GLOBAL HEALTH SECURITY THREATS IN AMERICA

2018

SGNL

LARC

CSTE

Contents

Executive Summary

INTRODUCTION

National and state-level health and economic indicators for jobs, trade, agriculture, and travel illustrate U.S. global interconnectivity. While these connections benefit Americans across all states through jobs and economic revenue, they also make Americans vulnerable to the economic and health impacts of global health threats, such as infectious diseases.

Recent events, like the Ebola outbreak in 2014–2016, and the emergence of Zika virus in 2016, demonstrate this issue. To assess such impacts, SGNL Solutions, in consultation with the Council of State and Territorial Epidemiologists (CSTE) and the Centers for Disease Control and Prevention (CDC), explored infectious diseases that threaten the health security of state, tribal, local, and territorial jurisdictions.

METHODS

SGNL Solutions began by conducting a review of the literature pertaining to imported infectious diseases and the impacts of these threats in the United States. Following and informed by the literature review, SGNL Solutions selected seven infectious disease events for further exploration that occurred in the United States in the last 10 years.

Those selected were (1) caused by introduction of a pathogen from outside the United States (i.e., imported), (2) associated with a declared public health emergency of international concern from the World Health Organization, (3) associated with CDC Bio-Terrorism Agents, and/or (4) associated with pathogens that are well controlled or eradicated in the United States. Key informant interviews were scheduled with 22 stakeholders (21 conducted) from 7 jurisdictions to hear first-hand accounts of local impacts. Based on the response rate of the key informants and availability of data, 5 final jurisdictions were selected as case studies, which were documented separately. The lessons gleaned from all the case studies and interviews are

synthesized in this document, with findings from past events and recommendations for improved response to future global health security threats to protect U.S. communities.

FINDINGS

The findings were categorized to answer 3 key questions regarding global health security threats:

1. What are the impacts of imported infectious diseases on public health systems and the communities they serve?
2. What are the barriers and enabling factors encountered by state and local jurisdictions that could be modified to prevent or mitigate impacts of future outbreaks? (e.g. through policy or practice changes at the federal, state, and/or local level)?
3. What are the roles of all levels of domestic and international governments in global health security?

Impacts on Public Health Systems and Communities

Imported infectious disease cases or outbreaks are a burden to local public health agencies, where personnel and resources are often redirected from routine and essential activities to meet the surge demand for preparedness and response activities. Additional staff hours are needed for surveillance, case detection, contact follow-up, monitoring, communication, vaccination, and other mitigation efforts. This scaling up of efforts can even be felt in jurisdictions that have not yet seen a case, but need to plan their response should a patient present in their hospital or community. For hospital leaders, there are many questions that need to be answered about changes in protocol, handling of specimens or waste, procurement of and training on personal protective equipment (PPE), and what to do if and when their employees get sick. Medical supply manufacturers must also respond to increases in demand for supplies such as masks or gloves. But because the

procurement requests come with little warning and are not always reflective of the true need, it is difficult for manufacturers to surge production while protecting their bottom line.

For the local economy, impacts can be felt in the form of lost business due to negative public perception, resulting in layoffs, closures, or decreased revenue. Health threats can also reveal public fear or misperceptions about disease characteristics or transmission routes of a virus, often leading to discrimination or stigma towards certain populations. In addition, funds are often wasted on prevention efforts such as unnecessary cleaning and school closures even when not warranted.

Views of Jurisdictions on Prevention and Mitigation of Future Impacts

Discussions with informants revealed a number of barriers and facilitators experienced by local jurisdictions in their efforts to protect the public from threats to global health security. Because many of these diseases are not seen often, there is a need to improve the ability of clinicians in the United States to recognize infectious diseases. Similarly, acknowledging the effects of globalization at the local level could aid health departments or hospital staff in tailoring their surveillance and screening for particular diseases. Every American city has residents that are connected in some way to people or places in other countries, and recognizing this can help to generate a better understanding of risks.

Informants called for investments in public health preparedness that are consistent over time—at both the state and local level—to sustain the infrastructure and workforce capacity developed. The current trend of creating categorical funding in response to a crisis that is later abolished depending on available resources makes it difficult to leverage this infrastructure and knowledge base in a sustainable way. Nearly all of the jurisdictions described funding cuts or funding gaps that made maintaining preparedness levels and surging for response more difficult.

Finally, critically important is trust in government, as many jurisdictions found during the infectious disease events they experienced. Actions sometimes sent mixed messages, and resulted in setbacks and disagreements about decisions that were made or mistrust in guidance that was offered about a disease. All stakeholders emphasized the need for proactive community engagement, especially at the grassroots level and liaising with trusted community members to disseminate messages.

Role of All Levels of Government in Global Health Security

Communication and collaboration is a natural and well-understood role of governments at any level – though some might be more familiar with one another. Levels of formality may impact the timing of information sharing as well, if information first needs to be cleared by a central authority. This emphasizes the importance of trusted relationships and unofficial data sharing to inform real time responses. Additionally, global surveillance was highlighted as a key role that the government, especially the federal level, but also the state and local level can be doing to maintain an awareness of active diseases worldwide. Beyond just surveillance, several informants agreed that building capacity in countries abroad is a valuable investment and risk reduction effort for the United States, so that those countries can detect and respond to the outbreaks in their own nation, before it lands on U.S. soil. When cases of a health security threat do emerge in a U.S. location, important roles for government agencies include vaccination campaigns, as well as diplomacy and leadership in their jurisdiction to handle the emotions or panic that may ensue due to the news of the disease. Finally, a key role identified for the federal level is developing guidance to share with state and local partners about certain diseases to help inform decision-making, while also making the approach similar around the country. Practitioners at the local level can then push this standardized information and guidance out to their partners – both public and private – at the local and community level so there are less misunderstandings. This helps to coordinate the actions of responders in all states, ensuring that your diagnosis and treatment are the same regardless of your location.

RECOMMENDATIONS

The analysis revealed few formal studies and reports that describe the impact of imported infectious diseases on U.S. communities. While many of the outbreaks on U.S. soil have been handled swiftly and successfully, they are not without impact, especially at the local and community level.

The recommendations that emerged from the literature and case studies fall into two main categories: 1) improving understanding and 2) fostering effective action.

There are many gaps in understanding the impacts of the infectious disease events that have occurred in the United States, whether short- or long-term. In the heat of a response effort, it may be difficult to think about collecting data, but more complete knowledge about what negative effects the outbreak (whether real or perceived) is having on a community can help inform future planning and mitigation. A solid framework for research, more purposeful data sharing, and learning all emerged as needs to mitigate future impacts.

How can we better understand the impacts on local jurisdictions?

- Develop a framework for further research on impacts of threats to global health security (e.g., imported infectious diseases) that includes various sectors and metrics for assessing such impacts.
- Encourage the development of standardized research methodology and documents (e.g., IRB application, questionnaires, consent documents) for collecting impact data during and following an infectious disease event or outbreak.
- Incentivize sharing of privately held data across sectors impacted by threats.
- Continue the U.S. investment in identifying, exploring, and understanding the impacts in other countries to better anticipate domestic impacts.

The second category for recommendation is policies and practices to either prevent or mitigate impacts from future outbreaks or epidemics. Experts agree the next outbreak is a matter of "when", not "if". The better prepared state and local jurisdictions are–working together with the many private partners they depend on during these outbreaks–the better chance they will have of preventing adverse impacts.

How can all levels of government and their partners mitigate the impact on U.S. communities?

- Provide consistent funding for dedicated local or regional staff positions, functions, and resources to support planning, practice, and partnerships for global health security.
- Develop policies and foster practices that permit flexibility for local authorities during threats that permits them to bypass standard "chains of command" (e.g., procurement, data sharing, communication).
- Strengthen the supply chain for medical countermeasures through public-private partnership and communication pathways.
- Standardize evidence-based, international guidelines for case definitions, right-sized laboratory confirmation, treatment, PPE, mitigation, and prevention.
- Encourage open source international surveillance and case sharing capabilities and electronic case reporting for clinicians, laboratories, and public health partners.
- Develop policies and practices that align with infectious disease control and prevention needs (e.g., insurance reimbursement for transport and treatment, testing for sexually transmitted diseases).
- Conduct campaigns aimed at "norming" threats so that the general public and health care and public health providers have a better sense of the true risk of disease, and are more likely to spot illness and take precautions and follow recommendations.
- Expand public health and healthcare critical infrastructure situational awareness.
- Update local and state policies and protocols to reflect global interconnectivity.
- Recognize the mental health burden on local staff when in prolonged response mode.
- Continue to identify, assess, and import practices and policies from other countries that could be applied domestically to help mitigate the impacts of outbreaks.
- Provide and ensure consistent and coordinated messaging across all levels.
- Educate policy- and decision-makers about how their policies can positively or negatively affect the public's health.

CONCLUSION

A global health security threat need not be of nation-wide consequence like Ebola to have dramatic impacts on local jurisdictions. Even more localized outbreaks (e.g., measles or dengue) may have unrealized consequences to the economy and society.

Most of the available literature on these topics focused on quantifying direct costs (to public health and health care) in time and dollars. But there is a need to better understand, qualify, and quantify (where possible) the indirect costs of these outbreaks and where the impacts are felt within a local jurisdiction. In addition to better and more rapid understanding of impacts, stakeholders called for better planning and communication at all levels, including information sharing across districts and jurisdictions, and more proactive global surveillance and interpretation of that surveillance to inform decision-making at the state and local level.

Future outbreaks cannot be prevented, as in this globalized society it is almost impossible to know what will become an emergency next and where it will emerge. Improving these attributes for state, tribal, local, and territorial jurisdictions, supported by stable funding and invested federal agencies can assist in making the public safer and more protected from the impacts of these outbreaks.

Introduction

National and state-level health and economic indicators for jobs, trade, agriculture, and travel illustrate U.S. global interconnectivity. While these connections benefit Americans across all states through jobs and economic revenue, they also make Americans vulnerable to the economic and health impacts of global health threats, such as infectious diseases.

Recent events, like the Ebola outbreak in 2014–2016, and the emergence of Zika virus in 2016, demonstrate this issue. To assess such impacts, SGNL Solutions, in consultation with the Council of State and Territorial Epidemiologists (CSTE) and the Centers for Disease Control and Prevention (CDC), explored infectious diseases that threaten the health security of state, tribal, local, and territorial jurisdictions.

Methods

SGNL Solutions began by conducting a review of the literature pertaining to infectious disease outbreaks and impacts in the United States. Scholarly articles, books, and other sources (e.g. dissertations, conference proceedings, government reports, journalism, reports, and websites) in the United States were explored to determine the significant contributions to the topic, and where gaps in information may be.

In addition to the key search terms, limiters were placed on all searches (e.g., United States and published from 2000 through the present). From this search, 137 items were identified for consideration. Items were further screened, and those that were not U.S. focused were excluded, resulting in 64 remaining items for further analysis. Of those, SGNL Solutions assessed the methodology (e.g., cost analysis, survey, modeling, anecdote), pathogen, impact variables measured, and description of qualitative and qualitative impacts. This information was synthesized across impact areas. The nine impact areas that emerged during the analysis were local and state public health, healthcare, supply chain and critical infrastructure, policy and ethics, workforce, education, tourism, hospitality and entertainment, trade, and psychosocial. However, findings for each impact area were not evident for each pathogen. For each of these impact areas, the literature was further divided, when possible, into two categories: "What We Know", or findings from literature that measure or estimate the impact of actual events, and "What We Think We Know", or findings from literature that model, project, or hypothesize about the impact of hypothetical events.

Threat	Informants Identified and Invited to Participate	Interview Scheduled	Interview Conducted
Novel influenza H1N1	5	0	0
Measles (California)	4	1	1
Measles (Ohio)	2	1	1 (partial)
Ebola	19	9	9
Zika	7	1	1
Dengue	7	5	4
Multi-Drug Resistant Gonorrhea	5	5	5
Total	**48**	**22**	**21**

Following and informed by the literature review, SGNL Solutions then selected ten global health security threats for assessment. Those selected were (1) caused by introduction of a pathogen from outside the United States, (2) associated with a declared public health emergency of international concern from the World Health Organization, (3) associated with CDC Bio-Terrorism Agents, and/or (4) associated with pathogens that are well controlled or eradicated in the United States. These threats included Novel influenza H1N1, Measles (California and Ohio outbreaks), Ebola, Zika, Dengue, Avian Flu, Multi-Drug Resistant Imported Gonorrhea, Severe acute respiratory syndrome (SARS), Bovine spongiform encephalopathy (Mad Cow), and Tuberculosis. In consultation with CSTE and CDC, SGNL Solutions narrowed this list to seven infectious disease events for further exploration, which included Novel influenza H1N1, Measles (California and Ohio), Ebola, Zika, Dengue, and Multi-Drug Resistant Imported Gonorrhea. SGNL Solutions then initiated a data collection process, which included identifying, scheduling, and conducting interviews with key informants (e.g., government staff, local businesses); collecting consent forms; obtaining data for impact factors; and scanning for local media coverage of the incident.

The purpose of the key informant interviews was to collect information from a wide range of stakeholders—including community leaders, professionals, and business owners—who have first-hand knowledge of the threats in question and their impacts on communities. Forty-eight potential key informants were identified and invited to participate. The initial approach for requesting the interviews was made by email, which explained why the interview was being requested, asked the person to participate, and explained that a transcript of their interview responses would be shared and their statements attributed to them in publicly available documents. Those that agreed to participate were asked to select an appointment for a phone interview of one hour in duration and to complete a participant consent form.

Between May 21 and June 14, 2018, a total of 22 key informant interviews were scheduled and 21 were conducted.

Participants included seven lead epidemiologists, six health department executives, four infectious disease specialists, and leads for vector control, product manufacturing, and preparedness. Nine participants worked for local jurisdictions, eight worked for state jurisdictions, one worked for a regional organization, and four worked at the federal or national level.

Based on the response rate of the key informants and the data available, five local jurisdictions were selected for documentation as case studies:

- Yuma County, Arizona (Dengue fever, 2014)
- Dallas and Houston metropolitan areas, Texas (Ebola virus disease, 2014)
- Orange County, California (Measles, 2014-15)
- Broward and Miami-Dade Counties, Florida (Zika, 2016)
- Hawaii (Multi-Drug Resistant Imported Gonorrhea cluster, 2016)

The collected data and interview transcripts were first coded for sector type (e.g., local and state public health, healthcare, supply chain, workforce, education, tourism/hospitality, trade) and for impact type (e.g., economic, psychosocial, compliance with regulations/contracts/public expectations, policy, provision of goods/services). Additional themes also emerged during the analysis. Each SGNL Solutions coder independently coded at least three interviews, compared results, and discussed discrepancies to improve inter-rater reliability. All interview transcripts and collected news articles, reports, and other data were coded, synthesized, and summarized as part of the documentation process. The findings and results of this analysis was then organized to help answer the following questions:

1. What are the impacts of imported infectious diseases on public health systems and the jurisdictions they serve?
2. What are the barriers and enabling factors encountered by state and local jurisdictions that could be modified to prevent impacts of future outbreaks? (e.g. through policy or practice changes at the federal, state, and/or local level)?
3. What are the roles of all levels of domestic and international governments in global health security?

Findings and Results

What are the impacts of imported infectious diseases on public health systems and the jurisdictions they serve?

LOCAL GOVERNMENT

The work of preparing for threats and responding to cases and outbreaks is time and resource intensive. One participant summed it up as "the immediate shifts in effort and labor and follow-up that happened as the cases were identified; and then our subsequent efforts to reorganize and be better positioned for things like this in the future".

When a case of an infectious disease is confirmed, "disease detectives", typically epidemiologists and disease intervention specialists, initiate activities to understand the scope of the threat, including tracing contacts and identifying "hot zones". For example, if an adult who works in an office is infected with measles, staff must evaluate everyone in the office for evidence of immunity to the disease. If the adult works at a restaurant, the effort to notify those potentially exposed and verify immunity is extended to patrons of the restaurant. For imported infectious diseases where the index patient was contagious during their flight, contact tracing involved obtaining flight passenger information. For sexually transmitted diseases, cases were asked to disclose sexual partners.

A really big outbreak requires ramping up the ability of a local jurisdiction, or many local jurisdictions, to do a huge amount of increased testing and screening and outbreak response.
[federal epidemiologist]

Additional staff and resources were needed for interventions, which may include vaccination, education, monitoring, and enforcing isolation or quarantine recommendations. Several participants reported that responding to requests from the media and from the community were particularly time-consuming.

Even before [the first confirmed case], we started getting a high amount of media interest, and it was nonstop for us. We were getting media requests daily at one point.
[local vector control lead]

We were frequently out there with the public talking to anybody who would talk to us, and there was the high-level interest – homeowners associations, church groups. Thirty-one municipalities within the county wanted us to come talk to them about what they could do to help.
[local vector control lead]

When an outbreak occurs domestically, or even globally, many agencies must respond to spikes in local concern among the community and the healthcare system. For example, when the first cases of Ebola were identified in the United States, many agencies had to respond to questions of how an outbreak might be handled in their jurisdiction.

Even though we had zero cases [of Ebola] in Harris County, we mirrored Dallas as if we had cases of Ebola here in our community. We were looked at very early by our community as being a leader in public health and so healthcare was increasingly looking our way to ask us what our recommendations were.
[local health department executive]

As public health authorities, local agencies are looked to for guidance and support during threats and outbreaks. Keeping many providers up to date on case definitions, reporting requirements, treatment recommendations, and prevention guidance required additional workforce and resources.

Keeping the large number of providers up to date on what the local guidance is a challenging effort and it takes a lot of manpower and time and thought.
[local health department executive]

All of the representatives from local governmental public health agencies described a significant strain on staffing and resources. For most threats, the surge in workload meant that staff directly involved in response activities put in additional hours, and staff from other programs were redirected from standard job duties to response activities. In some cases, state and federal public health agencies provided supplemental support.

During [the measles outbreak], both on the weekdays and the weekends, we had staff who were being pulled every single day away from their regular program. I would say three to five staff from other programs, for about a month, were being pulled away from their regular work to come over to help us; and for the entire two months, those nurses and epidemiologists who worked with us were redirected one way or another toward responding to this event.
[local epidemiology lead]

We had to divert from our normal daily tasks of investigating. Our state health department partners who were not immediately impacted in the contact tracing and contact monitoring were able to absorb some of those activities.
[local epidemiology lead]

We have a finite number of these disease intervention specialists, and they're pretty maxed-out on cases. This [event] made the disease intervention specialists work more than their regular hours, work evenings, go out to off-site entities.
[state infectious disease specialist]

At that time, we had about thirty nurses who conducted community outreach for a variety of different reasons, not necessarily even focused on infectious disease, to take care of families with various medical and public health needs. They were all redirected, at one point or another, to assist our program in responding to the event.
[local epidemiology lead]

The redirection of staff and resources meant that business as usual was put on hold or delayed.

Instead of following-up on that salmonella case in one day, you follow-up in two days. Instead of following up on the whooping cough case immediately, you follow-up two or three days after it comes in. Our staff who conduct outreach to needy families, there were going to be fewer visits that were going to happen for a couple of months to those families.
[local epidemiology lead]

We had to stop doing regular maintenance for drainage. We had to reduce our pavement program. We had to reduce our guardrail construction and maintenance program, and we had to reduce our mowing program and potholes program. Anything related to roadway was drastically cut-back to accommodate what we needed to handle in mosquito control.
[local vector control lead]

The strain on the public health system's workforce and resources was often exacerbated by funding cuts that left agencies understaffed and overextended. In addition, local agencies reported that these response activities typically were not resourced.

[Outbreak response activities] are not resourced with any funding. Whenever they occur, you have to pull resources that are already probably doing 115% of a job to do another 5 or 10% in their job.
[local health department executive]

There is a strain on staff, but that's directly tied in to how much staff we already have in place.
[local health department executive]

The monies that became available to support some of the activities that the health departments were taking on, for example, came much later in the game.
[local preparedness lead]

The duration of the surge varied from incident to incident. For established threats, like measles and foodborne illness, outbreak timelines were easier to anticipate. For novel threats, like Ebola and Zika, the duration and scope of response was constantly evolving.

It was exhausting, and it did not seem like there was a defined end in sight.
[local preparedness lead]

Part of what was hard for a lot of the staff was not knowing when this was going to end. It wasn't like we had this very clear recovery date, it just sort of continue to grow and grow and that was challenging for those front line staff that were doing all of this extra work, particularly with the monitoring on weekends and outside of hours.
[local preparedness lead]

For these novel threats, the work was relentless and worrisome to senior leaders. While support from state and federal agencies was invaluable, local staff bore the brunt of work and thus had high rates of response fatigue.

My young epidemiologist staff – I think the median age is twenty-eight – most of them had been with the health department for less than a year and a half. It was incredibly difficult for them. This was the first very intense major public health response they had ever been through.
[local epidemiology lead]

We understand the physical effects of exhaustion on a team, on decision-making, on ability to function, and on burnout. This [response] burned out my team – I will say that – and this is very heartbreaking for me as a supervisor to see a team go through this.

We did not do this by ourselves. We had a great deal of phenomenal support from CDC and from State partners, and they were there alongside of us. But again, they got to rotate out after twenty-one days and my team did not.
[local epidemiology lead]

STATE GOVERNMENT

The burden of response on state public health agencies varied by jurisdiction. In some cases, the local agencies were less experienced or resourced, and state staff were called in to provide leadership.

The local jurisdiction had only two environmental technicians, and we needed five to conduct the field investigation, so we needed to pool our resources from the state and from the university.
[state epidemiologist lead]

In the case of larger scale threats or outbreaks, state staff were coordinating across regions rather than in specific jurisdictions.

We had to have our financial team track costs of outbreaks, make sure that we had materials ready for local health departments to disseminate, have communication tools ready, work with epidemiologists from other areas to bring them up to speed with what we needed them to do to, whether follow up on activities for the outbreak or support other activities that had to be left alone by the vaccine-preventable disease team.
[state epidemiologist lead]

Still, state agencies did experience staff and resource burden. For example, response to just one outbreak in one state exhausted the annual budget line item for travel. State staff also had to put their regular jobs on hold during events.

When we have an outbreak, I'm not the major investigator, but I need to know [what is going on], and all the rest of my work will be on hold. There's nobody that will do anything for me [at the state], because it's just me, and it diverts a lot of attention.
[state epidemiologist lead]

HEALTHCARE SYSTEMS

Preparing a facility to screen for, assess, and treat cases during an outbreak has an expense. Beyond the cost of treating sick patients, outbreaks often require shifts in practices, specifically related to the use of personal protective equipment (PPE) and data collection. In some cases, the strategy for preparing involves a "tightening up" of the policies and procedures already in place. In others, the normal practices need to be updated or modified.

When our hospitals initially started having to do this screening of folks for travel and fever, it was like "Oh, my god. This is going to take so much time in triage and blah, blah, blah," but even today, it's still a part of their triage now. What started as a reaction to an event that occurred has now become part of their practice. Folks, when they come in, they automatically get screened. Many of them wrote it into their electronic patient records, so as they're entering them in and these questions pop up, if they meet the algorithm, it'll pop up and say place in isolation. It's become their norm now, which is good, because it keeps them on the heightened awareness, and they can be the first folks that identify this trend.
[regional preparedness lead]

Because of the nature of healthcare facilities with providers interacting with sick patients, healthcare system leaders were especially concerned about protecting staff from exposure to infectious diseases. Changes to recommendations related to PPE posed additional challenges. In addition to acquiring and storing the supplies, staff required training, practice, and in some cases, fitting of equipment. Participants described how the time and resources necessary to prepare the workforce and facility for a threat influenced their decision-making.

If you've got a large medical center of 15,000 employees, I don't know who's going to encounter them, so now do I fit-test 15,000 individuals plus my physicians plus any contractors that come in? How far do you really go on all of this, or do I just do a small cadre of individuals and hope that nobody else gets in contact with this person inadvertently?
[regional preparedness lead]

There wasn't a whole lot of information consistently coming out about the different types of personal protective equipment you should be using. Do you just use a basic surgical mask or was this is a big, bad disease? I remember thinking that if I was still in the emergency

department, my staff would be wearing more than just a surgical mask.
[regional preparedness lead]

As facilities made decisions about what levels of protection to adopt, the actions of their peers came into play.

A lot of folks, like at the hospital, didn't have the same level of protection. They said that because [the emergency medical technicians and firefighters] were at in a higher level of protection, it made their hospital staff feel like the hospital wasn't protecting them properly.
[local health department executive]

During one outbreak, health care workers who were monitored following exposure experienced stigma within their communities.

The healthcare workers themselves experienced stigma when others learned that they were being monitored, being considered one of the contacts. For example, they were told that they were not welcome at their gym. They also were told that their family members, who were not contacts, were not welcome in schools. We had examples of children of nurses and physicians being told that their school would not allow them in school until their parents had completed their monitoring period, even if there was no risk from that child. That was something that was completely unexpected.
[local epidemiology lead]

Healthcare facilities also had concerns that receiving a case of infectious disease might cause damage to their brand or reputation after some organizations experienced dips in revenue and cancellations of routine medical treatment and procedures.

[Other facilities] saw what happened to [the hospital in Dallas] and they saw what happened to the staff. They didn't want folks to say, "Well, I don't want to go to your ER because the Ebola patients are going there."
[local preparedness lead]

MEDICAL SUPPLY MANUFACTURERS

During infectious diseases outbreaks, the need for PPE, such as face masks and shields, increases as healthcare facilities, healthcare providers, first responders, public health responders, and the public take measures to protect themselves. At the beginning of a threat of an infectious disease outbreak, manufacturers often experience a surge in customer demand. This can be manageable if the threat is local or regional. However, when a threat is global, or even national, this puts a strain on the supply chain and manufacturers do not always have the most accurate information about who and which locations to prioritize. Participants reported difficulty obtaining desired equipment in a timely manner.

Initially getting the proper personal protective equipment was difficult. Once CDC upped their recommendations, everybody was trying to buy it across the nation.
[regional preparedness lead]

Hospitals order more than they need. They panic, and they order from everybody, hoping they'll get something, so they create a lot of false demand. Then, they want to cancel orders, and they want to return stuff.
[product manufacturer]

Most manufacturers do not keep a supply of product on hand for surges because it is not good business practice. Rather, they practice "just-in-time" production and ramp up manufacturing to meet customer demand.

I will bust my butt to make as many masks as I can, to help as many people as I can when it happens, but I can't spend millions of dollars waiting for something that may or may not happen.
[product manufacturer]

We were running [our machines] seven days a week trying to make enough face shields for our customers.
[product manufacturer]

For one manufacturer, this lesson was learned the hard way. Manufacturers were weary of creating long-term production improvements if the market would not support that level of production after the threat diminished.

For one outbreak we tried to fulfill the face mask orders of everyone who came to us. We hired hundred-and-fifty people. We built machines. We bought a bigger facility. Everyone said they were going to stay with us [for future orders], but they didn't. We nearly went out of business because we geared-up and hired all these people, and then [the customers] all went back to foreign-made masks.
[product manufacturer]

What we traditionally see is that the demand goes way up, and then one day it's like somebody says, "Okay, everybody stop wearing masks," and it just quits. It just – boom – quits.
[product manufacturer]

LOCAL ECONOMY

The impact of infectious diseases on local businesses seemed to be linked to public perceptions of the threat and tended to be hyper local. For "known" threats, such as measles, the impact appeared to be minimal. For novel threats, such as Zika and Ebola, however, the impact was much more noticeable.

For multiple disease events, restaurants, bars, and shops located in a "hot zone" or near a publicized treatment facility reported measurable declines in patronage and revenue. Some businesses closed during the threat or laid off staff. Many participants also provided anecdotes about local impacts.

I heard that there were large office buildings full of small dental practices and private practices in the building complexes adjacent to the hospital where patients just simply cancelled their appointments

because they didn't want to go even near [the facility where the patient was treated].
[local epidemiology lead]

I heard of pizza delivery people who did not want to deliver pizza to the building [near the facility where the patient was treated].
[local epidemiology lead]

Public perceptions about the threat of disease also appeared to factor into decision-making about travel and recreation, which could have an impact on a local economy dependent on tourism and hospitality.

We had calls from people who were very concerned about whether [the theme park] was safe.
[local epidemiology lead]

There probably is a proportion of people who are traveling to specific cities knowing that they're having sex, and they might choose a different city or a different place if there was a drug-resistant outbreak of a sexually transmitted disease, particularly among the gay male population.
[federal infectious disease specialist]

A friend asked me, "My daughter is having a wedding, and she's invited a lot of her friends. Should we cancel? All of her friends have young families and they don't want to get infected. What should we do?"
[local vector control lead]

Businesses grappled with fiscal decisions connected responding to threats. Some reported closing outdoor portions of their facilities to protect patrons from mosquito-borne illness, risking revenue loss. Others, while spared for past outbreaks, might make different decisions in the future based on potential for exposure alone.

What was also concerning is that [the theme park] is a fair-size place; it's a community unto itself. The number of people exposed was certainly going to be in the thousands. We know that between forty and fifty thousand people visit every day.
[local epidemiology lead]

GENERAL POPULATION

These disease events or outbreaks were found to raise the public's consciousness about the cost of not vaccinating and about childhood vaccination rates.

It raised a concern, and it certainly built momentum for people who were pro-vaccination, who believed in keeping their kids safe, to make their voices heard. This event was a significant driver that was referenced very consistently toward the passage of the State senate bill.
[local epidemiology lead]

Some outbreaks revealed the where the public's trust, especially among vulnerable populations, was weaker.

What we found out in the response was that there are pockets in the community that didn't necessarily trust government, especially from the African immigrant population.
[local health department executive]

Often the public's fear of infection is out of proportion to their actual risk, causing unnecessary stress, discrimination, and social distancing. News media shared numerous instances of discrimination and needless spending in response to threats. A public college in Texas stopped accepting students from Nigeria. A school shut down three campuses after a family with two students traveled on a flight with an exposed healthcare professional. Another school spent $36,000 on precautionary cleaning after a student was tangentially linked to an exposed individual. Participants shared similar stories.

The psycho-social piece of [the threat] was definitely more impactful than the actual disease itself. It was the concern and fear of the disease, not necessarily the disease being a risk for most individuals. Their sense of fear for the disease was much greater than their actual risk for it.
[local health department executive]

I had some quiet conversations with people through our health department who were feeling stigmatized from interactions that they had in the community. They felt like they were being treated differently because they were from a West African nation, never mind that they had been in the United States for the past 20 years and had not gone back to their home country.
[local preparedness lead]

The healthcare system players also fell victim to fear and discrimination. Multiple participants described how some facilities were reluctant to get involved in response efforts for the Ebola outbreak.

My husband was working at the house and had fallen and needed to get some stitches in an arm, and we went into an emergency department out here in Houston. Went into an emergency department, and right on the door was a sign that said if you have been near or live by whatever the address was in Dallas, don't come in.
[local preparedness lead]

Hospitals here locally were working to become prepared, and they were all gung-ho and "be prepared" until Dallas happened, at which point absolutely nobody wanted to have an Ebola patient. There was this huge shift in their mentality once Dallas had their case.
[local health department executive]

We have this freestanding emergency room and they want to not accept a patient that's being transported by emergency medical services because the patient says they drove through Dallas. They clearly didn't have a clear understanding of what that true risk was at that point and they were just so scared.
[local preparedness lead]

What are the barriers and enabling factors encountered by state and local jurisdictions that could be modified to prevent impacts of future outbreaks? (e.g. through policy or practice changes at the federal, state, and/or local level)?

For all intents and purposes, the United States has remained relatively well protected from outbreaks and pandemics, with low levels of mortality and morbidity impacts due to the U.S. public health infrastructure. All of the participants credited the dedicated public health practitioners at the local and state levels, strong public health laboratories, astute local clinicians, and support from the CDC with controlling and containing the threats. However, participants did note a number of factors that helped or hindered their ability to assure global health security.

EXPANDING KNOWLEDGE AND AWARENESS OF THREATS

Several participants noted that most clinicians in the United States do not regularly see many of the infectious diseases that threaten global health security. This ranges from known diseases, like measles, which has not been endemic in the United States in decades, to novel diseases like Ebola that have never been seen here. This lack of knowledge, awareness, and experience with threats may lead to misdiagnosis and the unnecessary exposure of others. The slower clinicians are to diagnose, the more potential spread public health practitioners have to control.

Most providers don't see [certain infectious diseases] much in this country, so patients are routinely not diagnosed the first time they are seen. They need to be seen twice or a third time before the provider thinks of infectious disease, and that means two or three clinic or emergency room visits, and that means a widening scope of number of people who are exposed.
[local epidemiology lead]

Likewise, the public is no longer familiar with many infectious diseases, nor do they truly understand the risk and negative consequences. When the public does not perceive a risk, they are less likely to follow public health best practices.

For those generations where they got to actually see the threat of infectious diseases, people were real happy to do whatever the right public health things was; but today we live in a society where people don't see it, and they hear us ringing the alarm bell all the time and then nothing happens, so we're dealing with a very different society today; they're far more kind to their own personal individual rights than they are looking-out for the rights of the kid down the street.
[local health department executive]

ACKNOWLEDGING GLOBALIZATION

The effect of globalization was clearly experienced by local jurisdictions. All participants noted that their local communities and economies have numerous connections to the rest of the world. Workers and students legally cross borders every day for jobs and for school. Airports add flights to international destinations with unique health threats every day. U.S. residents travel for work, mission, and pleasure on a regular basis. Local health departments must take these connections into consideration when designing their infectious disease programs.

What are the travel and country of origin questions that need to be asked? When those change, you have to make sure that the providers are updating their materials, updating their question lists so that they are asking the right questions.
[local health department executive]

One of the interesting partnerships that developed from a global perspective is since we're an oil and gas community, we really started to build partnerships with some of our workforce partners that had employees in the affected areas.
[local health department executive]

We cannot just stay insular, we have to be thinking about this as an interconnected world. An American, living in our country in a local community may decide that he want to take a business trip or a personal trip or they have a family member that's visiting her, or they have an exchange student that's coming over. We can't - in the health realm - forget about all those interconnections.
[local health department executive]

Given the diversity of American cities, if an outbreak is happening globally, there is a good chance populations in the United States are affected – whether mentally, socially, or sometimes physically. As one interviewee said, "In general, there is an impact on the local level, regardless of whether the disease actually makes it to the local level or not".

Why do we not think about when there is a, especially from a mental health standpoint or a social connectedness standpoint, of what's happening for a resident here who might have ties globally?
[local health department executive]

This new community resilience officer position is to actually now build bridges to these other communities. One, so we continue to have the trust of the communities, not just in the midst of Ebola and Zika but on an on-going basis so you can leverage it during emergencies. But number two is to really also think about when emergencies don't

always happen in our jurisdiction or even our country or when it happened in another setting, how does that play out for our residents and their health and wellbeing even from a social connectedness and a wellbeing standpoint–mental health-wise.
[local health department executive]

CULTIVATING CULTURAL HUMILITY

Some participants expressed concern about the ego of the United States getting in the way of bi-national or multi-national approaches to global health security. Local and state jurisdictions may not be accustomed to collaborating with neighboring jurisdictions that do not necessarily have the same values, resources, constituent concerns, and strategic priorities.

Five to ten percent of the cases were tested for laboratory-confirmation. By U.S. standards, it was like, "Well, what do you mean they're not testing every single person?" but part of the job, part of our role within the state government is to explain to our own agency that not every country runs everything exactly the same.
[state health department executive]

I remember one time we had an epidemiologist at the state who said, "We should shut down the beaches and issue a public health advisory." Luckily, our director at that time said, "There's no way that the state is going to issue a public health advisory and tell another country to shut down their beach."
[state health department executive]

We don't have control over what treatment recommendations another country might have. We can't tell any other country to recommend a different treatment; yet, those conversations should be happening around the world, where people are in agreement as to what the strategies are to reduce the likelihood of the spread of disease.
[federal infectious disease specialist]

Participants described situations in which the strategies suggested and materials provided by U.S. experts did not meet the needs of local populations. In those cases, local jurisdictions sought guidance from other sources and countries. Likewise, at times the U.S. resources were deemed more trustworthy and were shared with foreign partners.

The information that [the CDC] sent us to share with the public was not of use in this area. We ended up working with the foreign government, and they shared their information with us about how they communicate that with the public.
[state health department executive]

Our people here were actually shipping some of our educational materials, emailing them, sending them back over to their family in Liberia, because it was our understanding from the community here that the population in Liberia didn't necessarily trust the government there.
[local health department executive]

Through mutually respectful and beneficial relationships with other jurisdictions, both foreign and domestic, state and local health departments were able to strengthen their ability to protect the public's health.

If the foreign government's laboratory system works better because they received some training here in our laboratory, then that's better for us. If our epidemiologists are better trained because of something they learned in that country, we're all safer.
[state health department executive]

If we truly want the borders to be safer, we need to work that much closer with our colleagues on the other side. The important thing here is, there's got to be something in this for them, or else they're going to see this as, "It's just U.S.-driven".
[state health department executive]

SUPPORTING PLANNING, PRACTICE, AND PARTNERSHIPS

It was clear from multiple discussions that planning, partnerships, and practice improved the ability of local jurisdictions to respond to global health threats. Many participants described extensive planning and practice prior to and during events. Unsurprisingly, planning with all affected parties led to enhanced trust and better plans.

We held a meeting with city officials, including public health and emergency medical services (EMS), medical directors, and came up with kind of a basic blueprint to go from. Then later that afternoon, we actually did a full-scale exercise with the fire department and with one of our hospitals based on this blueprint plan that we had just put together. From that point, that was a very eye opening one, and we were quickly able to realize what PPE issues we needed to address, what type of patient handoff we needed to address, the education and training that needed to go into all of our EMS providers as well as our hospital receiving folks, so we got to work then on developing those types of things, going through as much research as was being put out.
[regional preparedness lead]

When we developed these protocols, they were developed jointly. So, it wasn't our state telling the other country, "Hey, you need to do this for us," but it was us coming together, and them telling us who would be the key person, and then us letting them know, as well, and so working…that's part of us developing that trust.
[state health department executive]

Building these relationships prior to threats or outbreaks contributed to problem solving for concerns like securing needed supplies or anticipating public relations issues.

It didn't make sense for over 50 hospitals to stock in the same way whereas let's have the hospital stock sort of that immediate, if that patient walks in the door now, can we cover the next 24 hours or even

12 hours, and then we can pull from the regional cache as needed. So, that was sort of one of the strategies that was adopted local/regionally to address some of those issues.
[regional preparedness lead]

It's always good to get [partner] input to make sure I understand what their concerns are, and to make sure that there isn't something that they are seeing that I am not seeing. At the same time, their suggestions are always simply that – suggestions. We always felt comfortable as an agency with what we were going to tell the public. [The corporate partner] had feedback, but it didn't modify our response to any significant degree.
[local epidemiology lead]

In addition, local public health agencies stressed the importance of building relationships with communities within their jurisdictions so that when threats occur, they can more easily reach members.

The local health departments were very good about communicating through the bishops of the families. In this community, they get a lot of their leadership through the bishop of their church.
[state epidemiology lead]

Finally, planning, practice, and partnerships were all common to jurisdictions that opted to "lean forward" for global health threats. These health departments adopted frameworks like "One Health" to integrate and strengthen their approach to containing infectious diseases.

Every 9, 12, 18 months there is going to be another global disease that is a threat. It may not be an impact, but at least a threat to the community. It has really changed the way that we, as an organization, monitor, prepare, and ultimately, respond. You have to lean forward on these or you'll get caught flat-footed and unprepared to deal with them when they're on you.
[local health department executive]

We're trying to take a One Health approach. We have regular meetings with both our game and fish and department of agriculture and some of our veterinary schools here to make sure we keep in communication and let them know about what we're up to, what they're up to. Often times, there will be indicators that one population will affect the others. We do have to talk to them on a regular basis. It does help cement that relationship.
[local health department executive]

Our department has been very forward thinking and linked in with things that are happening not just across this state of ours, not just this country of ours but also globally. We're on a number of different listservs and we do a lot of real global health monitoring.
[local health department executive]

We feel very strongly as a department that global health is domestic health. We're one of the few departments that has human health, animal health, entomology, insects as well as the environmental health under one umbrella.
[local health department executive]

STABILIZING CAPACITY AND RESOURCES FOR PREPAREDNESS AND RESPONSE

At the state and local level, many noted that response capacity, whether laboratory testing and turnaround or surveillance, or case-follow up, will be heavily dependent on the local public health infrastructure that already exists when an outbreak is detected. This has been a difficult ebb and flow existence for many working in emergency preparedness because the infrastructure follows the funding–federal, state, or local dollars–which changes depending on the timing of crises.

The community is not putting any investment into public health at the local, state, or regional level because they don't see the need, because there's not a crisis; but when a crisis comes, we're going to be so far behind in terms of infrastructure and expertise and manpower, that I'm really afraid of what's going to happen. We're going to be completely unprepared. We have been so fortunate for so many years that we have totally put all of our guard down. The Public Health Army no longer exists; it's just not there.
[local health department executive]

Federal support has been very helpful because it's extremely difficult to do anything like that with our State-based funding. We have some staff members now who are especially tasked with following up in the community, following up with patients; that's been something that's come along in recent years.
[local infectious disease specialist]

I feel like this is the job of the state, local and federal level to make sure that there are public health systems in place to support these kinds of outbreaks, and to be able to do surveillance to know what is even circulating in their region.
[federal infectious disease specialist]

Nearly all of the jurisdictions described funding cuts or funding gaps that made maintaining preparedness levels and surging for response more difficult. Without consistent and reliable funding, public health and healthcare systems find it challenging to maintain their capacity to control threats. This is evidenced in part by the participants references to workforce challenges during events.

Prior to Zika, though, and during Zika, there was a drastic reduction of state level of funding for our local mosquito control. In the past, we would get several hundred thousand dollars from the State Department and Agriculture to help support the local Mosquito Program; in 2015, that level was reduced to forty thousand a year, and that really didn't help us.
[local vector control lead]

Every year public health funding gets smaller and smaller, whether at the state, regional, or local level. I think we're down to about thirty percent of our budget from the city's general fund, and seventy percent funded by outside grants, and that's just mind-boggling.
[local health department executive]

Often, the emergence of a global health threat in the United States is followed by an increase in public funding. Participants experienced these patterns in their local jurisdictions. Reactive, categorical funding is not consistent, which also makes it hard for health departments to maintain staffing and capacity.

I would argue that funding continues to be reactive and event driven. You have this buildup of funding after a lot of that initial effort has already taken place. Your health departments are already a little bit burdened. Then these funds come through and you use that and then that fund goes away because they say that the immediate risk is gone. And then six months later, something else is happening, and you're building up again.
[local preparedness lead]

[After the event] a number of the public health laboratories and the laboratory response network got funding through the CDC for the creation of a lab biosafety officer position and that officer to address lab biosafety issues both directly inside of the lab, as well as with hospital-based, commercial, and private labs in that region as well. That was a really nice addition to the resources within that laboratory response network system and it enhanced capacity, both for that lab as well as other labs across the region. But it was three years of funding, and now it's gone.
[local preparedness lead]

From the healthcare perspective, participants stated that it was difficult for hospitals, ambulance services, and other providers to be reimbursed for expenses related to preparing for and responding to infectious diseases.

For taking someone to the hospital for appendicitis, the ambulance service gets $200. For transporting somebody with a highly infectious disease, they get $200. There's no level of reimbursement for highly infectious diseases. The hospitals, again, reimbursements on infectious disease are not going to meet the costs of what they've put out keeping that equipment up and running and in working order and replaced.
[regional preparedness lead]

While the CDC does invest in state and local capacity, including enhanced surveillance for certain infectious diseases, many participants expressed concern about outbreaks occurring in areas without strong disease control and prevention programs. If an outbreak occurs in an area without the workforce and resources needed for investigation and control activities, the threat is more likely to spread. Likewise, there was some concern about the lag between the onset of a threat and a jurisdiction's capacity to identify and intervene.

It's unlikely that the specific places that the CDC is doing surveillance are exactly the places that any sort of outbreak would necessarily occur. A big outbreak could occur in a different city where the CDC doesn't have any infrastructure set up at all, and that could cause more challenges, and particularly to some programs that have been really depleted over the last number of years.
[federal infectious disease specialist]

We have to get certified to conduct tests relative to these new diseases; therefore, there is a time lapse, and there's a capacity issue. There is a strain on staff, but that's directly tied-in to how much staff we already have in place.
[local health department executive]

A primary impact of gaps in funding, training, and workforce is staff burn out. None of the participants reported experiencing reluctance among public health staff to work during an outbreak. On the contrary, staff members were often willing to go above and beyond due to a sense of duty to protect the public's health.

[Our staff] were all eager to work and help because they were all very concerned and they all wanted to help. Getting them to work long hours, and getting them trained to do other things that they weren't comfortable with…It wasn't an issue of folks not wanting to help.
[local vector control lead]

Several participants described the response fatigue that sets in when staff members work endless hours for prolonged periods of time. In addition to the stress at work, threats such as infectious disease are accompanied with concerns for personal and family wellbeing. The stress of these events weighs on public health and healthcare staff.

I'm concerned about staff burnout. I really am. We've had a lot of staff that has stuck with us through a lot of these things. Staff burnout is definitely an issue.
[local preparedness lead]

It's a little bit of a PTSD that you experience at the health department from an event like that, that consumes your staff members personally, and just consumes hours. It takes a physical/psychological toll on your immediate workforce that I don't think people ever generally talk about.
[local epidemiology lead]

CREATING INFRASTRUCTURE FOR REAL-TIME INFORMATION SHARING

Access to real-time data played a large role in successful disease control and intervention. Participants praised timely clinician reporting, rapid laboratory confirmations, and electronic case reporting with positive outbreak experiences. Many participants reported using data to target mitigation strategies, such as spraying for mosquitos in areas with higher ratios of women of childbearing age during Zika control efforts.

Our local public health lab played such a critical role in providing us laboratory diagnosis very quickly. Other counties around the state recognized that not having that capacity locally, or the ability to get that testing turned around quickly, could be a significant issue. So, I do think that it's made everybody think through how to assure that when there are suspected cases, that you don't have a five- or seven-day delay in period of time before they are diagnosed.
[local epidemiology lead]

In some jurisdictions the ability to share information across jurisdictions–and even borders–in a timely manner was especially important. When official information channels proved inefficient, state and local agencies developed informal solutions to meet mutual needs.

There's always that lag of epidemiological information–how long it takes a Ministry of Health to make the data official. If you can imagine an outbreak on the border, and you relied on this federal-to-federal, and you had a two-week lag of information, that would be very dangerous.
[state health department executive]

If every time they requested something, it took two weeks to get them the answer, I think there would be a lot more mistrust, and there would be a lot more hysteria about what's really going on.
[state health department executive]

I do think because we have such a good relationship, we could share data about the cases on either side. We shared our data with them and they shared their data with us, which is unusual, I think, for most countries.
[state epidemiology lead]

ADDRESSING SUPPLY CHAIN FRAGILITY

Some outbreaks exposed the fragility of the medical supply chain, especially for medical countermeasures. A large portion of U.S. supplies, like face masks, come from foreign sources that many are concerned will not be able to ship to the United States during a severe global event or pandemic. Several reasons for this include, federal regulations limiting the origins of medical device imports, the manufacturer being unable to produce goods due to workforce shortages created by some outbreaks, or the need for devices and supplies being greater in other areas. The implications of this are massive.

If our normal importers can't meet that need because they're meeting somebody else's need which is greater, then we can't, unless we get a dispensation from the Food and Drug Administration to allow - let's say - France to send us the equipment, we're not getting the equipment.
[regional preparedness lead]

When you've got all 50 states, you've got the territories, you've got the CDC, you've got the World Health Organization, you've got everybody else now on a standardized approach to what personal protective

equipment looks like. There's not that many manufacturers of it, and it's got to go through a lot of quality testing to be sure that the seams are closed and the filters are working properly, and so they can only manufacture so many. So who gets them first from the manufacturers?
[regional preparedness lead]

IMPROVING ADHERENCE TO AND ENFORCEMENT OF PUBLIC HEALTH RECOMMENDATIONS

Participants mentioned several factors that make it difficult for the public to follow or for authorities to enforce prevention strategies. Many workers do not have paid sick leave or cannot afford to miss work. When individuals feel like they have to choose between getting paid and spreading illness, they are likely to be influenced by their fiscal wellbeing and show up to work anyway.

Some states, like Texas, only allow orders to be delivered in person, which can be more difficult or time consuming to achieve. Also, in Texas, public health authorities can quarantine somebody in their residence against their will, but there is concern about the ability and desire of law enforcement to back up those orders.

I can quarantine a whole city block or a whole neighborhood if I need to. The problem, then, is enforcing the quarantine because law enforcement doesn't always feel empowered. We're here in Texas, and you've got a guy who's supposed to stay in his house, and he says, "No, I'm leaving," and the police officer says, "No. We've got this court order, and you need to stay in your house," and he says, "Damn the court order. I'm getting in my truck and I'm driving out the driveway. You're going to have to shoot me to stop me." I don't think you're going to find a cop who's going to shoot him.
[local health department executive]

On the healthcare side, participants stressed the importance of clinicians being aware of and following screening and treatment recommendations for infectious diseases. Likewise, insurance reimbursement policies might not align with screening recommendations, allowing potential cases to slip through the cracks.

You can have gonorrhea in your genitals, in your throat, or in your rectum. There are certain insurance policies where you can have one gonorrhea test, but you can't have three gonorrhea tests even though people have three anatomic sites that can be exposed to gonorrhea. Perhaps somebody getting tested for gonorrhea in their urethra, but they don't get tested in their throat. They were treated for urethral gonorrhea, but they weren't monitored in their throat, and pharyngeal gonorrhea is much harder to treat.
[federal infectious disease specialist]

BUILDING TRUST IN GOVERNMENT

If the public does not feel comfortable going to public health agencies when they have a potential infectious disease, it might increase the risk that the disease will spread throughout a community. The relationship between the local health department and the public is both integral to successful disease control and prevention and susceptible to damage. During threats and outbreaks, the gaps in trust become clear, as demonstrated during the Ebola and Zika threats.

People were not trusting what CDC said. Within the first week of our response it dawned on me that there was something terribly wrong in the depth to which the public's trust had been shaken in public health agencies.
[local epidemiology lead]

A number of factors affect the trust the public and partners have in governmental public health. Many participants emphasized the importance of communication and messaging, including traditional public relations and grassroots strategies as well as the messages perceived by the public through the actions of the government. Many participants were aware of potential reluctance to trust government agencies and took care to adjust their strategies and messaging to be responsive to local concerns and fears. Often, this approach resulted in higher engagement with the public and less pushback or controversy over control and prevention strategies.

The local health department did alert the public first through the media. They knew that they were coming. That really made a big difference in the acceptance by those they did interview, because many of them did say, "Oh, yes. I heard about this on the radio" or "I read about it or saw it on TV".
[state epidemiology lead]

We have to be very culturally sensitive; we have to be able to let individuals know that they can trust us, that we are not going to turn them over to the government.
[state infectious disease specialist]

One of the questions people always asked was, "What are you spraying?" and "What is the impact to me, my kids and my pets?" So, when we talk about larvicide, we always talk about the reason that we chose the product we use is because it's a biological product. It's found naturally on the earth, and it's organic. In fact, we always mention that you can spray this over an organic farm, and the farm will still be organic, which relieves a lot of concerns for folks.
[local vector control lead]

Many participants observed the experiences of other local health departments to learn from their setbacks and successes in working with the public to control infectious diseases.

The reason we shut the program down is because there was so much controversy about inhalant spraying in a neighboring county, and we didn't want to get that message mixed that, "Hey, you're spraying an inhalant up here?"
[local vector control lead]

What are the roles of all levels of domestic and international governments in global health security?

COMMUNICATION AND COLLABORATION

Global health security threats require a new level of coordination and collaboration among many players – some of whom may already be familiar with one another, such as state and local governments, and some who are less familiar with one another, such as local and federal stakeholders or local responders from two different countries. At an international level, communication and collaboration with other countries is necessary to maintain an appropriate awareness of what global health security threats are emerging or should be priorities.

Within local, regional, and state public health systems, support is needed to connect all the various agencies that play a role in protecting the health of a community, including public health, health care, vector control, animal health, environmental health, and more. In addition, there are needed connections between local and state jurisdictions, including across domestic and international borders.

What we have to do is to create a better network and tie-in between local health departments and the state health departments and the CDC to make sure that there is a surge capacity to confront some of the challenges that you mentioned.
[local health department executive]

Making sure that this information is shared as soon as possible with enough information to provide guidance for the first responders and the receivers, the healthcare providers. I think that's essential. If the federal agencies have that information, then we can share that, and we can also help cut down on the stuff that the public is hearing through the media.
[regional preparedness lead]

One of the reasons that we are able to maintain this level of trust with our international partners is that it's very important for them that when they share this unofficial information, that we do not go to the press and share any of that information.
[state health department executive]

GLOBAL SURVEILLANCE

In addition to working bilaterally with other countries to stay abreast of the current trends of viruses or ongoing outbreaks, global surveillance is something that can be done at all levels of government. Proactive surveillance is necessary to inform preparedness and mitigation efforts, trigger screening protocol and response activation, and ensure the proper prophylaxis and treatments are recommended and shared with all partners.

Ebola was a reminder of why global health and domestic health are so intertwined and something that would be happening globally can very quickly happen here locally. This is why we have to remain cognizant of the intersection of global health and both security and safety and health of our communities.
[local health department executive]

In order to conduct surveillance and to know what's being introduced and where it's coming from, it would also be helpful to have a more complete or international bank of the various strains that are occurring in various regions and countries. If there isn't a bank that is to be referenced of the specimens, it's then really hard to track-down where it's coming from. If we knew where these specimens were originating from, that could be very helpful information to then focus resources not just at a local level or nationally, but also internationally to identify where the problems are truly occurring.
[state epidemiology lead]

However, with this increased surveillance there is also a need for coordination on decision-making, or some guidance on how to process the surveillance data. For example, there is a newly circulating outbreak of Ebola in the Democratic Republic of the Congo as of Spring 2018. State and local governments in the United States are naturally keeping an eye on this to ensure they don't revisit the experience in 2014, but at what point more activities should be triggered is a lingering question.

Do we know that all of those folks in the DRC that are infected, that they are all really low income [and rural]? Because it's not just in the remote areas anymore. They've got it in an urban center; they've got some cases. How many links in the chain need to be in place before we start leaning forward?
[local health department executive]

GLOBAL CAPACITY BUILDING

Beyond the roles of collaboration and global surveillance, there were many participants who endorsed the role of the U.S. government in building global health security capacity in other countries in order to ensure threats can be identified and contained at the source before they make their way to the United States.

It's so much easier to put out a fire when it's small, and it's the same thing with infectious diseases: It is so much easier to stop it when it's a small outbreak. I absolutely love the train of thought and the mentality of the federal government trying to help stop these outbreaks where they start, and not letting them get imported here; by the time it gets imported here, it's too late.
[local health department executive]

I am in complete agreement and support with the federal government's efforts to confront global health threats at their source; I think that's absolutely critical, and there's no question that is something I believe is very important, and I am proud that our government is able and willing to put in those resources to be able to help to do this, because I think that's the only genuine way to deal with these emerging global health threats, to be able to assist in combating them at their source.
[local epidemiology lead]

I remind folks here in our own state that there's nothing we are doing that is altruistic, honestly, and so if another country's laboratory system works better because maybe they received some training up here in our laboratory, then that's better for us. If their epidemiologists are better trained because of, maybe, training they took up here, or if our epidemiologists are better trained because of something they learned on due to improvements in their own system, we're all safer.
[state health department executive]

GUIDANCE FOR PUBLIC HEALTH AND HEALTHCARE PRACTITIONERS

Once there is an identified outbreak, many of the actions will take place at the local level, along with much of the decision-making. However, local and state governments often look to the federal government for guidance to help direct their response. Whether the issue is quarantine recommendations, treatment guidelines, infection control during hospital stays or transport, there is a need for a unified national approach to these types of outbreaks - especially when experts are uncertain where the next case may emerge, such as was the case during the Ebola outbreak. Citizens should expect the same treatment and restrictions for patients if they are diagnosed in Nebraska, New Jersey, or Texas.

We don't know what the other agencies across the country are doing if the federal level is not providing that guidance across the whole area.
[local vector control lead]

The role of the federal government is to help with the linkages and to provide appropriate guidance to locals and the state, to providers, as well as the public, regarding appropriate treatment and to monitor the success or failures of those treatments.
[state epidemiology lead]

From there, the local government will likely be tasked with interpreting the federal guidelines and recommendations and applying them to their local context, and then disseminating the right information to the right players at the local level. For example, as guidance changed regarding hospital intake during Ebola, it is critical that the same information is being shared vertically from the federal agencies down to the local level, as well as horizontally – from the local governments out to their local partners working on the front lines.

July through September 2014, CDC had issued a National Health Advisory about Ebola, which we were attentive to across the US. What we did locally was that we further disseminated these guideline documents and advisories that we were receiving from CDC and other professional societies to our local medical and healthcare communities.
[local epidemiology lead]

The other things that we did locally to prepare is we developed a screening questionnaire with our local hospitals. Also, we developed a screening, a decision framework, what we call an algorithm, for clinicians, specifically for emergency department physicians in our area.
[local epidemiology lead]

IMMUNIZATIONS

As they have done for several decades, maintaining strong immunization programs at the state and local levels for vaccines where available is an important role, and can be one of the best tools to prevent outbreaks of infectious diseases from other countries. This is especially important for Americans who travel frequently.

If you live in the United States – so you're never exposed to measles, but you elect not to get vaccinated – those two weeks or that month that you spend in an area where measles is endemic, you're a much higher risk to happen to have been infected right before you travel back, than someone who is immigrating here.
[local epidemiology lead]

Dislocation due to natural disaster or to war introduces risk in other parts of the world, and that's just inevitable. So, protecting ourselves, when we have an opportunity, like with a great vaccine like measles, becomes ever more important over time.
[local epidemiology lead]

LEADERSHIP AND DIPLOMACY

Finally, some roles can be difficult to measure and may not be clear until well after the outbreak, such as the leadership and diplomacy necessary to manage the range of emotions during an outbreak.

In addition, we were occasionally being asked to act more as care coordinators as opposed to what they had been traditionally used to, as epidemiologists, and needed to negotiate tough situations. People under monitoring would say, well, I need you to pay for my hotel room because I don't want to stay at home and put my family at risk. Or if they were told they couldn't go to the grocery store they would ask if food was going to be delivered to their house. Working through these requests without extra resources and maintaining fairness amongst all those being monitored required a hard look at what would set a precedent moving forward.
[local preparedness lead]

Recommendations Based on the Overall Findings

Generally, across all articles and data on impact areas analyzed, there are very few formal studies and reports done to describe the impact of past global health security threats on U.S. communities. While many of the outbreaks on U.S. soil have been handled swiftly and successfully, they are not without impact.

For example, because it was unknown where the next Ebola case might appear, the U.S. government set up screening at 5 different airports. But response efforts were not limited to these 5 cities. Instead, public health, local government, and health care staff in every U.S. city rightfully ramped up their surveillance and screening efforts, as well as specialty supply sourcing, to prepare for additional cases. The costs of these diverted resources and staff time in every major city across the country have not been fully quantified but are likely enormous. Furthermore, a global health security threat need not be of nation-wide consequence like Ebola to have dramatic impacts on local jurisdictions. Even more localized outbreaks (e.g. measles or dengue) may have unrealized consequences to the economy and society. Extra child care costs may be incurred and family stressors may be felt from the additional workload during an outbreak. Outbreak associated stigma, reduced tourism, and fear could result in losses to businesses and adversely affect the financial security of individuals and overall social cohesion of a community.

Most of the available literature on these topics focused on quantifying direct costs (to public health and healthcare) in time and dollars. But there is a need to better understand and qualify and quantify (where possible) the indirect costs of these threats and where the impacts are felt within a local jurisdiction. Using this information appropriately to guide decision-making and actions at all levels will be critical to avoid the mistakes from past events. The recommendations that emerged from the literature and case studies fall into two main categories: 1) improving understanding and 2) fostering effective action.

There are many gaps in understanding the impacts of the infectious disease events that have occurred in the United States, whether short- or long-term. In the heat of a response effort, it may be difficult to think about collecting data, but more complete knowledge about what negative effects the outbreak (whether real or perceived) is having on a community can help inform future planning and mitigation. A solid framework for research, more purposeful data sharing, and learning all emerged as needs to mitigate future impacts.

How can we better understand the impacts on local jurisdictions?

- Develop a framework for further research on impacts of threats to global health security (e.g., imported infectious diseases) that includes various sectors and metrics for assessing such impacts.
- Encourage the development of standardized research methodology and documents (e.g., Institutional Review Board application, questionnaires, consent documents) for collecting impact data during and following an infectious disease event or outbreak.
- Incentivize sharing of privately held data across sectors impacted by threats.
- Continue the U.S. investment in identifying, exploring, and understanding the impacts in other countries to better anticipate domestic impacts.

The second category for recommendation are policies and practices to either prevent or mitigate impacts from future outbreaks or epidemics. Experts agree the next outbreak is a matter of "when", not "if". The better prepared state and local jurisdictions are–working together with the many private partners

they depend on during these outbreaks–the better chance they will have of preventing adverse impacts in their communities.

How can all levels of government and their partners mitigate the impact on U.S. communities?

- Provide consistent funding for dedicated local or regional staff positions, functions, and resources to support planning, practice, and partnerships for global health security.
- Develop policies and foster practices that permit flexibility for local authorities during threats that permits them to bypass standard "chains of command" (e.g., procurement, data sharing, communication).
- Strengthen the supply chain for medical countermeasures through public-private partnership and communication pathways.
- Standardize evidence-based, international guidelines for case definitions, right-sized laboratory confirmation, treatment, PPE, mitigation, and prevention.
- Encourage open source international surveillance and case sharing capabilities and electronic case reporting for clinicians, laboratories, and public health partners.
- Develop policies and practices that align with infectious disease control and prevention needs (e.g., insurance reimbursement for transport and treatment, testing for sexually transmitted diseases).
- Conduct campaigns aimed at "norming" threats so that the general public, healthcare providers and public health professionals have a better sense of the true risk of disease, and are more likely to spot illness and take precautions and follow recommendations.
- Expand public health and healthcare critical infrastructure situational awareness.
- Update local and state policies and protocols to reflect global interconnectivity.
- Recognize the mental health burden on local staff when in prolonged response mode.
- Continue to identify, assess, and import practices and policies from other countries that could be applied domestically to help mitigate the impacts of outbreaks.
- Provide and ensure consistent and coordinated messaging across all levels.
- Educate policy- and decision-makers about how their policies can positively or negatively affect the public's health.

Conclusion

The infectious diseases that threaten the health, welfare, and security of communities throughout the United States are in large part determined by interrelated global factors. Thus, strong and sustainable public health surveillance, prevention, and control efforts across the globe are the first line of defense against infectious disease.

Chief among global infectious disease control and prevention is real-time information sharing between entities that do not typically exchange data rapidly (e.g., business to government, among competing hospital systems, foreign government to U.S. government). Joint planning efforts to establish and practice protocols build trust among these entities. Local and state leaders and practitioners emphasized the importance of support for communication and collaboration across borders, both international and domestic. In addition, simple and timely guidance for prevention and control (e.g., treatment, vaccination, case definitions, PPE) based on the data available bolsters local efforts.

Infectious diseases know no borders. No single nation can be protected if other nations remain unprepared to counter threats. Therefore, it is essential to build capacity at the source of an outbreak. In addition, because local jurisdictions in the United States are often the first to identify and respond to threats in their communities, a complementary investment in a robust U.S. workforce and infrastructure capable of detecting and responding to global health threats is required. Global health security requires leaders who understand the complex connections between their jurisdictions and the rest of the world and can practice the diplomacy necessary to develop systematic and proactive prevention and control strategies and build relationships for collective actions to mitigate risk.

For further information, contact:

Justin Snair, MPA
CEO and Principal Consultant
SGNL Solutions
jsnair@sgnl.solutions

Jordan Peart, MPH
Program Analyst
Council of State and Territorial Epidemiologists
jpeart@cste.org