

Intra-Action Report—A Dynamic Tool for Emergency Managers and Policymakers

A Proof of Concept and Illustrative Application to the 2014–2015 Ebola Crisis

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Many people will long remember 2014 for the outbreak of Ebola virus disease (EVD) in West Africa, the most severe in known history. The outbreak originated in late December 2013 in Guéckédou, a village in southeast Guinea that shares borders with Sierra Leone and Liberia. Unlike previous outbreaks, which were confined to rural areas and were contained in a matter of months, this most recent outbreak (hereafter, the *2014 Ebola outbreak*) became more widespread as it crossed from Guinea to Liberia in March. This transmission set off a complex chain of infection in West Africa that eventually spread across continents to nations including Spain, the United Kingdom, and the United States.

The first laboratory confirmation of Ebola (in a case in Guinea) came in March 2014. By the end of March, a few cases had also been imported from Guinea into Liberia and Sierra

Leone but were not immediately reported. By April 7, Liberia had reported 21 cases, but the situation then stabilized through the rest of April and May before resurging during the summer. The outbreak in Sierra Leone was first reported in May. The disease spread in all three countries in the ensuing months. In late July, the infection was carried to Nigeria by a Liberian national. On August 8, 2014, the World Health Organization (WHO), in accordance with its International Health Regulations of 2005 (WHO, 2005), declared the Ebola outbreak in West Africa a *public health emergency of international concern*. The infection spread from Guinea to Senegal in late August and to Mali in late October. In late September, the first U.S. case was diagnosed in Texas in a man who had recently arrived from Liberia. Delays in initial diagnosis and isolation of this patient, as well as the subsequent infection of two nurses who cared for him, highlighted gaps

in U.S. preparedness. In total, WHO indicated in its December 31, 2014, *Situation Report* (WHO, 2014k) that the 2014 Ebola outbreak had caused 20,206 reported cases of the disease worldwide, including 7,905 deaths.

Given the far-reaching impacts of this unprecedented Ebola outbreak, many nations (both those affected by the disease and others) and nongovernmental and intergovernmental organizations have become involved in the public health response. Response efforts to date have highlighted some strengths and weaknesses; actions taken or not taken at all levels have resulted in both positive and negative outcomes. In some cases, adjustments have been made to mitigate failures and to replicate successes.

Learning While Doing

Assessments of disaster response and recovery are typically undertaken after the response is complete, in order to inform response to a future emergency. Also, they typically focus on cataloguing failures, often not capturing those things done well during a response. Here, we make a clear distinction between simply documenting a success or failure and what we consider to reflect a lesson learned and applied—when action is taken to mitigate a problem or replicate a success. There is currently no framework to track, synthesize, evaluate, and communicate the problems and successes identified or the lessons that are being learned and applied *during* a response and recovery effort. In this perspective, we propose the Intra-Action Report (IAR)—a label we coined to describe a proof-of-concept tool to address these important gaps.

In contrast to an After-Action Report, which focuses on recently completed response and recovery for application to a future incident, the IAR is intended for dynamic use to inform and guide

ongoing response and recovery efforts, capturing experiences and learning and applying lessons during an emergency that unfolds over a protracted time frame (that is, the IAR is not applicable to an incident for which response requires only hours or days). The IAR tracks both negative and positive experiences and the lessons that can be learned from them during an ongoing public health emergency response in order to improve outcomes from that same event. It also enables capture of actions to successfully address initial negative experiences (lessons learned and applied from initially doing things wrong) and replication of initial successes (lessons learned from doing things right—including both expected and unexpected successes; the latter has been labeled *positive deviance* and is described in detail by Pascale, Sternin, and Sternin [2010]). Positive deviance, which has been employed at a microlevel in communities around the world, is the observation that certain individuals in negative situations take successful actions or exhibit successful behaviors different from their neighbors in a similar situation, thereby achieving better outcomes (Pascale, Sternin, and Sternin, 2010).

We apply the IAR tool to the 2014 Ebola outbreak as an illustrative proof of concept for its utility, recognizing that the examples captured here reflect only some of the many that would be included in a more exhaustive application of the tool. Though we have used the 2014 Ebola outbreak as the example, we envision the IAR as a means to capture, inform, and clearly communicate progress in responding to and recovering from a broader range of future public health or humanitarian emergencies. We believe the IAR can become a practical addition to the toolkit for decisionmakers and emergency managers.

Intra-Action Report Framework

We aimed to create an IAR framework that includes a broad range of relevant areas of emergency response activity. Such a framework would enable systematic organization of the myriad observations to be captured in the IAR, including actions initially taken and subsequent actions to mitigate problems or replicate successes. To create the foundation for such a framework, we reviewed and synthesized key elements from a number of authoritative domestic and global disaster management guidelines. These included the U.S. Department of Homeland Security (DHS)'s *National Response Framework* (DHS, 2013), the Office of the Assistant Secretary for Preparedness and Response (ASPR)'s *Healthcare Preparedness Capabilities* (ASPR, 2012), the Centers for Disease Control and Prevention (CDC)'s *Public Health Preparedness Capabilities* (CDC, 2011), and the World Health Organization (WHO)'s *Consolidated Preparedness Checklist* (WHO, 2014d). The U.S. guidelines apply across all types of health emergency—natural, accidental, intentional—while the WHO guidance is specific to Ebola. The U.S. guidelines often label as *capabilities* what we refer to in this report as *areas of activity*. We included areas of activity that we considered to be relevant to the Ebola outbreak and did not include others, such as search and rescue, emergency evacuation, and provision of sheltering (which are relevant to other kinds of emergency and could be included in IARs for such situations). Through reviewing publicly available reports describing the actions taken in the West African and U.S. Ebola responses, we recognized that several of the reported observations did not neatly correlate to an element in the existing guidelines. Therefore, we created some additional areas of activity to help organize those actions that were otherwise difficult to classify. We believe that these additions fill gaps and are rel-

evant because they were created to accommodate activities directly related to the ongoing Ebola response. Examples include (1) executive decisionmaking and political engagement and (2) the absorptive capacity of a country for receiving foreign technical, material, and financial assistance.

We sought to further organize the substantial number of areas of activity by creating seven broad domains and grouping the areas of activity under them. Those domains include governance, incident management, public health, health care, logistics, sociocultural/community, and global response. Table 1 shows the organizational scheme for the broad domains and areas of activity, and it provides descriptions that are intended to ensure consistent understanding of them among professional communities and nations that may use different terminologies. Wherever possible, we have kept the areas of activity broadly applicable to response and recovery efforts beyond the 2014 Ebola outbreak, because most of the areas come from U.S. policy documents that are oriented toward a broad range of emergencies. However, as noted above, the elements in this table could be tailored to better fit other types of emergencies.

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Table 1. Sources and Description of IAR Areas of Activity

Area of Activity	Description	Source(s)
Domain: Governance		
Executive decisionmaking and political engagement	Engagement by senior government leaders at the national, state, and/or local levels and promptness of their response—for example, in making decisions about funding, policy, or other aspects of disaster response and recovery.	RAND
Regulatory and legal context	Legal and regulatory policies and enforcement capabilities to support disaster response and management—for example, ready authorization for emergency use of new diagnostics or drugs, enforcement of movement restrictions, and sharing of response materiel.	RAND
Financing	Sufficient funding for timely and effective response and recovery. WHO: “The availability and deployment of sufficient funds at national and subnational levels to prepare and rapidly respond to an emergency.”	WHO, 2014d
Domain: Incident Management		
Emergency operations coordination and incident command	Emergency operations center to oversee and coordinate incident management; incident command structure and leadership. CDC: “The [cap]ability to direct and support an event or incident with public health or medical implications by establishing a standardized, scalable system of oversight, organization, and supervision consistent with jurisdictional standards and practices and with the National Incident Management System.” DHS: “Unified and coordinated operational structure and process that appropriately integrates all critical stakeholders and supports the execution of core capabilities.” WHO: “Efforts to clarify roles and responsibilities of national authorities and international partners in preparedness activities under a shared set of objectives.”	ASPR, 2012; CDC, 2011; DHS, 2013; WHO, 2014d
Information-sharing and situational awareness	ASPR: “Effective intelligence/information sharing and dissemination system [to] provide durable, reliable, and effective information exchanges (both horizontally and vertically) between those responsible for gathering information and the analysts and consumers of threat-related information.” DHS: “All decisionmakers [have the] decision-relevant information [they need] regarding the nature and extent of the hazard, any cascading effects, and the status of the response.”	ASPR, 2012; CDC, 2011; DHS, 2013

Table 1—Continued

Area of Activity	Description	Source(s)
Domain: Incident Management—Continued		
Operational communications	Timely and effective communications among responders, often requiring technologies and processes for interoperable communication systems. ASPR: “Redundant, interoperable communication systems” and processes supporting “healthcare situational awareness that contributes to the incident common operating picture.” DHS: “Capacity for timely communications in support of security, situational awareness, and operations by any and all means available between affected communities in the impact area and all response forces.”	ASPR, 2012; DHS, 2013
Domain: Public Health		
Health system preparedness	ASPR: “A continuous cycle of planning, organizing, training, equipping, exercising, evaluating, and taking corrective action in an effort to ensure effective coordination during incident response.”	ASPR, 2012; DHS, 2013; WHO, 2014d
Surveillance	CDC: “The ability to create, maintain, support, [and] strengthen routine surveillance and detection systems and epidemiological investigation processes, as well as to expand these systems and processes in response to incidents of public health significance.” WHO: “Cross-country effective alerting/notification system to immediately investigate a person for potential EVD.”	CDC, 2011; WHO, 2014d
Laboratory	Timely access to laboratories that can proficiently test to confirm cases. WHO: “All efforts to ensure that samples are safely taken and transported to laboratories which are ready to swiftly analyze them.”	CDC, 2011; WHO, 2014d
Rapid response teams	WHO: “A group of experienced experts that are on stand-by and can reach any part of the country within 24 hours. Their actions will help to contain/stop an outbreak early on.” National-level rapid response teams typically include the following: clinicians, epidemiologists, laboratory experts, social mobilizers/anthropologists, logisticians, psychosocial support experts, data managers, burial staff, media experts, and administrative officers.	WHO, 2014d
Control at points of entry	WHO: “Efforts at Points of Entry ready to deal with an Ebola case once it occurs. This includes the preparation of facilities [and] increasing staff capacity.”	WHO, 2014d
Contact tracing and monitoring	Process to identify and track the chain of transmission within the first 72 hours of reporting a confirmed or suspected case and monitoring of potentially infected persons for a full incubation period (e.g., 21 days for Ebola).	CDC, 2011; WHO, 2014d

Table 1—Continued

Area of Activity	Description	Source(s)
Domain: Public Health—Continued		
Emergency public information and warning/ Public awareness/ Public communications	<p>CDC: “The [cap]ability to develop, coordinate, and disseminate information, alerts, warnings, and notifications to the public and incident management responders.”</p> <p>DHS: “Coordinated, prompt, reliable, actionable information [for] the whole community through the use of clear, consistent, accessible, and culturally and linguistically appropriate methods to effectively relay information regarding any threat or hazard and, as appropriate, the actions being taken and the assistance being made available.”</p> <p>WHO: “Efforts to promote the understanding of [Ebola in] at-risk communities . . . and address any stigma hampering EVD emergency healthcare and effective surveillance The community has a crucial role in the alert.”</p>	<p>CDC, 2011; DHS, 2013; WHO, 2014d</p>
Nonpharmaceutical interventions	Interventions other than vaccines, drugs, or other pharmaceutical products; examples include isolation and quarantine, movement restrictions, social distancing, external decontamination, hygiene, and precautionary protective behaviors.	CDC, 2011
Responder safety and health	<p>Protection specifically of health care workers and other responders from infection—for example, through appropriate personal protective equipment (PPE) and procedures.</p> <p>CDC: “The [cap]ability to protect public health agency staff responding to an incident and the ability to support the health and safety needs of hospital and medical facility personnel, if requested.”</p> <p>WHO: “Optimum [infection prevention and control] capacity and support [to] facilities to ensure safe working conditions within healthcare facilities and social mobilization.”</p>	<p>ASPR, 2012; CDC, 2011; WHO, 2014d</p>
Development and/or accelerated availability of medical countermeasures	Medical countermeasures (e.g., diagnostics, therapeutics, vaccines) that have been developed, tested, produced, and/or authorized and approved for emergency use.	RAND
Guidance development and dissemination	Process of developing and disseminating response-specific guidance in coordination with subject-matter experts, emergency managers, community organizations, businesses, and other partners.	CDC, 2011

Table 1—Continued

Area of Activity	Description	Source(s)
Domain: Health Care		
Case management: Suitable treatment facilities	New or repurposed facilities capable of safely and effectively providing clinical care (e.g., Ebola treatment centers for treating patients with EVD).	WHO, 2014d
Case management: Clinical care	Safe, effective medical care provided to patients (e.g., EVD patients); includes safe transport, timely diagnosis, isolation, and appropriate therapeutic and supportive care, all of which enhance the chances of both patient recovery and protection against disease transmission to others.	WHO, 2014d
Case management: Fatality management/ Safe burials	CDC: "The [cap]ability to coordinate with other organizations (e.g., law enforcement, healthcare, emergency management, and medical examiner/coroner) to ensure the proper recovery, handling, identification, transportation, tracking, storage, and disposal of human remains and personal effects; certify cause of death; and facilitate access to mental/behavioral health services to the family members, responders, survivors of an incident." WHO: "Efforts to ensure safe burial with due regard to local custom and religion while safe handling of deceased is necessary to prevent wider transmission to communities."	ASPR, 2012; CDC, 2011; DHS, 2013; WHO, 2014d
Medical surge	CDC: "The [cap]ability to provide adequate medical evaluation and care during events that exceed the limits of the normal medical infrastructure of an affected community. It encompasses the ability of the healthcare system to survive a hazard impact and maintain or rapidly recover operations that were compromised."	ASPR, 2012; CDC, 2011
Health care system recovery	ASPR: "Short-term and long-term efforts for the rebuilding and revitalization of affected communities."	ASPR, 2012
Domain: Logistics		
Critical transportation	Provision of transportation (including infrastructure access and accessible transportation services) for response priority objectives, including the evacuation of people and animals, and the delivery of vital response personnel, equipment, and services to affected areas.	DHS, 2013
Medical materiel management and distribution	CDC: "The [cap]ability to acquire, maintain (e.g., cold chain storage or other storage protocol), transport, distribute, and track medical materiel (e.g., pharmaceuticals, gloves, masks, and ventilators) during an incident and to recover and account for unused medical materiel, as necessary, after an incident."	ASPR, 2012; CDC, 2011
Volunteer and personnel management	CDC: "The [cap]ability to coordinate the identification, recruitment, registration, credential verification, training, and engagement of volunteers and personnel to support the jurisdictional public health agency's response to incidents of public health significance."	ASPR, 2012; CDC, 2011

Table 1—Continued

Area of Activity	Description	Source(s)
Domain: Sociocultural/Community		
Culturally appropriate community engagement	Response approaches should take into consideration the public’s views—including gender, ethnic, and religious biases, as well as cultural or linguistic traditions—in managing the complex risks and risk perceptions associated with a public health emergency, and to promote the understanding of Ebola in at-risk communities and address any stigma hampering emergency health care and effective surveillance.	WHO, 2014d
Community preparedness	CDC: “The [cap]ability of communities to prepare for, withstand, and recover—in both the short and long terms—from public health incidents.”	ASPR, 2012; CDC, 2011
Community recovery	CDC: “The [cap]ability to collaborate with community partners, (e.g., healthcare organizations, business, education, and emergency management) to plan and advocate for the rebuilding of public health, medical, and mental/behavioral health systems to at least a level of functioning comparable to pre-incident levels, and improved levels where possible.”	ASPR, 2012; CDC, 2011
Domain: Global Response		
Absorptive capacity	The ability of recipients of external aid (financial/technical) to channel and coordinate the provided help.	RAND
External aid	The availability and deployment of sufficient funds to nations to augment or complement their capacity to prepare and rapidly respond.	WHO, 2014d
Technology and innovations	Deployment of resources to facilitate, harness, and leverage technology and innovation to improve disaster preparedness, response, and recovery.	RAND

Building upon this first dimension of the framework (the areas of activity), we added a second dimension to categorize and display experiences and lessons learned and applied. This built-out framework takes the form of a color-coded matrix that organizes all the areas of activity under the seven broad domains into two main categories: “initial failure or challenge/initial success” (failures or challenges are denoted in red, successes are denoted in pale green) and “improvement made/success replicated” to fix an initial failure or challenge, potentially replicate that fix, or replicate an initial

success (in darker green). In principle, one could create a middle category (color-coded yellow) to distinguish between a “failure” (e.g., critical delay, failed attempt) and a “challenge” (e.g., difficulty faced), but we do not make such a distinction here because we did not find compelling examples to distinguish between the two. Also in principle, an activity could be color-coded yellow if there is initial uncertainty about whether it should be considered a success or a failure; again, we do not include that here because we did not find any compelling examples in our illustrative IAR elements.

Once we created the two-dimensional framework, we populated the cells in the matrix with illustrative examples of recent successes, challenges, failures, and mitigation strategies, drawing from open source data, media coverage, published reports, and judgments of experts within RAND.

IAR in Practice—Examples from the 2014 Ebola Response

In Guinea, Liberia, and Sierra Leone, the three countries most heavily affected by Ebola, the outbreak has had a devastating effect on the economy, the health system, education, agriculture, and residents' livelihoods. According to the World Bank (2014), the growth of the gross domestic product in these countries has been crippled, and significant gains from the past decade have been practically reversed by this unprecedented outbreak. In addition, countless health workers have lost their lives in the course of providing care to Ebola-infected patients. With most countries in West Africa already having a low ratio of health workers per population, these deaths have dealt a considerable blow to the already fragile health system infrastructure of the affected countries. Furthermore, food security and livelihoods of entire communities have been affected by the scourge, especially in farming communities. Mandatory curfews and quarantines have had negative effects on businesses and standards of living.

While the Ebola outbreak has been a formidable foe, there has been positive news amid the disaster and devastation. Senegal experienced a single case of Ebola imported from Guinea in late August 2014; it responded quickly, experienced no further cases, and was declared by WHO to be Ebola-free on October 17, 2014. Nigeria experienced its first case of Ebola when a visiting Liberian

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national arrived in Lagos in late July 2014. The outbreak spread from Lagos to Port Harcourt, another major metropolis, but was successfully contained; Nigeria was declared Ebola-free on October 19, 2014. Mali, originally thought to have contained the virus, had a second cross-border transmission from Guinea but then successfully contained the outbreak and was declared Ebola-free on January 17, 2015. Furthermore, a separate outbreak unconnected to the ongoing West African outbreak was reported in Democratic Republic of the Congo (DRC) in central Africa. The country benefited from its experience from six prior outbreaks and successfully contained the 2014 outbreak. It was declared Ebola-free by WHO on November 20, 2014.

On September 30, 2014, the first laboratory-confirmed case of Ebola in the United States was diagnosed at a Dallas, Texas, hospital in a man who had traveled from Liberia. By mid-October, two health care workers who had cared for this patient at the hospital were diagnosed with Ebola. Before the end of the month, a fourth case of Ebola was diagnosed in a health care worker returning to New York City from Guinea (CDC, 2014d). The United States was declared Ebola-free on November 10, 2014. However, these

The IAR exercise is intended to organize failures and successes into a framework that enables stakeholders to continue to improve responses by learning from recent experiences.

incidents prompted CDC, many health care systems, and hospitals to evaluate their readiness to diagnose and treat potential cases of Ebola and to protect health care workers and the public from further spread of the disease.

The observations and lessons captured in the proof-of-concept IARs for Africa and the United States in the following sections are drawn from actions in countries that have succeeded in overcoming the outbreak, as well as from those in countries that are still fighting the battle, where applicable. In identifying our observations in countries and communities, we consider not only initial problems (failures or challenges) and actions taken to fix them, but also initial successes, including unexpected successes, which are described as positive deviance and are a particularly important source of lessons to be learned and applied.

We also present observations where necessary response actions were not taken or were delayed. We expand on this further by identifying the actions, where they exist, that have been taken to correct these initial delays or failures. Examples include the widely acknowledged delay in global response to the outbreak in West Africa, the less-than-aggressive response of some country governments to the outbreak in its early stages, and failures in such areas as communication, surveillance, and contact tracing. Public health experts have also speculated that the magnitude and spread of the outbreak could have been curbed significantly if the initial response

had been earlier and more comprehensive. Note that the IAR exercise is not geared toward placing blame, but rather is intended to organize observed failures and successes into a framework that enables stakeholders to continue to improve responses by learning from recent experiences.

The remainder of this report consists of two proof-of-concept IARs—one for the African response and one for the U.S. response. Each is accompanied by a brief narrative describing (1) key failures or challenges and the actions taken to correct them, where applicable, and (2) some of the key successes observed in the Ebola 2014 outbreak and the actions taken to replicate them. The IARs and accompanying narratives are intended to reflect illustrative examples of how the tool could be used, as a proof of concept, rather than claiming to be exhaustive in their content. We drew examples from publicly available reports (e.g., media, CDC, WHO) but do not purport to have completed an exhaustive search. In practice, emergency managers would likely want to capture a more comprehensive set of observations and lessons learned in the Ebola response, and to periodically update the report to reflect progress over time. Indeed, the IAR is designed as a dynamic tool to monitor progress over time and capture lessons that have been learned and applied. This more comprehensive effort would be a useful follow-on that would require significant involvement from key informed officials involved in these response efforts, to complement information available to us from public sources.

Proof-of-Concept Intra-Action Report for Africa

Illustrative observations from the Ebola experience in Africa are summarized in Table 2. The remainder of the IAR is a narrative description of key observations and lessons learned.

Table 2. Intra-Action Report for the 2014 Ebola Outbreak in Africa

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Governance		
Executive decisionmaking and political engagement	Guinea/Liberia/Sierra Leone: Governments delay in declaring national state of emergency until three to four months after the disease was first confirmed in-country. (At the time of the WHO declaration of a “public health emergency of international concern” on August 8, 2014, Guinea had reported 495 confirmed, probable, or suspected cases; Liberia, 554; Sierra Leone, 717) (Schnirring, 2014b; WHO, 2014a).	Guinea/Liberia/Sierra Leone: National emergency is eventually declared in late July (Sierra Leone), early August (Liberia), and mid-August (Guinea); country leaderships have become more aggressive in fighting the outbreak (BBC, 2014a; Flynn, 2014; RT News, 2014).
	Mali/Nigeria/Senegal/DRC: Government responds aggressively and places the country on high alert immediately when index cases are identified (WHO, 2014g, 2015h).	
Regulatory and legal context	Liberia: Quarantines are ineffectively enforced and marred with protests and deaths (Murtala and Hollis, 2014).	Liberia: Security personnel are trained by U.S. military in isolation operations, and food supplies are provided to quarantined residents; president sets up board of inquiry to probe alleged misuse of force by security agents (Giahvue, 2014; Sim, 2014).
	Nigeria: Effectively enforces quarantine through a push to amend the nation’s quarantine laws (Federal Republic of Nigeria, 2014; Obi and Balogun, 2014).	
	Sierra Leone: Passes laws to deter (through fines and imprisonment) secret burials and failure to report sick Ebola patients (NewVision, 2014).	
Financing	Liberia: Government is initially unable to adequately mobilize sufficient resources to properly execute response (Sack et al., 2014; WHO, 2015d).	Liberia: President appeals to the United States and other partners for aid in September 2014 (Flynn, 2014).
	Nigeria/Senegal: Timely deployment and mobilization of internal and external funds (WHO, 2015h).	

Table 2—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Incident Management		
Emergency operations coordination and incident command	Liberia: The Ebola national task force poorly coordinates response activities among partner organizations, which affects development and execution of clearly articulated action items (Pillai et al., 2014; Sack et al., 2014).	Liberia: President sets up and leads presidential task force in July 2014 (Sack et al, 2014; WHO, 2015d). With technical assistance from CDC, an incident management system is developed between July and August, and an incident manager is appointed in August 2014 (Pillai et al., 2014).
	Guinea/Liberia/Sierra Leone: Poor integration across different arms of response, as well as across borders (Sack et al., 2014).	Guinea/Liberia/Sierra Leone: WHO sets up a regional coordinating center in Guinea in July 2014 (Sack et al., 2014).
	Mali/Nigeria/Senegal/DRC: From the outset, government agencies and partner organizations effectively coordinate emergency response (WHO, 2014g, 2015h).	
	Nigeria/Senegal/DRC: There is multisectoral collaboration among government agencies involved in the response (WHO, 2015h).	
	All affected countries: An emergency operations coordination center is set up immediately after Ebola outbreaks are confirmed in respective countries (Schnirring, 2014).	
Information-sharing and situational awareness	Liberia: From the outset, the Ministries of Information and of Health and Social Welfare put out contradictory messages about the presence of Ebola in the country (Worzi, 2014).	Liberia: More-consistent messaging from government authorities (Pillai et al., 2014).
	Nigeria: Minister of Health provides regular and consistent updates on the status of the Ebola situation (Federal Republic of Nigeria, 2014).	
Operational communications	Guinea: Information on possible cross-border transmission from Guinea to Sierra Leone fails to reach health authorities in Sierra Leone (Sack et al., 2014; WHO, 2015b).	Guinea: WHO sets up a regional coordinating center in July 2014 to improve cross-border communication (Sack et al., 2014).

Table 2—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Public Health		
Health system preparedness	Guinea/Liberia/Sierra Leone: Has no national preparedness and response protocol prior to outbreak (WHO, 2015b).	Guinea/Liberia/Sierra Leone: Develop plans and strategies with assistance of experts from WHO, CDC, and other partners (WHO, 2014c).
	DRC: Has extensive response plan in place (likely drawing from its experiences with six previous Ebola outbreaks).	
	Senegal: Has a detailed response plan and creates National Crisis Committee in March before any case of Ebola is identified (WHO, 2014g).	
	Latin America/Caribbean: WHO and the Pan American Health Organization appointed an Ebola incident manager to help mobilize Latin American and Caribbean states to set in place Ebola preparedness measures (Pan American Health Organization/WHO, 2014).	
	Africa: In late August 2014, WHO begins preparedness strengthening efforts to support countries contiguous with the three most affected countries in West Africa (WHO 2014b, 2015a).	
Surveillance	Guinea/Sierra Leone: First cases of Ebola are identified, about three to four months after onset of the outbreak (Sack et al., 2014).	Guinea/Sierra Leone: Strengthen surveillance systems with training and support from WHO, CDC, and other partners (United States Agency for International Development [USAID], 2014a, 2014d; WHO, 2014c).
	Mali/Nigeria/Senegal: Promptly identify index case (WHO, 2015h).	
Laboratory	Guinea/Liberia/Sierra Leone: Lack of (or inadequate) laboratories; delayed turnaround time of laboratory results (WHO, 2015a).	Guinea/Liberia/Sierra Leone: Increase number of laboratories accessible to affected districts, with the assistance of international partners (WHO, 2015a).
	Mali/Nigeria/Senegal/DRC: Existence of in-country laboratories with Ebola testing capacity (WHO, 2014g, 2015h).	

Table 2—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Public Health—Continued		
Rapid response teams	Mali/Nigeria/Senegal/DRC: Promptly deploy rapid response teams to affected areas (WHO, 2014g, 2015h).	
Control at points of entry	Liberia/Sierra Leone: Ebola is transmitted across the border from Guinea due to deficient point-of-entry surveillance (Sack et al., 2014).	Liberia/Sierra Leone: With the support of international partners, strengthen point-of-entry-surveillance through training and mobilization of border surveillance teams (Sack et al., 2014; USAID, 2014d).
	Nigeria: Activates point-of-entry surveillance system; conducts screening at airports and country borders in July 2014 (Federal Republic of Nigeria, 2014).	
Contact tracing and monitoring	Guinea/Liberia/Sierra Leone: Fail to visit and follow up all registered contacts due to insufficient contact tracing teams and difficulty in accessing hard-to-reach rural places (Sack et al., 2014).	Guinea/Liberia/Sierra Leone: Recruit and train more contact tracing teams, with the assistance of international partners (Garrett, 2014; Sack et al., 2014; USAID, 2014c; WHO, 2015g).
	Mali/Nigeria/Senegal/DRC: Prompt, effective contact tracing (WHO, 2014g, 2015h).	
Emergency public information and warning/ Public awareness/ Public communications	Guinea/Liberia/Sierra Leone: Early efforts at public awareness reinforce fear and hopelessness, which results in avoidance of health centers for treatment (Sack et al., 2014; WHO, 2015b).	Guinea/Liberia/Sierra Leone: Communication improves through social mobilization campaigns, outreach, and the media (WHO, 2014c, 2015a). Campaign messages are altered to reinforce hope and provide actionable information when symptoms are noticed (Sack et al., 2014).
	Mali/Nigeria/Senegal/DRC: Effectively disseminate information via mass media and social media (Federal Republic of Nigeria, 2014; WHO, 2015h).	
Non-pharmaceutical interventions	Mali/Nigeria/Senegal/DRC: Prompt isolation of infected victims; isolation facilities are built or repurposed (WHO, 2014h, 2015g).	
	Nigeria: Successful widespread adoption of hygienic and precautionary protective behaviors, such as hand-washing and limiting body contact (Federal Republic of Nigeria; 2014).	

Table 2—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Public Health—Continued		
Responder safety and health	Guinea/Liberia/Nigeria/Sierra Leone: Appreciable number of health workers die; PPE and training protocols are not available (Pathamanathan, 2014; WHO 2014b).	Guinea/Liberia/Nigeria/Sierra Leone: Train health workers in infection prevention and control protocols; provide PPE (USAID, 2014c; WHO, 2014b).
Development and/or accelerated availability of medical countermeasures	West Africa: No effective drugs are approved for treating Ebola. Some potentially effective drugs (ZMapp and others) are in the early stage of trials and thus are largely unavailable (in West Africa or elsewhere) (Papenfuss, 2014).	West Africa: The United States expedites clinical trials for ZMapp in September 2014 (Healy, 2014).
	West Africa: Sites hosted by Doctors Without Borders launch clinical trials of new treatments (e.g., brincidofovir and favipiravir) in December 2014 (Papenfuss, 2014; Tully et al., 2015).	
	Worldwide: International consortia accelerate collaborative multisite trials of experimental Ebola virus vaccines, such as cAd3-EBOZ and rVSV-EBOV, in September 2014 (Tully et al., 2015; WHO, 2015e).	
Guidance development and dissemination	Guinea/Liberia/Sierra Leone: Local health workers lack guidance on managing and recognizing Ebola symptoms and signs, and on methods to prevent and control infections (Forrester et al., 2014; Pathmanathan, 2014).	Guinea/Liberia/Sierra Leone: Provide technical assistance, guidance, and training by experts from WHO and other partners (Forrester et al., 2014; USAID, 2014b).
Domain: Health Care		
Case management: Suitable treatment facilities/ Clinical care	Guinea/Liberia/Sierra Leone: There are inadequate Ebola treatment center facilities, insufficient beds for patients, and long travel times for patients to access care (WHO, 2014c, 2015b).	Guinea/Liberia/Sierra Leone: Increase number of Ebola treatment centers; monitor bed-to-patient ratio to help inform focus of response efforts, with the assistance of international partners (WHO, 2015a).
	Mali/Nigeria/Senegal: Governments promptly set up designated Ebola treatment centers (WHO, 2015h).	

Table 2—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Health Care—Continued		
Case management: Fatality management/ Safe burials	Guinea/Liberia/Sierra Leone: Unsafe burials result in documented Ebola transmission (WHO, 2014c, 2015b, 2015g).	Guinea/Liberia/Sierra Leone: Increase the number of trained safe burial teams and practices, with the assistance of international partners (WHO, 2014c).
	Nigeria: Residents comply with safe burial guidelines; no record of infection transmission via unsafe burials (Federal Republic of Nigeria, 2014; Ogundipe and Akoni, 2014).	
Medical surge	Guinea/Liberia/Sierra Leone: Due to shortage of staff and treatment facilities, health workers are overwhelmed by the number of patients needing treatment (Garrett, 2014; WHO, 2015b).	Guinea/Liberia/Sierra Leone: Appeal to the international community for help; volunteers deploy from other countries; international partners build more treatment facilities (WHO, 2015a).
Health care system recovery	West Africa: WHO convenes meeting on building resilient health systems in affected countries (WHO, 2014i).	
Critical transportation	Guinea/Liberia/Sierra Leone: Transportation for infected patients is inadequate, especially in remote rural areas (WHO, 2015b).	Guinea/Liberia/Sierra Leone: Funds are made available to help procure more vehicles; U.S. and British militaries provide logistic support (Thomas, 2014; USAID, 2014b; Zavis, 2014).
	Nigeria/DRC: Designated ambulances, vehicles, and helicopters transport patients and responders, to ensure efficient and safe patient management and worker protection (Federal Republic of Nigeria, 2014; WHO, 2015h).	
Medical materiel management and distribution	Guinea/Liberia/Sierra Leone: Distribution of medical supplies to frontline health workers is limited (Pathmanathan, 2014; USAID, 2014a).	Guinea/Liberia/Sierra Leone: Improve distribution, with external assistance (Pathmanathan et al., 2014; USAID, 2014c).
Volunteer and personnel management	Liberia/Sierra Leone: Response is hampered by strikes and irregular payment of wages of local responders (Garrett, 2014; USAID, 2014c; WHO, 2015g).	Liberia/Sierra Leone: External aid from international partners helps pay wages of local responders in October and January 2014 (United Nations Development Programme, 2015; WHO, 2015g).
	Nigeria/Senegal: Effectively manage and incentivize responders (Federal Republic of Nigeria, 2014; WHO, 2014e).	

Table 2—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Sociocultural/Community		
Culturally appropriate community engagement	Guinea: Problems exist with community resistance to response measures and public mistrust of response workers, sometimes escalating to the killing of public health workers (Murtala and Hollis, 2014; WHO, 2015b, 2015c).	Guinea: Establish social mobilization task forces to help develop safe and culturally acceptable practices; involve community groups, including traditional and religious leaders, in reaching out to communities (WHO, 2015a).
	Liberia/Sierra Leone: Public reacts negatively to cremation policy; there is widespread resistance and denial of the reality of Ebola (Murtala and Hollis, 2014; WHO, 2015b).	Liberia/Sierra Leone: Roll out social mobilization activities; involve community groups, residents, and religious leaders as liaisons in disseminating information to communities (WHO, 2014j, 2015a).
	Nigeria/DRC: Country-driven information dissemination and engagement of community and religious leaders enhanced high receptivity and adoption of healthy practices throughout the period of outbreak (Federal Republic of Nigeria, 2014; WHO, 2014g, 2014h).	
Community preparedness	Liberia: Most communities are unprepared despite confirmation of Ebola in neighboring Guinea (Summers et al., 2014; WHO, 2015b).	Liberia: Launch public campaigns and involve local political leaders to improve community participation in isolating suspected cases, feeding quarantined families, and ensuring safe burials (Garrett, 2014; WHO, 2015d).
Community recovery	Guinea/Liberia/Sierra Leone: Ebola patients and survivors are stigmatized and support is nonexistent; there is a lack of mechanisms to reintegrate Ebola survivors into their communities (Arwady et al., 2014; Murtala and Hollis, 2014; WHO, 2015b).	Liberia/Sierra Leone: Provide material support to Ebola survivors and establish counseling and reintegration teams to facilitate reintegration of survivors into their communities (Arwady et al., 2014; USAID, 2014d).

Table 2—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Global Response		
Absorptive capacity	Mali/Nigeria/Senegal/DRC: Teams from each country effectively take ownership and lead response efforts (WHO, 2014g; 2015h).	
External aid	West Africa: International response is slow in regard to funding; donations are still short of amounts requested in late October 2014 (Murtala and Hollis, 2014; BBC, 2014b).	West Africa: Response and coalition of multiple international partners improves with respect to fundraising and human resources; United Nations sets up the U.N. Mission for Ebola Emergency Response (UNMEER) in mid-September 2014 (WHO, 2015a).
	Nigeria: Retrofit polio control center (donated by the Bill and Melinda Gates Foundation) for Ebola response; receive early funding from the Gates Foundation (Federal Republic of Nigeria, 2014).	
	Mali: Retrofit a well-functioning biosafety level 3 laboratory (established with the support of the U.S. National Institutes of Health, for tuberculosis bacteria and HIV diagnosis) for Ebola testing (WHO, 2014f).	

The illustrative successes and failures captured in the IAR framework in Table 2 can be further analyzed to identify themes. Below is a discussion of these themes, or *meta-lessons*, learned from the African experience.

Governance

Rapid response by country leadership is critical in ensuring successful containment of the disease outbreak. An important feature of the response in Mali, Nigeria, Senegal, and DRC was the aggressive response of the political leadership. These countries were placed on high alert immediately after index cases were identified. The rapid responses in these countries are also a result of the world having become aware, as of August 2014, of the struggles of Guinea,

Liberia, and Sierra Leone to contain the outbreak. In contrast, those first-affected countries did not declare a public health emergency until well into the outbreak, after hundreds of lives had been lost.

Adequate laws and law enforcement capabilities are essential in executing response activities. Quarantine and case-finding measures were marred by violence and riots in Guinea, Liberia, and Sierra Leone. Governments are responding by instituting better security measures. For example, the Nigerian government sought to amend outdated quarantine laws and prosecute violators after an Ebola patient escaped quarantine in Lagos and transmitted the disease to Port Harcourt. Also, Sierra Leone passed laws with penalties, such as fines and imprisonment, for people found guilty of conducting secret burials.

Incident Management

Effective coordination and integration of response activities across all actors is critical for successful implementation of response plans. The successful outcomes in Mali, Nigeria, Senegal, and DRC can be attributed in part to strong coordination and multisectoral collaboration among government agencies involved in the response. This is in contrast to the poorly coordinated response observed early on in Liberia, which was corrected by setting up an incident management system with the help of CDC in August 2014 (Pillai et al., 2014).

Public Health

National preparedness and response plans are essential. Senegal had a head start in its response to Ebola because it had a detailed response plan and had inaugurated a national crisis committee to coordinate national response even before any case of Ebola was identified in the country. DRC was also successful in containing the disease thanks to developing robust response plans from its experiences with six previous outbreaks.

Adequate capacity for national surveillance, laboratory testing, and contact tracing and monitoring is also essential. Surveillance systems in Mali, Nigeria, and Senegal were able to promptly identify cases. This is in contrast to Guinea and Sierra Leone, where the disease festered for about three to four months before it was reported to and confirmed by WHO. In addition, Mali, Nigeria, Senegal, and DRC already had in-country laboratories with the capacity to test for Ebola, unlike in Guinea, Liberia, and Sierra Leone, where this deficiency resulted in long delays in obtaining test results. In response, since January 4, 2015, all districts now have access to test results from laboratories within 24 hours (WHO, 2015a). Furthermore, tracing and monitoring suspected contacts of cases in Mali,

The IAR framework helps identify themes, or meta-lessons, learned from the experience. In the Ebola response, for example, national preparedness and response plans are essential, and public awareness messages must be sensitive and tailored to reinforce hope and provide actionable information.

Nigeria, and DRC was about 100 percent (WHO, 2015h). In contrast, limited contact tracing teams and difficulty in accessing hard-to-reach rural places resulted in the failure to visit and follow up all registered contacts in Guinea, Liberia, and Sierra Leone, ultimately requiring the massive recruitment and training of these teams.

Public awareness messages must be sensitive and tailored to reinforce hope and provide actionable information. Information campaigns were conducted in all affected countries. However, in Liberia, early efforts at public awareness reinforced fear and hopelessness, which resulted in people's reluctance to seek help from health centers for their sick relatives. Public awareness campaigns were subsequently reframed to reinforce hope and to provide actionable information.

Health care workers must be adequately trained in infection prevention and control protocols. As of early January 2015, 820 health care workers had been infected, with 488 deaths recorded due to inadequate preparation of health care workers and lack of PPE (WHO, 2015a). With the assistance of international partners, efforts have been made to provide materials and to help countries develop and adhere to protocols. In Nigeria, some of the health workers who

had contact with the index patient were infected and died. However, following training and provision of PPE, there were no further health worker fatalities in designated Ebola treatment centers.

Health Care

Countries need adequate physical and human resource capacity to isolate and treat infected patients. In Guinea, Liberia, and Sierra Leone, there were insufficient Ebola treatment center facilities and beds, resulting in people in remote areas traveling long distances to access care and overwhelming available facilities. Massive efforts are being made to scale up the number of Ebola treatment centers in these countries. In addition, these countries are recruiting volunteers and incentivizing health care workers by paying bonus stipends.

Safe and dignified burial practices are critical in reducing transmission of infections. More than two-thirds of infections were attributed to unsafe burials, which were widespread in Guinea, Liberia, and Sierra Leone because people did not want to submit their dead to burial practices that contradicted their traditional customs (WHO, 2015b). In contrast, in Nigeria, the government complied with standard guidelines in burying dead Ebola victims

Safe and dignified burial practices are critical in reducing transmission of infections. CDC, WHO, and other partners worked with authorities in the three most affected countries to develop and implement guidelines for such burials and to actively engage community leaders to ensure compliance.

by cremation. Also, corpses could be transported across state lines only upon presenting medical certificates showing that the cause of death was not Ebola. Hence, there were no records of transmission via unsafe burials in Nigeria (Ogundipe and Akoni, 2014). CDC, WHO, and other partners worked with authorities in the three most affected countries to develop and implement guidelines for safe and dignified burials and to actively engage community leaders to ensure compliance.

Logistics

Adequate provisions must be made for transportation and efficient distribution of medical materiel. One of the barriers to infected patients accessing care was inadequate transportation in Liberia and Sierra Leone. This also resulted in inefficient distribution of necessary materials, such as PPE and drugs for supportive care. The intervention of the U.S. military in Liberia and the British military in Sierra Leone helped improve logistical support in transporting patients and responders and in distributing medical supplies.

Sociocultural/Community

The engagement of communities in response efforts is crucial to achieving success. Widespread community resistance to response measures, such as cremation policies, quarantines, and movement restrictions, occurred in the three most affected countries (escalating in some cases to the killing of public health workers). This is being mitigated by establishing social mobilization task forces and involving religious, traditional, and community leaders as liaisons in disseminating information and helping achieve community buy-in.

Ebola survivors must be assisted in getting reintegrated into their communities. Stigmatization of Ebola patients and lack of reintegra-

tion may result in people hesitating to seek treatment. This situation is being addressed in Liberia and Sierra Leone, with the assistance of international agencies, by providing material support to Ebola survivors and establishing counseling and reintegration teams.

Global Response

Prompt response of international partners and agencies is important in preventing escalation of outbreaks. The response of the international community to the outbreak in West Africa was slow, evidenced by great delays in raising adequate funding to help affected countries. Prompt external aid, however, can make a huge difference in outcomes. For example, in Nigeria, the polio control center earlier donated by the Bill and Melinda Gates Foundation was retrofitted to become the Ebola Emergency Operations Center, which enabled Nigeria to combat the disease outbreak early and effectively. Similarly, Mali was able to retrofit a biosafety level 3 laboratory—established with the support of the U.S. National Institutes of Health for tuberculosis, bacteria, and HIV diagnosis—to support Ebola testing. There have since been improvements in fundraising and human resource support from multiple international partners. In August 2014, WHO declared Ebola to be a global public health emergency, and the United Nations set up UNMEER in September.

Proof-of-Concept Intra-Action Report for the United States

Illustrative observations from the Ebola experience in the United States, drawn from public source materials, are summarized in Table 3. The remainder of the IAR is a narrative description of key observations and lessons learned.

The full range of successes and failures captured in the illustrative IAR framework in Table 3 can be further analyzed to identify themes. Below is a discussion of these themes, or meta-lessons, learned from the U.S. experience.

Governance

Response from political leadership must be clear, consistent, and supported by public health evidence. Several responses from political leadership at both the state and federal levels arguably caused more harm than good, at least initially. Examples of this include the attempts by the governors of Maine, New Jersey, and New York to enforce a mandatory quarantine of all returning health care workers who had volunteered in heavily affected countries. A quarantine for nonsymptomatic individuals was not supported by evidence, was opposed by public health experts, and was eventually struck down in a court of law. Since that time, the mandatory quarantine has been reduced to a strict 21-day monitoring, which is the commonly accepted public health procedure for this type of disease.

Public Health

Federal and state public health expertise is vital in a response of this kind, but it is only valuable when consistent and trustworthy. CDC and state public health officials play a key role in both communicating risk and supporting health care facilities in this type of response. However, there were several instances when inconsistent information, which was in some cases proven to be wrong, was reported by such officials (e.g., clearing Amber Vinson, who contracted Ebola in her position as a nurse, to travel). This undermined trust in these public health officials and significantly limited their credibility in the public's mind.

Table 3. Intra-Action Report for the 2014 Ebola Outbreak in the United States

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Governance		
Executive decisionmaking and political engagement	October 2014: Governors in Maine, New Jersey, and New York impose mandatory quarantines on health care workers returning from affected area, causing significant public debate (Yan and Betelho, 2014).	October 2014: Modify policy to active 21-day monitoring.
	October 2014: Appointment of an Ebola response coordinator to serve as the White House touch point for Ebola instead results in significant negative press attention at the outset and little since (Eilperin and Nakamura, 2014).	
Regulatory and legal contexts	October 2014: The public discord in Maine related to enforcement of mandatory quarantines without a scientific basis results in nurse Kaci Hickox refusing to comply and the U.S. Department of Health filing suit against her (Bukaty, 2014).	October 2014: Maine judge rules against the mandatory quarantine.
	August 2014: Ebola diagnostic assays are made available quickly through rapid emergency use authorization (McCarty, 2014).	
Domain: Incident Management		
Emergency operations coordination and incident command	Early Summer 2014: Federal government is slow to appoint a leader for response coordination (i.e., incident manager), leaving room for miscommunication and lack of coordination.	August 2014: A CDC incident commander is named for response coordination (CDC, 2014e).
	August 2014: To manage U.S. participation in the Ebola response, CDC activates its Emergency Operations Center at the highest alert level in August—before a case appears in the United States (Schnirring, 2014a).	
Information-sharing and situational awareness	Ongoing: To facilitate information-sharing, efforts are made to roster appropriate staff into a Health Alert Network (White House, 2014).	

Table 3—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Public Health		
Health system preparedness	Fall 2014: Initial delays in providing guidance leave hospitals underprepared for incoming Ebola cases.	November 2014: In preparation for additional cases, CDC develops and disseminates the “Top 10 Ebola Response Planning Tips: Ebola Readiness Self-Assessment for State and Local Public Health Officials” (CDC, 2014c).
Surveillance	July 2014: The New York City Department of Health and Mental Hygiene—in close coordination with local hospitals and clinicians, nongovernmental organizations, community groups, and city, state, and federal agencies—establishes systems for Ebola surveillance, among other preparedness efforts (CDC, 2014b).	
Laboratory	December 2014: Live Ebola samples are inadvertently sent to a lab not equipped to handle them, endangering lives and risking transmission in the United States (Grady and McNeil, 2014).	
	Ongoing: CDC offers guidance, conducts rapid lab testing, and confirms suspected cases as positive or negative (CDC, 2015b).	
Rapid response teams	October 2014: CDC deploys 26 experts to Dallas to support response.	October 2014: CDC pledges to deploy a rapid response team to any hospital in the United States that diagnoses an Ebola case (Associated Press, 2014).
Control at points of entry	October 2014: Enhanced screening is established for Ebola virus disease at major ports of entry, and travel alerts are disseminated (U.S. Department of Homeland Security, 2015).	
Contact tracing and monitoring	December 2014: CDC completes contact tracing of more than 450 individuals in New York, Ohio, and Texas, with no new cases of Ebola (CDC, 2014d).	
Emergency public information and warning/ Public awareness/ Public communication	Fall 2014: CDC and response officials attempt to provide a calm perspective amid media reporting of inappropriate risk perceptions. Communication is too reassuring and does not recognize uncertainty. This leads to public doubt in government credibility (Baron, 2014).	

Table 3—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Public Health—Continued		
Nonpharmaceutical interventions	October 2014: CDC grants permission for Amber Vinson, a nurse who contracted Ebola, to fly despite showing symptoms.	October 2014: CDC works with Frontier Airlines to determine potential contacts for monitoring and has the airplane taken out of commission and decontaminated (Horowitz, 2014). “Interim U.S. Guidance for Monitoring and Movement of Persons with Potential Ebola Virus Exposure” is updated to ensure that the situation cannot be repeated (CDC, 2014f).
Responder safety and health	October 2014: Inadequate PPE procedures in Dallas result in two health care workers contracting Ebola.	October 2014: PPE guidance is updated, disseminated, and, in many health care settings, trained and exercised. This incident motivates development of a three-tiered system of care (see Health Care domain in this table) (Greenemeier, 2014).
Development and/or accelerated availability of medical countermeasures	Ongoing: Candidate vaccine trials are rapidly designed and initiated. Phase I begins in the United States in September 2014 and Phase II begins in Africa in December (WHO, 2015f).	
Guidance development and dissemination	October 2014: Rapidly evolving guidelines and unclear messaging lead to confusion about appropriate Ebola procedures (Baron, 2014).	October 2014: Guidance documents are updated and communicated.
Domain: Health Care		
Case management: Suitable treatment facilities	December 2014: CDC develops a three-tiered approach to health care facility preparedness.	December 2014: Guidance on this framework is disseminated, and 35 U.S. hospitals are designated as Ebola treatment centers (CDC, 2015a).

Table 3—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Health Care—Continued		
Case management: Clinical care	September 2014: The initial discharge of an active Ebola case from Texas Health Presbyterian Hospital in Dallas puts the public at risk.	October 2014: The hospital upgrades its medical record software to clearly highlight travel risks. It also implements new triage procedures to quickly identify at-risk patients and move them immediately from the emergency department. Lessons learned are posted to the hospital website for reference by other hospitals (Texas Health Resources, 2014).
	October 2014: Ebola virus is transmitted to two health care workers in Dallas due to lack of appropriate PPE preparation.	October 2014: Texas Health Presbyterian Hospital Dallas consults with CDC to comply with evolving PPE guidance (Fox, 2014).
	Summer/Fall 2014: There is successful case management at the National Institutes of Health, Emory University Hospital, Nebraska Medical Center, and others (Lyon et al., 2014).	November 2014: Clinical resources are disseminated in a variety of formats (for example, clinical case reports are published in the <i>New England Journal of Medicine</i> , Ebola response-specific page is added to Emory’s website) (Emory Healthcare, 2014).
Domain: Logistics		
Critical transportation	Summer/Fall 2014: Emergency medical services successfully transport patients inbound to the United States and in Georgia, Maryland, Nebraska, and New York (EMS World, 2014).	
Medical materiel management and distribution	October 2014: Medical materiel from the index patient is initially not handled in accordance with Ebola procedures (McKay, Burton, and Campoy, 2014).	August 2014: Procedures for handling medical materiel from Ebola patients, including multiple bagging, are updated (CDC, 2014f).
Volunteer and personnel management	October 2014: CDC establishes the “Preparing Healthcare Workers to Work in Ebola Treatment Units (ETU) in Africa” training course, held in Anniston, Alabama. The course has graduated 333 volunteers bound for West Africa (CDC, 2014a).	

Table 3—Continued

Area of Activity	Initial Failure or Challenge (Red)/Initial Success (Green)	Improvement Made/Success Replicated
Domain: Sociocultural/Community		
Community preparedness	Fall 2014: Inappropriate public risk perception and overblown news coverage (Baron, 2014).	
Domain: Global Response		
Technology and innovations	December 2014: A new suit designed for protecting health care workers in the field against Ebola won a USAID contest. The suit was designed by researchers at Johns Hopkins University and could optimistically be in the field in a few months, if picked up by major manufacturers (Sun, 2014).	

Health Care

Despite missteps in the handling of an initial case, the U.S. health care system has improved its preparedness level significantly. The initial discharge of a symptomatic man—Thomas Eric Duncan—from Texas Presbyterian Hospital in Dallas and the transmission of Ebola to two health care workers who provided his care gave strong impetus for rapid improvement in U.S. preparedness for medical management of Ebola patients. This has resulted in improved guidance documents for several processes, including donning and doffing PPE and medical material management, as well as a three-tiered approach to the facilities needed to treat Ebola.

The three pre-existing U.S. biocontainment centers (Emory University Hospital, Nebraska Medical Center, and the National Institutes of Health) provided safe and effective care for patients and served as a model to accelerate medical preparedness in other U.S. hospitals. Before the outset of the 2014 Ebola outbreak, CDC had already established and certified three medical units that were capable of isolating and safely caring for patients with diseases such as Ebola.

Most patients in the United States have been treated in one of these centers.

Logistics

An innovative use of federal resources has added value in the context of both U.S. preparedness and volunteer capacity to address the outbreak at its source. A new program for prospective Ebola volunteers was established at the Center for Domestic Preparedness, a DHS facility in Anniston, Alabama (typically used to provide routine training for U.S. responders). This training course, titled “Preparing Healthcare Workers to Work in Ebola Treatment Units (ETU) in Africa,” has graduated 333 volunteers bound for West Africa since October 6, 2014.

Sociocultural/Community

The media response to the U.S. Ebola experience was extreme and contributed to public panic, including inappropriate fears. Media coverage of the evolving Ebola response in the United States was constant and often inescapable. It contributed significantly to public

panic and ungrounded fears, such as a significant number of passengers on a plane from Atlanta, Georgia, to Washington, D.C., on October 20, 2014, who wore face masks, reportedly because “there is Ebola in Atlanta” (Moore; 2014). (At the time, one patient was being treated at the isolation facility at Emory Hospital in Atlanta.) Without further transmission of Ebola in the United States, this media coverage has tapered off. However, this remains an important area for improvement that has not been fully addressed.

Discussion and Opportunities for Future Development

We believe the IAR offers unique value for emergency managers and policymakers. It provides a structured framework for capturing initial failures or challenges and initial successes, identifying opportunities to fix problems or replicate successes and best practices, and tracking progress over time, all *during* the response and recovery effort for that emergency. We found this to be a valuable exercise as we worked through the proof-of-concept examples described. In our examples, we pulled together—into the organized framework of the new IAR tool—myriad pieces of information to achieve a broader view of the various responses to the 2014 Ebola outbreak in both Africa and the United States.

In addition to providing a structured framework to capture, organize, and display information during an emergency for use during that same emergency, the IAR tool readily highlights actions that were initially unsuccessful or posed challenges and whether and how they were subsequently addressed. It also highlights opportunities to address remaining problems or replicate successes. In principle, the empty dark green cells in the matrix

indicate opportunities for further action—to address a problem or replicate a success. Busy emergency managers or decisionmakers can easily lose track of various threads in their response. By providing a consistent and comprehensive framework, the IAR adds value to their existing set of tools: It helps them maintain situational awareness of all elements of their response, and it points to opportunities for further action. While our two illustrative IARs do not offer any clear example of positive deviance—success in the face of all odds—we believe that this concept is important to keep in mind for IARs in the future. Such lessons are particularly important to understand and to try to replicate.

The periodic updating of this framework makes the IAR a dynamic tool, and thus both unique and useful. Early application of the IAR framework identifies problems that should be resolved and successes that should be disseminated and replicated. Periodic updating indicates progress that has been made or continuing

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opportunities in areas where action has not been taken. As emphasized throughout, a unique feature of the IAR is its use *during* an emergency. The IAR tool also facilitates clear communication by policymakers or emergency managers to other senior executives or the public about the quality and effectiveness of response efforts in various areas of activity and about progress that is made over time.

The proof-of-concept examples in this report were limited to open source, widely known information and therefore stop short of generating new information *per se*. However, future iterations completed by responders in the field would undoubtedly be more comprehensive and likely uncover new information. The application of the systematic IAR tool also will enable users to make connections between the lessons learned and applied across domains and the levels of response both within a country (e.g., national, state, provincial, local) and between countries across national borders.

This initial proof of concept suggests some potential next steps. More-exhaustive IARs can be undertaken to add to both the initial observations and follow-up actions taken in Africa and the United States. This would capture a broader range of content within the organized framework presented here. Such an exercise

Future, more-exhaustive IARs likely would uncover new information (not previously reported to the public) and also demonstrate more clearly the value of the IAR for periodic updates to monitor progress and use the information during the response to the same emergency.

likely would uncover new information (not previously reported to the public) and also demonstrate more clearly the value of the IAR for periodic updates to monitor progress and use the information during the response to the same emergency. Thus, we strongly encourage efforts in the near term to capture a more comprehensive set of African and U.S. experiences and lessons learned and applied from the 2014 Ebola outbreak; these will serve as a real-time IAR that can continue to inform the ongoing response. Doing so would require collecting data from on-the-ground officials who have participated in response activities in these countries, which was beyond the scope of this proof of concept. This information will help enrich the immediate utility and further development of this tool, and will expound on the full range of ways it can be employed in disaster preparedness, response, and recovery.

In addition, there are other potential sources of information that would be relevant to an Ebola (or other emergency-related) IAR. For example, shortly after the first case of Ebola was diagnosed in the United States, the American College of Emergency Physicians (ACEP) conducted three surveys to better understand the state of Ebola preparedness in emergency departments and health care facilities across the country, from the perspective of a sample of ACEP's emergency medical service and disaster preparedness section members, emergency department directors, and practicing emergency physicians (Singh, 2014). In the United States, ACEP is among the organizations that have taken an active role in disseminating Ebola-related information to health care providers, hospitals, and the public (ACEP, 2014). RAND is collaborating with ACEP to analyze the survey data gathered during the 2014 Ebola response. This analysis is pending and will be published separately, but such results will undoubtedly be another valuable

Development of further empiric information, either through data collection from responders in the field or through surveys, could inform modifications to the elements in the IAR framework. For example, some new observations may not fit neatly into one of the areas of activity in the current framework and thus may inform relevant modifications. These updates will strengthen the IAR framework for future uses.

source of information for a more comprehensive U.S. Ebola IAR. As such, the surveys administered by ACEP in fall 2014 are a powerful example of how organizations outside of government can also play an important role to help *capture* failures, challenges, and successes from a response already under way. The ACEP surveys are noted here to illustrate how ACEP in particular, as well as other professional organizations, can collect useful information from their respective members to help inform future IARs. In addition, such organizations as ACEP can be leveraged as a useful venue to *disseminate* lessons learned from the IAR.

Development of further empiric information, either through data collection from responders in the field or through such surveys

as those conducted by ACEP, could also inform modifications to the elements in the IAR framework. For example, some new observations may not fit neatly into one of the areas of activity in the current framework and thus may inform relevant modifications. These updates will strengthen the IAR framework for future uses. Finally, while the IAR is presented here through illustrative application to Ebola, the systematic IAR framework is applicable to a broader range of natural and manmade disasters and emergencies. Future efforts could test its applicability in such situations. These various potential next steps represent opportunities for further development and use of the IAR, which we hope will add enduring value to the field of emergency response.

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About This Perspective

This report describes a new tool that is intended to help decisionmakers periodically assess elements of a protracted emergency response as a means to identify initial actions that were successful or not, and to learn lessons and take further actions to improve or replicate them during the response to that emergency. Using the current Ebola outbreak as an illustrative example, we introduce a practical, visually simple, proof-of-concept policy analysis tool—for which we have coined the label Intra-Action Report—that provides a systematic way to capture and communicate progress over the course of an emergency response.

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