afflict. This is only rarely the case. So why has this belief taken hold?

Here we leave the domain of medical science for that of fantasy. Ebola may have caused only a couple dozen documented outbreaks prior to 2013, but it had already starred in movies, novels, and at least one nonfiction bestseller: *The Hot Zone*, by Richard Preston. His book, which reconstructed episodes of illness characterized by massive bleeding, drew more from an outbreak among lab monkeys housed near Washington, D.C., than from outbreaks among actual people in Africa. (A lab colony in Reston, Virginia, was invaded by an Ebola strain now held to be avirulent among humans.) In Preston's account of the disease in humans, blood weeps, seeps, or gushes from every orifice, or oozes from the eyes. Clinicians called up during the West African epidemic have, alas, seen people die this way, but the endgame was usually much different. In the most thorough reviews of Ebola's chief signs and symptoms, uncontrolled bleeding doesn't even make the top ten. In the West African outbreak, the most common signs and symptoms were fever, intense fatigue, loss of appetite, headache, nausea, vomiting, and diarrhea.[34] These signs and symptoms—especially when accompanied by delirium or disorientation—can all lead to dehydration and, when persistent and untreated, to hypovolemic shock: a more common mode of exit than the massive blood loss implied both by the term "hemorrhagic fever" and by many journalists' descriptions of Ebola.

At any rate, solely biological factors cannot account for why some die and some do not, or for why almost none of the Ebola caregivers in the United States—whether of the nearest-and-dearest variety, meaning family, or the professional ones, meaning nurses, physicians, and others in contact with patients, samples, or infected waste—were infected in the course of providing care. If you want to explain wildly varying fatality rates among those infected with the same strains of a virus, you have to understand the social context in which care is given. The same is true of transmission: the setting determines what kind of care is available *and* how safely care is delivered. Similar points have been made regarding most communicable pathogens for well over a century. That century has also taught us that medical impoverishment and high fatality rates and untrammeled contagion can be radically and rapidly reduced by vigorous human countermeasures. This point was not made, alas, during the first months of the West African Ebola epidemic.

The disparate fates of professional caregivers afflicted in the course of the West African epidemic reflect the grotesque disparities seen among our nations, bound together and yet held apart for centuries. Unequal bonds of the sort evident during the colonial period, but also before and well after it, have linked the home countries of the researchers, clinicians, and

sundry others whose reports and studies are cited in this book. Even as those credited with authorship of studies in academic journals have tended to reflect a tardy (if now de rigueur) interest in reciprocity, the health systems on either end of these bonds have become more disastrously disparate. One sad reminder of this growing inequality appeared in an article published at the height of the Ebola epidemic in *Science*, perhaps the world's premier scientific journal. The article, which was based on work conducted in Pardis Sabeti's lab, analyzed the genomes of the Ebola variants circulating at the time. By the time the article appeared in print, five of the study's fifty-eight authors were dead, killed by Ebola.[35] One of them was Humarr Khan.

Understanding how Ebola and related pathogens spread, and how they kill, allows us to learn from the West African outbreak and make a broader case for what our priorities should be. So does COVID-19. But to do that, and to understand social context, we need to retrieve more than a little history from the dustbin. We also need to pay closer attention to the lived experience of the afflicted, which requires social proximity. For me, that proximity did not begin in late June 2014, at the surgery conference we held in Freetown; it began in September of that year. But social proximity was nonetheless the unexpected result of that chance meeting.

2.

Tough Calls

The division of responsibility, authority, and power between public health and medicine has been a continuing source of concern and conflict. Although representatives of both fields have traditionally voiced strong commitments to health and social betterment, the relationship between public health and medicine has been characterized by critical tensions, covert hostilities, and, at times, open warfare.

—Allan Brandt and Martha Gardner, "Antagonism and Accommodation," *American Journal of Public Health*, 2000

I first laid eyes on Freetown in mid-June 2014, when a group of us traveling from Rwanda flew there for a medical conference. The topic at hand was surgical care—or the lack thereof—in what are these days inelegantly termed "resource-poor settings."

None of us who'd helped organize the meeting had then been thinking about Ebola, even though post-conflict Sierra Leone would prove fertile ground for the virus. In May, as some planning to attend the meeting questioned whether or not Freetown was a safe venue, the World Health Organization had announced that the outbreaks in Liberia and Guinea were soon to be contained. When the question was raised again, and when that announcement was rescinded, I reassured a couple of surgical colleagues that no, Ebola wasn't spread by attending medical conferences. But there was no cause to be glib.

As reports of new cases climbed in those countries, we worried that our presence might be an added burden on our Sierra Leonean hosts. Since they didn't want to cancel the conference, I continued to hope for the best. A couple of weeks before a contingent of us headed west from Kigali, Rwanda's capital, it was clear these hopes, too, had been misplaced: eastern Sierra Leone was by then the theater of a major Ebola outbreak. When our hosts again insisted we come, we boarded a regional jetliner not knowing what we'd find on the ground. Now, as our delegation approached the continent's west coast, the virus and international disease-control experts alike began to invest Freetown.

Our plane made its descent toward Freetown in the early evening. It was a clear day, and the view was spectacular. Before us: the great dull green Atlantic, dappled with orange under a westering sun; the shoreline, a brighter green and fissured by innumerable rivers, streams, and estuaries also reflecting the orange light, their banks lined by a darker green margin of meandering mangroves; and imposing headlands that reared over the western edge of the continent. Freetown surrounded those hills, reaching up steep inclines and sprawling across every valley. But if the city looked lovely from the air, there were signs that it might look less so on the ground. We saw neighborhoods perched in the wrong places, gashed red hillsides that suggested recent landslides, plumes of smoke coming from sources clearly larger than cookfires, the leaching of reddish topsoil all along the seaboard. It didn't look much like pristine (and landlocked) Kigali. But my friends who lived in Freetown loved the place and I was pretty sure I would, too.

Our plane touched down at Lungi International Airport at about 6:00 p.m. We assumed we'd be able to enjoy the best time of day to see a west coast city this close to the equator—as the sun sets and the heat wanes. I was looking forward to meeting up with a handful of Sierra Leonean friends for dinner. Their number included one of my favorite students. He was a busy doctor, and I'd insisted he not bother meeting us at the airport. In truth, I wanted to take in the initial sights in silence, or something close to it. That hope evaporated as soon as we stepped onto the tarmac and were greeted by a blast of damp heat unfamiliar in Kigali.

Also unlike Rwanda, the airport was dilapidated and congested, a cacophonous mess. The same might of course be said of LaGuardia, but the Lungi airfield still bore scars of war, even though the conflict that had inflicted them had ended a decade earlier. Some of the buildings were pocked with bullet holes, and others were missing bowl-size chunks of plaster. Some had been covered by paint, but other structures near the terminal looked to be abandoned husks. And, if conditions out on the tarmac were scorchingly hot and humid, they didn't get much better inside the terminal, which was tiny, and where the odor of jet fuel gave way to pungent smells of salt water, cook smoke, diesel exhaust, and sweat; the power twice flickered off as our luggage was being unloaded.

The scene reminded me of Haiti, which was oddly comforting, but not everyone converging on Freetown that evening viewed the surroundings with equanimity. We were joined in the terminal by others arriving for the conference from elsewhere in Africa, and we somehow arrived shortly before several colleagues arriving from or via Europe. Gradually, this jet-lagged collective was herded onto a bus headed, we were told, to "the next terminal." Those herding us (and at least some of our bags) gestured vigorously, smiled readily, and barked orders at us in a language that sounded a bit like English. I understood almost none of it.

Off we went to that next terminal. The heat inside the bus was suffocating, and those who could leaned out the windows. We bounced down a short and mostly unpaved road, raising an orange dust that coated everything in our vicinity: people (including us passengers), houses, little shops, and the garbage that lined the roads. We made a sharp turn and headed down a steep decline, at which point, through a sparse collection of leaning coconut palms, we saw the terminal in question—a long, narrow, rickety wooden dock that reached out into the choppy dun water. Several small boats and one large ferry bobbed up and down on dauntingly large swells. The sun was growing redder as it sank, and lights began to appear across the water. *That must be Freetown*, I thought, but didn't want to reveal my ignorance by asking. I couldn't see any tall buildings on the far shore, but by then the light was fading. I'd forgotten that getting from Lungi to Freetown meant crossing a giant estuary.

The prospect was less than inviting. The estuary's near shoreline was littered with debris. I saw plastic, Styrofoam food containers, bobbing coconuts, a few palm trunks, shards of painted wood that bore a troubling resemblance to what might have once been bits of boats. There were also a couple of drowned kapok trees, replete with shredded leaves and propelled before us at a mysterious clip by some unseen current not far offshore. As we gathered under a large open gazebo to await the crossing, thin young men began hoisting our bags onto the ferry from the jetty, which wobbled precariously. They were cheerful and confident, and soon began helping the first of our lot to board. The rest of us nursed lukewarm beers as the dark enveloped the landing; it took three trips to get us all to the other side. Our passage, across twenty kilometers of open water, was punctuated by sudden decelerations for unseen masses of seaweed and plastic flotsam.

That evening, in Freetown, we had dinner with my student and several others, most of them physicians. The Ebola outbreak, we soon learned, had everybody on edge. I hadn't ever felt such an undercurrent of shared anxiety during the decade I'd practiced medicine in Rwanda, and knew our dinner companions were right to worry: Ebola aside, the country was becoming a medical no-man's-land that steadily swallowed people with far more common

ailments or injuries. To the east, we heard, health professionals were fleeing their posts as the epidemic moved west toward the city from Kailahun and Kenema. Surgical care, and even basic first aid, was evaporating. Roadside trauma was a ranking killer. More women were dying in childbirth, as were their infants—and their malnourished, unvaccinated, older, and now often motherless children. For many citizens of Guinea, Liberia, and Sierra Leone, it was as if an ambush waited around every corner.

And that was in mid-June. By September, when we returned to Freetown to tackle Ebola, western Sierra Leone was ground zero of the epidemic, and Upper West Africa was just about the worst place in the world to be critically ill or injured.

★ ★ ★

More than just the Ebola outbreak convinced us at Partners In Health to establish a presence in Upper West Africa, which was, along with the eastern Congo, perhaps the most arid patch of Africa's clinical desert. To explain what drove us, let me turn to the backstory, which I'll relate from my own point of view—that of an infectious-disease physician trained in the late eighties and early nineties and who since has battled several epidemics in the medical desert.

In the past century or so, especially since the advent of vaccines, the story of humankind's struggle against infectious disease has been one of steady progress, at least in the affluent world. Some infections still kill, of course, even in medical oases like Boston, but the general trend is positive. Thanks to a mix of specific therapies (antibacterial, antiparasitic, antifungal, antiviral) and nonspecific therapies (supportive and critical care), we have made most formerly fatal microbial diseases eminently survivable. I've been fortunate to witness this process several times over the past three decades.

One obvious example is AIDS—a disease with disputed (but likely zoonotic) origins that emerged in force in the 1980s, made headlines, and triggered numerous social epidemics. During that era, AIDS surged across the United States to become the leading infectious killer of young adults and, through transmission from mother to unborn or nursing infants, a ranking cause of death among children. The same was true in Haiti, where I spent the year between college and medical school, and part of every year in the ensuing decades. This was why I came to specialize in infectious disease, and it was how I met Dr. Anthony Fauci, the director of National Institute of Allergy and Infectious Diseases, or NIAID for short. The institute is the nation's primary sponsor of research on infectious pathogens—even those, like Ebola, that are unknown in the United States.

When Tony Fauci took over as NIAID's director, in 1984, HIV—the human immunodeficiency virus, which causes AIDS—had only just been discovered. He directed the attention of researchers, clinicians, policy makers, and political leaders to AIDS, winning a massive increase in federal funding for basic and clinical research on the affliction and the virus that caused it. Such investments bore fruit rapidly. Fauci also helped break down barriers between researchers and the afflicted. During the worst years of the American epidemic, he listened to the voices of AIDS activists and came to be a voice for people affected by HIV. Under his charismatic and effective direction, an unlikely coalition of scientists, clinicians, and activists moved forward the discovery, development, and delivery of new drugs and diagnostics that, even in the absence of a vaccine, saved millions of lives across the United States, as was Fauci's duty, and across the world, which was not.

AIDS established Dr. Fauci as the nation's premier infectious-disease doctor and an indefatigable bridge builder. It also made him uncommonly aware of obscure zoonoses that jump out of forested obscurity and into towns and cities, and from there across continents and oceans. NIAID became, during his happily long tenure, the chief institution tasked with identifying new or resurgent microbial threats around the world. He argued that the full force of science, and the sprawling network of NIAID-supported researchers and clinicians, be brought to bear on allegedly exotic and far-off problems like Ebola and Marburg. Bighearted,

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