Ready or Not?

PROTECTING THE PUBLIC'S HEALTH FROM DISEASES, DISASTERS AND BIOTERRORISM

2017

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Acknowledgements

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INTRODUCTION

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PROTECTING THE PUBLIC'S HEALTH FROM DISEASES, DISASTERS AND BIOTERRORISM

In the 16 years since the 9/11 and anthrax tragedies, the country has had countless reminders demonstrating the need for a sufficient response to the public's health needs during major incidents—be they caused by extreme weather events, disease outbreaks or a contaminated food supply.

The 2017 Atlantic Hurricane Season was particularly historic. After Hurricane Harvey made landfall in Texas, it hovered over Houston for days—dropping several feet of rain that caused unprecedented flooding and sank the Earth's crust around Houston two centimeters.[1] Harvey was followed by two Category 5 storms–Hurricanes Irma and Maria, which had a profound impact on many Caribbean nations, Puerto Rico, the Florida Keys and other areas in the region. Out West, rain was scarce as communities were ravaged by one of the worst wildfire seasons ever. The fast-moving blaze in California's wine country killed 43 people, scorched 250,000 square miles and destroyed 8,900 structures.[2]

Despite the frequency of health threats, often the country is not adequately prepared to address them, even with all the prior lessons about what is needed for an effective response. Emergencies are a matter of when, not if; there is no reason to continue to be caught off guard when a new threat arises.

The good news is that considerable progress has been made to effectively prepare for and respond to public health emergencies of all types and sizes, and much of what it takes to prepare for bioterrorism, major disease threats or major disasters is also essential to respond to ongoing health threats. The bad news is that the accomplishments achieved to improve public health and preparedness for all hazards are being undermined due to severe budget cuts and lack of prioritization.

Instead, the nation is in a continued state of reacting inefficiently with a series of federal emergency supplemental funding packages each time a disaster strikes. The country does not invest enough to maintain strong, basic core capabilities for health security readiness and there is often a need for additional funds — emergency surge dollars in the form of a standing Health Emergency Fund that can be used when major events happen. Rather, funding to support the base level of preparedness has been cut — by more than half since 2002 — eroding advancements that had been achieved and the country's standing capabilities have been reduced. This leaves our country unprepared to respond effectively, and scrambling to divert funds from other ongoing priorities when health emergencies, inevitably, happen. This leads to a situation of being reliant on emergency funding to try to backfill basic gaps while also trying to address the new surge problems created by any given crisis.

- Many improvements made after 9/11, the anthrax tragedies and Hurricane Katrina have eroded. The primary source for state and local preparedness for health emergencies has been cut by about one-third (from $940 million in fiscal year (FY) 2002 to $667 million in FY 2017) and hospital emergency preparedness funds have been cut in half ($514 million in FY 2003 to $254 million in FY 2017).[3] The one time supplemental funding in FY 2016 for the ongoing public health threat of Zika means that states may have to redirect other funds in FY 2018 to address this continuing threat;

- Further cuts to preparedness programs at the Centers for Disease Control and Prevention (CDC) would disrupt key critical infrastructure — the nation's disease command and control centers — including the Emergency Management Program, Emergency Operations Centers (federal and in states), Laboratory Response Network, Strategic National Stockpile and management of select biological agents and toxins;

- Lack of available emergency funds has led to redirection of money from other priorities when a crisis hits. For example, delays in funding for the 2016 Zika response led to redirecting money from the Ebola response and from core state and local preparedness grants. This left most states with a weaker preparedness infrastructure that was not easily backfilled when emergency money was finally available. In May 2016, the Association of State and Territorial Health Officials, National Association of County and City Health Officials, Association of Public Health Laboratories and Council of State and Territorial Epidemiologists examined the Impact of the Redirection of Public Health Emergency Preparedness Funding (PHEP) from State and Local Health

Departments to Support National Zika Response and found that of jurisdictions responding to a survey, more than 88 percent noted that ongoing readiness activities (e.g. planning activities, trainings, exercises, volunteer recruitment, coalition participation, etc) would be affected; more than 72 percent responded that functional preparedness areas (e.g. surveillance, epidemiology, vector control, clinical services, lab services, etc.) would be affected; and a majority reported that supplies and staffing levels would be affected;[4] and

- Unstable funding leads to a cycle of hiring and firing of trained specialists — which often means the experts needed to respond are not on-staff or available when new crises hit.

Investments in improving preparedness also bolster health departments and the healthcare system overall — so they can better deal with ongoing needs like the opioid epidemic, foodborne diseases, water and lead safety, and other challenges communities regularly face.

Hospital Emergency Preparedness Funds Have Been Cut in Half Since 2003

$514 million — FY 2003

$254 million — FY 2017
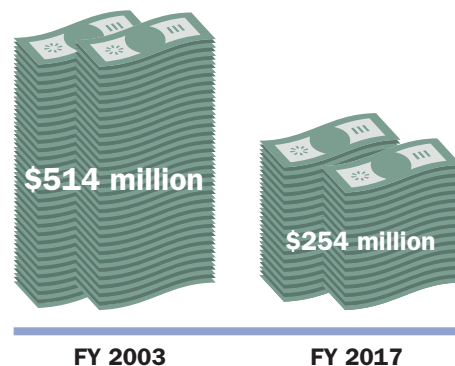
HEALTH SECURITY MATTERS[5, 6]

- As of 2016, in the course of one year, CDC's Emergency Management Program conducted 585 global activities, including 65 Emergency Operations Center activations for outbreaks in the United States and 27 other counties, and 135 exercises. In 2016, for the first time, there were four simultaneous CDC Emergency Operations Centers responses: Zika, Ebola, the Flint water crisis and polio.

- CDC's Emergency Operations Center was activated more than 90 percent of the time in the past 7 years. CDC scientists have responded to more than 750 health emergencies in the United States and around the world in the prior two years alone.

- There have been more than 16 known terror plots in just New York City since 9/11.

- For the past 30 years, there is an average of one brand new contagious disease emerging each year. Infectious diseases regularly cost the country a minimum of $170 billion year, and major new pandemics have the potential to disrupt the global economy. A severe new flu pandemic could cost the country more than $680 billion — 5.5 percent of the Gross Domestic Product.[7]

In 2003, TFAH first issued the *Ready or Not?* report to examine the nation's readiness to respond to public health emergencies. Over time, the report has tracked significant progress that has been achieved, but also remaining vulnerabilities and the backsliding of some advances, as budgets have been cut.

Modern and stable health security requires refocusing public health departments, healthcare and resources to more effectively use workforce, existing infrastructure, emerging technology and strategies to achieve better outcomes and results — and better protect Americans from new and ongoing threats. A strategic modern biodefense also yields strong returns — investing in prevention and effective standing response capabilities helps avoid the costs in dollars and lives.

Ready or Not? includes a review of state and federal public health preparedness. The report is intended to help inform policymakers, partners and the public about the status of preparedness. It provides a snapshot of a number of important indicators of preparedness and reviews key national policies and priorities. It provides greater transparency for programs; encourages increased accountability for spending of preparedness funds; and recommends ways to help the nation move toward a more strategic capabilities system that is able to effectively respond to health threats. While it is impossible to be 100 percent prepared for all emergencies,

there are core basic capabilities that experts agree could be maintained to better protect the public from the range of possible concerns. In the past 15 years:

- **Some major advancements include:** Integrated public health emergency operations planning and coordination; upgraded public health laboratories; more advanced development and manufacturing for vaccines and other medical countermeasures (MCMs); development of the Strategic National Stockpile, a federal repository of medical countermeasures, as well as an improved system to develop medical countermeasures more quickly; improved plans, resources and tactical capacity to rapidly deploy MCMs to the community; enhanced surveillance, epidemiologic investigations, situational awareness and information sharing mechanisms and communications; enacted legal and liability protections; advances in foodborne illness detection; animal health surveillance; increasing and upgrading public health staffing trained to prevent and respond to emergencies; improving systems for deployment of emergency medical and

public health personnel; improvements in medical surge capacity, development of the National Disaster Medical System, Medical Reserve Corps, the HHS Operations Center, and emergency support function leadership in the Office of the Assistant Secretary for Preparedness and Response; and the Center for Medicaid and Medicare Service's release of *Emergency Preparedness Requirements for Medicare and Medicaid Participating Providers and Suppliers.*

- **Some major ongoing gaps include:** Coordinated, interoperable, near real-time biosurveillance, including a sustained investment to maintain surveillance systems to more rapidly identify emerging threats; sufficient funding for the entire medical countermeasure strategy, including funding to continue research, development, purchase and distribution of vaccines, antiviral medications, diagnostics and antibiotics; chemical and radiation laboratory services; surge capacity within the healthcare system for a mass influx of patients, along with standards of care and in-place tiered systems of care for a range of threats; standing surge capacity abilities within the public health system to respond to multiple emergencies at the same time, particularly if multiple states are experiencing multiple emergencies simultaneously and one state cannot rely on out-of-state assistance; ongoing reductions in the public health workforce; and the ability to help communities — and especially their most vulnerable populations — become more resilient to cope with and recover from emergencies.

In the 2017 *Ready or Not?* report:

Section 1 features 10 indicators of key areas in each state that together provide a snapshot of areas of health security. Reflecting a broad definition of all-hazards preparedness, they assess the ability to respond to a wide range of crises, from infectious disease outbreaks to natural disasters to man-made attacks.

- The scores in the report are not intended to serve as a reflection on performance of specific state or local health departments, since they reflect a much broader context including resources, policy environments, healthcare systems and availability and health status of communities, including many factors beyond the direct control of health departments. The report is intended to help identify where sufficient action has been taken to support adequate public health preparedness, and where and how federal and state governments can improve or overcome obstacles to better readiness.

Section 2 is an examination of national policy issues and recommendations from health and security experts for how to improve the nation's ability to ensure stronger baseline capabilities are in place and the system is more flexible and able to respond efficiently and effectively when new emergencies arise. Key priorities include:

- Requiring strong, consistent baseline public health abilities in regions, states and communities around the country. Communities should maintain a key set of **foundational capabilities** and focus on performance outcomes in exchange for increased flexibility and reduced bureaucracy.

- Ensuring stable, sufficient health **emergency preparedness** funding to maintain a standing set of core capabilities so they are ready when they are needed. In addition, a complementary **Public Health Emergency Fund** is needed to provide immediate surge funding for specific action for major emerging threats. The current process of insufficient funding means there are long-standing gaps in the baseline system. Emergency supplemental budgets take time, cause delayed responses and cannot be used to backfill ongoing vulnerabilities in the response system.

- Strengthening and maintaining consistent support for **global health security** as an effective strategy for preventing and controlling health crises. Germs know no borders as was recently seen with the Zika and Ebola outbreaks.

- Improving **federal leadership before, during and after disasters** — including senior leadership and coordination for a government-wide approach to health security, preparedness, response and recovery efforts. Clear federal leadership and an agreed upon framework of responsibilities — including fully utilizing authorities in existing law — can clarify roles, particularly in health emergency responses that cross federal agencies and involve domestic and international actions.

- **Innovating and modernizing infrastructure needs** — including a more focused investment strategy to support **science and technology upgrades** that leverage recent breakthroughs and hold the promise

of transforming the nation's ability to promptly detect and contain disease outbreaks and respond to other health emergencies. For example, continuing investments in the modernization of near real-time, interoperable surveillance, such as syndromic surveillance; developing the next generation of medical countermeasures, including antivirals, vaccines and rapid diagnostic tests; and adopting wider use of advances in genomics to detect and contain outbreaks.

- Recruiting and training a **next generation public health workforce** with expert scientific abilities to harness and use technological advances along with critical thinking and management skills to serve as Chief Health Strategist for a community. The workforce should be able to lead health investigations; build plans to address problems; bring partners and resources together across the health sector and other affected sectors for increased collective impact; support community engagement; and communicate and effectively educate the public on how to reduce risk and better protect themselves, their families and their neighborhoods.

- Reconsidering **health system preparedness for new threats and mass outbreaks.** Develop stronger coalitions and partnerships among providers, hospitals and healthcare facilities, insurance providers, pharmaceutical and health equipment businesses, emergency management and public health agencies. More integrated approaches help leverage the strengths and coordinate activities

across the public and private sectors, support regionalized health models and incentivize and speed the use of new technologies into practice. Engage all of the partners to invest in building a broader community response strategy since all partners in a community are at risk and stand to benefit from more effective preparedness and response abilities.

- Preventing the negative health consequences of **weather-related threats.** As climate changes, the likelihood of unusual weather patterns and extreme weather events increase, water rises to unsafe levels and the insects and animals that spread disease move into new geographic locations. It is essential to work to mitigate the impact of climate, weather and natural disasters on health problems, in addition to building the capacity to anticipate, plan for and respond to such possible events.

- Supporting **a culture of resilience** so all communities are better prepared to cope with and recover from emergencies, particularly focusing on those who are most vulnerable. Sometimes the aftermath of an emergency situation may be more harmful than the initial event. Loss and suffering of loved ones, dislocation associated with housing damage, continuing environmental risks and post-traumatic stress have occurred in many recent emergencies. Certain populations such as older adults, people with disabilities, pregnant women, infants and those with limited resources are

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often at disproportionate risk. This must also include support for local organizations and small businesses — which are essential and inherent parts of communities — to prepare for and to respond to emergencies.

- Prioritizing efforts to address one of the most serious threats to human health by expanding efforts to stop **superbugs and antibiotic resistance. Outbreaks of new and/or difficult to treat infectious illnesses require a range of capacities from sophisticated and timely laboratory testing to epidemiologists to track potential exposures to immunizations and treatment.**

- Improving rates of **vaccinations for children and adults —** which are one of the most effective public health

tools against many infectious diseases. In spite of effective vaccines to prevent disease, there are significant sections of the population who are unprotected leading to a number of recent outbreaks of such preventable illnesses as measles and meningitis.

- Focusing on **fixing the food safety system** to better match and address the potential risks in modern agricultural and food processing, sales and distribution approaches. **State and local governments need the capacity to detect and contain foodborne outbreaks, using modern technology as well as traditional tools and personnel for both prevention and rapid response.**

U.S. NATURAL DISASTERS IN 2017

Multiple natural disasters wreaked havoc on the nation in 2017 — from record hurricanes in the Atlantic to drought, floods, and fires in the West. According to the National Oceanic and Atmospheric Administration (NOAA), as of October 6, there have been 15 separate weather and climate disaster events, each with losses exceeding $1 billion across the United States.[8] This number does not include the California fires that killed over 40 people and destroyed nearly 9,000 structures in mid-October. Three Category 4 and 5 hurricanes (Harvey, Irma and Maria) made landfall in the U.S. and its territories, a record for a single year.[9]

Source: NOAA

- **California Floods.** In February, extreme rainfall across northern and central California created substantial property and infrastructure damage from flooding, landslides and erosion. Severe damage to the Oroville Dam spillway caused a multi-day evacuation of 188,000 residents downstream, and San Jose's Coyote Creek overflowed its banks, flooding neighborhoods and forcing 14,000 residents to evacuate.[10]

- **Extreme Drought in North Dakota, South Dakota and Montana** severely disrupted agriculture—damaging field crops and forcing ranchers to sell off livestock due to lack of feed for cattle. The drought also set the stage for devastating wildfires later in the season.[11]

- **Hurricane Harvey** made landfall near Rockport, Texas. It ultimately produced historic flooding in the Houston area
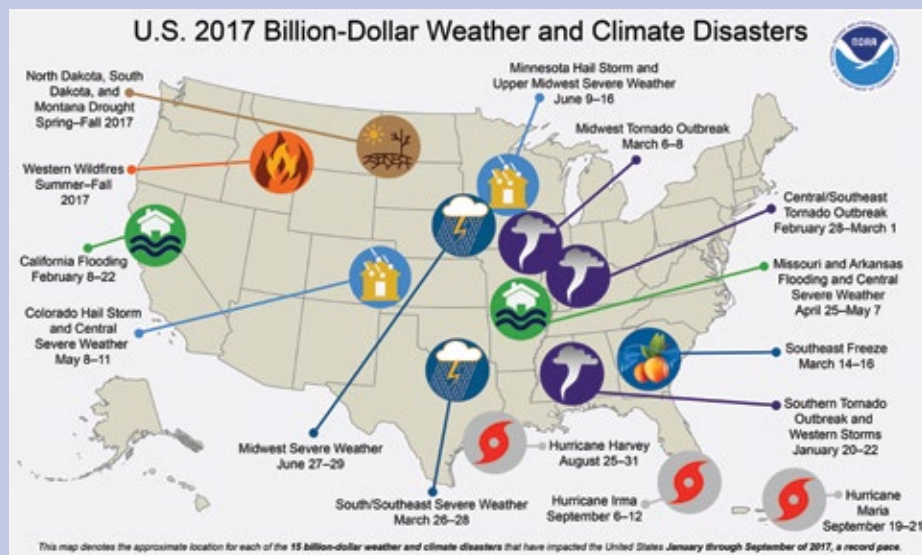
due to extreme rainfall. According to NOAA, more than 30 inches of rainfall fell on 6.9 million people, while 1.25 million experienced over 45 inches and 11,000 had over 50 inches. The massive flooding displaced over 30,000 people and damaged or destroyed over 200,000 homes and businesses. Harvey caused 84 deaths.[12]

- **Hurricane Irma** made landfall at Cudjoe Key, Florida after devastating the U.S. Virgin Islands at its full category 5 storm strength. Twenty-five percent of buildings in the Keys were destroyed while 65 percent were significantly damaged, and the Florida and South Carolina coasts experience significant storm surge damage. Irma maintained a maximum sustained wind of 185 mph for a record 37 hours, and it was also a category 5 storm for longer than all other Atlantic hurricanes except Ivan in 2004. Irma killed 95 people.[13]

- **Hurricane Maria** made landfall in southeast Puerto Rico after striking the U.S. Virgin Island of St. Croix. Up to three feet of rain caused widespread flooding and mudslides across the island and its transportation, agriculture, communication and energy infrastructure were severely damaged. Maria tied Hurricane Wilma (2005) for the most rapid intensification, strengthening from tropical depression to a category 5 storm in 54 hours.[14]

- **California Wine Country Wildfires** in October killed 43 people, scorched over 245,000 acres and destroyed over 8,900 structures. The rapidly moving fire forced approximately 100,000 people to evacuate, some at a moment's notice. This was the deadliest wildfire in California history and preliminary damage estimates exceed $3 billion.[15,16]

EXAMPLES OF KEY EMERGING AND EMERGENCY HEALTH THREATS

- **Zika:** Primarily transmitted by the bite of an infected *Aedes aegypti* mosquito, Zika can be passed from a pregnant woman to her fetus and can result in severe birth defects including microcephaly. Scientists continue to study how Zika virus affects mothers and their children to better understand the full range of potential health problems that Zika infection during pregnancy may cause.[17] The disease itself causes mild symptoms, like fever and joint pain, though many of those infected have no symptoms at all. Zika has also been shown to be transmitted through sex. Cases have been reported in 49 U.S. states, three U.S. territories, most of South and Central America, Africa, South Asia, and the Pacific Islands.[18, 19] On September 29 of this year, CDC deactivated its emergency response for Zika to transition efforts to normal program operations.[20] There is currently no vaccine or medicine approved for Zika.[21] The cost of care for an infant with severe microcephaly to adulthood is up to $10 million, and in just one year, the total costs for hospital care of people with birth defects exceeds $23 billion.[22, 23] As of November 28, 2017, 5,580 symptomatic cases of Zika have been reported in 49 states and the District of Columbia, along with cases in three U.S. territories, and many areas in South and Central America, Africa, South Asia and the Pacific Islands.[24]

- **Middle East Respiratory Syndrome Coronavirus (MERS-CoV):** MERS-CoV is a novel coronavirus that causes a severe viral respiratory disease. It has infected more than 2,000 individuals, spreading from the Middle East to South Korea through international travel, causing a significant outbreak, since first detected in 2012.[25, 26] MERS is fatal in more than 30 percent of cases.[27] There have only been two MERS-CoV cases in the United States (in 2014), and those individuals were traveling from other locations.

- **Foodborne Illness:** An estimated 48 million Americans get sick, 128,000 are hospitalized and 3,000 die from contaminated food annually.[28] In 2017, *Salmonella* linked to imported papayas sickened over 200 people, while a *Listeria* outbreak in soft raw cheese killed two out of the eight people it infected. Nearly 600 non-travel associated cases of cyclosporiasis were reported in 2017, and a brand of SoyNut Butter was found to be contaminated with Shiga toxin-producing *Escherichia coli* O157:H7.[29]

- **Superbugs (Antibiotic Resistance):** More than two million Americans develop antibiotic-resistant infections each year, leading to more than 23,000 deaths and $20 billion in direct medical costs and more than $35 billion in lost productivity.[30] Globally, by 2050, superbugs could claim 10 million lives a year and could cost a cumulative $100 trillion of economic output.[31]

- **Healthcare-Associated Infections (HAI):** Around one out of every 25 people who are hospitalized each year contracts a healthcare-associated infection leading to around 75,000 deaths a year.[32]

- **Seasonal Influenza (the Flu):** While the impact of the flu varies each year, it places a substantial burden on the health of people in the United States each year. CDC estimates that influenza has resulted in between 9.2 million and 35.6 million illnesses, between 140,000 and 710,000 hospitalizations and between 12,000 and 56,000 deaths annually since 2010.[33]

Annual Impact of the Flu

Deaths: 12,000 – 56,000
Hospitalzations: 140,000 – 710,000
Cases: 9,200,000 – 35,600,000

Source: CDC

● **Pandemic Flu:** In addition to the seasonal flu, there were three pandemics last century (1918, 1957, 1968) and one so far this century (2009). Pandemics occur when a new influenza virus emerges against which people have little-to-no immunity and the virus spreads globally with sustained human-to-human transmission. Most people have little-to-no immunity to fight against these new viruses. While experts predict influenza pandemics will occur in the future, they cannot predict when the next pandemic will occur, what strain of the virus will be involved, or how severe the pandemic will be.[34] Once a novel influenza virus becomes easily transmissible among humans, it can cause a worldwide pandemic in a relatively short time. A severe pandemic in 1918 resulted in 33 percent of the population becoming ill and more than 2.5 percent (675,000 Americans) of those died. The most recent H1N1 pandemic in 2009, while considered less severe than previous pandemics, infected around 20 percent of Americans (approximately 60 million individuals), and resulted in approximately 274,000 hospitalizations and more than 12,000 deaths.[35]

● **Chikungunya:** A mosquito-borne virus that, while rarely fatal, causes fever and joint pain that can be excruciating.[36] There are no vaccines or treatments for chikungunya, but symptoms usually subside in about a week. However, in some people, joint pain can persist for months. In 2013, the disease first appeared in the Americas and in the Caribbean Islands. In 2014, Puerto Rico experienced an outbreak resulting in 4,274 reported cases. Blood donor data suggests that an estimated 25 percent of adults on the island were infected. In 2017, there have been 95 cases reported from 23 states in the United States as of December 5th.[37]

● **Dengue Fever:** A mosquito-borne illness that causes flu-like symptoms and severe joint, muscle and bone pain. A dengue vaccine is registered in more than 10 countries, but is not currently licensed or available in the United States. Around 400 million people are infected each year, leading to about 96 million illnesses. An estimated 500,000 people with severe dengue require hospitalization each year, and about 2.5 percent of those affected die. Dengue is endemic in Puerto Rico and in many popular tourist destinations in Latin America, Asia and the Pacific islands. In the United States, several relatively small dengue outbreaks have occurred in the last decade in Texas, Florida and Hawaii.[38]

● **Chagas Disease:** Caused by the parasite *Trypanosoma cruzi* and spread by insect bites, it can lead to severe cardiac and gastrointestinal disease. It is transmitted to animals and people by insect vectors found exclusively in the Americas. As many as 8 million people in Mexico, Central America and South America — and more than 300,000 in the United States — have Chagas disease, the majority of whom do not know they are infected.[39] Many U.S. healthcare professionals are not familiar with the disease, which leads to under-diagnosis.[40]

● **Plague:** Caused by the bacterium *Yersinia pestis,* plague is a serious illness that is endemic in the western United States and can be fatal without prompt treatment.[41] While bubonic plague is usually acquired through the bite of an infected flea, the pneumonic form can be spread directly from person to person.[42] As of October 30, 2017, an outbreak in Madagascar resulted in up to 257 cases of pneumonic plague.[43] In mid-2017, there were four cases of plague in Santa Fe, New Mexico, but no deaths.[44]

● **Cholera:** Cholera is rare in the United States, but globally cases have increased steadily since 2005. Cholera is an acute diarrheal illness caused by the bacterium

Vibrio cholerae and usually transmitted by contaminated water or food. There are an estimated 3-5 million cases and over 100,000 deaths each year around the world.[45] In 2016-2017, the ongoing war cut millions of Yemeni people off from access to healthcare and clean water, resulting in an unprecedented cholera outbreak, causing over 770,000 cases and 2,132 deaths.[46]

- **West Nile Virus:** A potentially serious illness, for which there is no vaccine, which is spread by infected mosquitoes that contract the virus from feeding on infected birds. The majority of infected individuals have no symptoms, but up to 20 percent develop symptoms, including fever, headache, body aches, nausea, vomiting, swollen lymph glands and rashes on the trunk of the body that can last several weeks, and one in 150 people infected develop serious symptoms and in some cases permanent neurological effects.[47] In 2017 (as of October 10), nearly 1,300 cases of West Nile virus disease in the United States have been reported to CDC. Of these, 840 (65 percent) were classified as neuroinvasive disease (such as meningitis or encephalitis) and 455 (35 percent) were classified as non-neuroinvasive disease.[48]

- **Malaria:** A mosquito-borne disease, which can also be transmitted through blood contamination or childbirth, that results in fever, headache, fatigue and potentially coma and death.[49] Drugs can provide effective treatment, but resistant strains are emerging and spreading globally. In 2015, there were 214 million cases and 438,000 deaths worldwide,

mostly among young children in Africa.[50] The United States experiences approximately 1,700 cases of the disease per year, most are exposed outside the country.[51] Proven interventions in malaria endemic countries can have a profound impact on malaria control which saves lives, reduces risk of importation in the United States and advances the effort to eliminate malaria.

- **Valley Fever:** An infection caused by breathing in the fungus *Coccidioides,* which is endemic to the soils of the U.S. Southwest, mainly Arizona and California.[52] Most people never experience any symptoms, but some patients develop flu-like symptoms, 5-10 percent develop long-term lung problems and 1 percent may develop meningitis or die.[53] Blacks, Filipinos, pregnant women and people with diabetes or weakened immune systems are most susceptible to the severe forms of the infection. More than 147,000 Valley fever cases were reported to CDC during 1998 to 2014. Annual rates decreased from 2012–2014, but increased in 2016 to 13.7 per 100,000, with 5,372 reported cases, the highest annual number of cases in California recorded to date.[54] Fewer than 100 Americans die from Valley fever annually.[55, 56]

- **Lyme Disease:** The most common vector-borne disease in the United States and among the top 10 of all nationally notifiable illnesses, Lyme disease is mostly concentrated in the Northeast, mid-Atlantic and upper Midwest. From 2008–2015, a total of 275,589 cases of Lyme disease were reported to CDC.[57]

- **Acute Flaccid Myelitis Outbreak (AFM):** A recent uptick in children developing severe neurological symptoms has spotlighted a rare condition called acute flaccid myelitis.[58] AFM is a syndrome that affects the nervous system, especially the spinal cord, and can lead to temporary or permanent paralysis of the limbs. The cause of AFM is unknown and there is no known way to prevent the infection or cure it. It can be caused by a variety of infections, including enteroviruses, adenoviruses and West Nile virus. While the disease can infect anyone, most patients in recent outbreaks have been children. An outbreak occurred in 2014 (120 reported cases) and CDC initially suspected it was caused by a coinciding outbreak of the respiratory infection enterovirus D68, but it could ultimately not find a clear link between the two. In 2016, a total of 144 people in 37 states and DC were confirmed to have AFM.[59] Spinal fluid samples have been unable to point to one pathogen causing the paralysis.

- **Tuberculosis (TB):** More than 9,200 cases of this airborne infectious illness were reported in the United States in 2016, with cases in all 50 states.[60] More than 10 percent had documented drug resistance, the majority of whom were exposed outside the United States. And, more than 10 million people around the world become sick with TB each year and over half a million with the drug resistant form of the disease. Proven and emerging strategies to combat TB can reduce global numbers and have a direct impact on the risk of importation and spread in the United States.

BIOTERRORISM THREATS

There are a wide array of infectious or poisonous biological agents that can be weaponized against specific individuals or large populations. Fourteen agents meet the Material Threat Determination threshold, meaning the Secretary of the Department of Homeland Security (DHS) believes that they could be sufficient to affect national security. Some noted threats include anthrax; glanders; melioidosis; botulism toxin; hemorrhagic fever; tularemia; MDR anthrax; typhus; smallpox and plague. In addition, radiological and nuclear agents can also be a threat to human health.[61]

Two threats that have been of high focus in U.S. bioterrorism preparedness strategies include:

● **Anthrax:** Five people died, 22 people were sickened and more than 30 more tested positive for exposure during a set of anthrax attacks during September and October 2001, immediately following the 9/11 attacks.[62] More than 32,000 people took antibiotics for possible exposure, including many Capitol Hill employees.

Anonymous letters containing anthrax were sent to news agencies in Florida and New York and to then-Senate Majority Leader Tom Daschle (SD) and Senator Patrick Leahy (VT) in their offices in Washington, D.C. Thirty-five post offices and mailrooms were contaminated along with seven building on Capitol Hill. Postal workers in Hamilton Township, New Jersey, where the letters originated (postmarked Trenton, New Jersey), and Brentwood in Washington, D.C. were among those exposed, and the facilities in both locations underwent

multi-year, multi-million dollar decontamination processes.

Public health laboratories were overwhelmed receiving samples of items to test all around the country — testing more than 70,000 samples following the identification of the anthrax attacks.[63] Public health officials from CDC, New Jersey and Washington, D.C. and other agencies were among the primary investigators determining the sources of the anthrax, helping to ensure it was contained and developing containment and response strategies.

Anthrax is a potentially lethal infection, particularly when it manifests as inhalation anthrax. Historically, numerous nations have experimented with anthrax as a biological weapon, including the U.S. offensive biological weapons program that was disbanded in 1969.[64] The worst documented outbreak of inhalation anthrax in humans occurred in Russia in 1979, when anthrax spores were accidentally released from a military biological weapons facility near the town of Sverdlovsk, killing at least 66 people.[65]

● **Smallpox:** Although the WHO declared that smallpox was eradicated in 1980, this contagious and deadly infectious disease caused by the *Variola major* virus, remains high on the list of possible bioterror threats. The last naturally occurring case of smallpox was reported in 1977.[66] Currently, there is no evidence of naturally occurring smallpox transmission anywhere in the world, although small quantities of smallpox virus still exist in research laboratories in Atlanta, Georgia and in Novosibirsk, Russia.

2017 OUTBREAKS

- **Measles:** In Spring 2017, a measles outbreak in a Somali-American community in the Minneapolis/St. Paul area sickened 65 children. Vaccination rates have dropped in this community in the past several years due to concerns about a link to autism from the MMR vaccine—a link that has been repeatedly disproved.[67] As of November 7, there have been a total of 120 measles cases in the United States for the year of 2017.[68] Measles and mumps had been considered virtually eliminated as of 2000, but have experienced some resurgence in recent years.

- **Bacterial Infections:** Pets and backyard animals can often be a source of infection. There were multistate outbreaks of Salmonella Agbeni linked to pet turtles and multi-drug resistant Campylobacter linked to pet store puppies. The turtles sickened 37 people, while 67 people became ill from exposure to the puppies.[69, 70] In addition, the number of Salmonella infections from backyard poultry, such as chickens and ducks, was the highest ever recorded by CDC—a total of 1,120 cases, resulting in 248 hospitalizations and one death.

- **Salmonella:** Proper handling of infectious materials is essential to preventing illness among lab workers. Twenty-four people in 16 states were infected with Salmonella Typhimurium, which was linked to various clinical, commercial, and college and university teaching microbiology laboratories.[71]

- **Hepatitis:** As of early December, three states have seen over 1,300 cases of Hepatitis A—California (665 cases[72]), Michigan (555 cases[73]) and Utah (91 cases[74]). The outbreak has been ongoing since March—868 (72 percent) of those infected have been hospitalized and 40 have died. A shortage of Hepatitis A vaccination is complicating the response efforts.
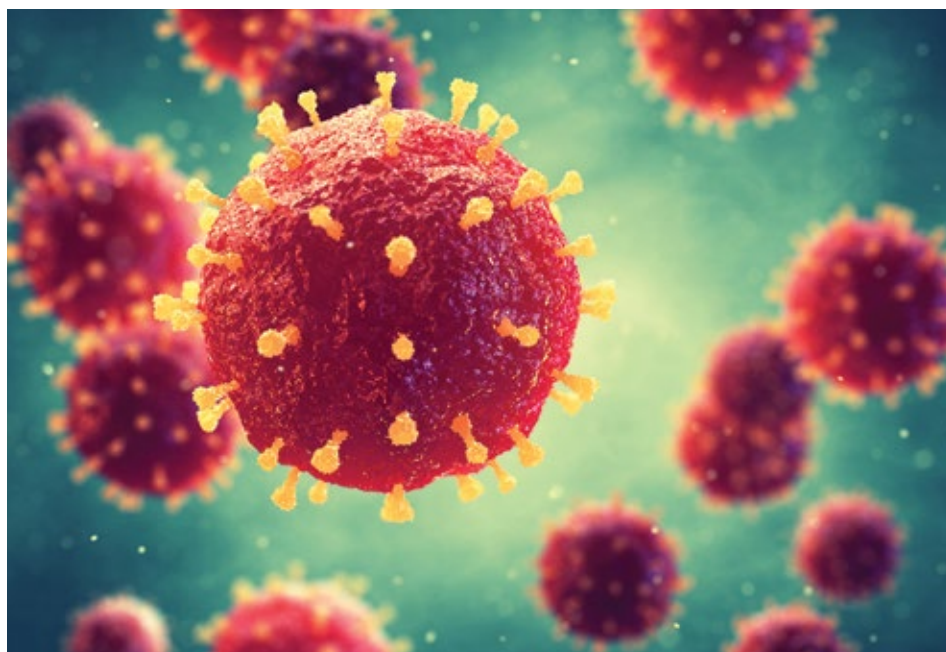
State-by-State Health Security Indicators

All Americans deserve to be protected during health emergencies, no matter where they live.

Readiness for health emergencies is a concern in every state. However, policies and programs vary from state-to-state. To help assess preparedness across the country, the *Ready or Not?* report examines a series of 10 indicators based on high-priority areas and concerns. It is not a comprehensive review; but collectively, it provides a snapshot of efforts to prevent and prepare for health threats in states and within the healthcare system.

The indicators were selected after consulting with leading public health and healthcare officials and reflect:

● Fundamental, systemic needs for public health emergency readiness; and

● Areas where there is consistent data available across all 50 states and Washington, D.C. — and information is publicly available and/or is able to be verified through surveys or consultation with state officials.

Each state received a score based on these 10 indicators. States received one point for achieving an indicator and zero points if they did not. Zero is the lowest possible score and 10 is the highest. The scores ranged from a high of nine in Massachusetts and Rhode Island to a low of two in Alaska and Idaho.

Scores are not intended to serve as a reflection of the performance of a specific state or local health department or the healthcare system or hospitals within a state, since they reflect a much broader context, including resources, policy environments and the health status of a community. Many of the indicators are impacted by factors beyond the direct control of health officials.

In addition, states differ in how they structure, deliver and fund public health services. For instance, states with high-density urban areas may function very differently than those with populations spread across smaller cities or towns.

However, all states should be able to meet basic preparedness goals as defined by federal health officials and leading experts. This report was developed to provide taxpayers and policymakers with information about how well-prepared their states and communities are for different types of health threats. The American people deserve to know how prepared their states and communities are for different types of health threats.

Using some consistent and some updated indicators allows the report to reflect a range of preparedness issues, changing expectations for preparedness and differences in data availability over time. It is important to note that many states have taken action and developed strengths in other areas of preparedness or may be in the process of developing capabilities that may not be reflected in this report. In addition, limited data is made publicly available to measure public health preparedness. The *Ready or Not?* report compiles indicators based on information that is timely and publicly available or data received from surveying states directly, and where information is consistently available across states.

STATE INDICATORS					
	(1) **Public Health Funding Commitment:** State increased or maintained funding for public health from FY 2015 to FY 2016 and FY 2016 to FY 2017.	(2) **National Health Security Preparedness Index:** State increased their overall preparedness scores based on the National Health Security Preparedness Index™ between 2015 and 2016.	(3) **Public Health Accreditation:** State has accredited public health department.	(4) **Antibiotic Stewardship Program for Hospitals:** State has 70 percent or more of hospitals reporting meeting Antibiotic Stewardship Program core elements in 2016.	(5) **Flu Vaccination Rate:** State vaccinated at least half of their population (ages 6 months and older) for the seasonal flu from Fall 2016 to Spring 2017.
Alabama		✓	✓		
Alaska				✓	
Arizona		✓	✓	✓	
Arkansas			✓		
California	✓		✓	✓	
Colorado	✓	✓	✓		✓
Connecticut		✓	✓		✓
Delaware		✓	✓	✓	✓
D.C.	✓		✓	✓	
Florida	✓		✓	✓	
Georgia	✓	✓			
Hawaii	✓	✓		✓	✓
Idaho		✓	✓		
Illinois	✓	✓	✓	✓	
Indiana				✓	
Iowa					✓
Kansas			✓		
Kentucky	✓				
Louisiana	✓	✓			
Maine		✓	✓		✓
Maryland	✓		✓	✓	✓
Massachusetts	✓	✓	✓	✓	✓
Michigan		✓			
Minnesota	✓	✓	✓		✓
Mississippi		✓	✓		
Missouri			✓		
Montana		✓	✓		
Nebraska		✓	✓		✓
Nevada				✓	
New Hampshire					✓
New Jersey		✓	✓	✓	✓
New Mexico			✓		✓
New York		✓	✓	✓	✓
North Carolina	✓	✓		✓	✓
North Dakota	✓	✓	✓		
Ohio			✓		
Oklahoma			✓		
Oregon	✓	✓	✓		
Pennsylvania		✓			✓
Rhode Island	✓	✓	✓	✓	✓
South Carolina	✓	✓		✓	
South Dakota	✓	✓			✓
Tennessee	✓	✓			
Texas					
Utah		✓	✓	✓	
Vermont		✓	✓		
Virginia	✓	✓		✓	✓
Washington		✓	✓	✓	
West Virginia		✓		✓	✓
Wisconsin		✓			
Wyoming					
Total	**19 states + D.C.**	**33 States**	**30 States + D.C.**	**20 States + D.C.**	**20 States**

	(6) Enhanced Nurse Licensure Compact (eNLC): State participates in an eNLC.	(7) United States Climate Alliance: State has joined the U.S. Climate Alliance to reduce greenhouse gas emissions consistent with the goals of the Paris Agreement.	(8) Public Health Laboratories: State laboratory provided biosafety training and/or provided information about biosafety training courses (July 1, 2016 to June 30, 2017).	(9) Public Health Laboratories: State laboratory Has a Biosafety Professional (July 1, 2016 to June 30, 2017).	(10) Paid Sick Leave: State has paid sick leave law.	Total Score
Alabama			✓	✓		4
Alaska			✓			2
Arizona	✓		✓	✓	✓	7
Arkansas	✓		✓	✓		4
California		✓		✓	✓	6
Colorado		✓	✓	✓		7
Connecticut		✓	✓	✓	✓	7
Delaware	✓	✓	✓	✓		8
D.C.			✓	✓	✓	6
Florida	✓		✓	✓		6
Georgia	✓		✓	✓		5
Hawaii		✓	✓	✓		7
Idaho	✓		✓	✓		5
Illinois			✓	✓		6
Indiana			✓	✓		3
Iowa	✓		✓	✓		4
Kansas			✓	✓		3
Kentucky	✓			✓		3
Louisiana			✓	✓		4
Maine	✓		✓			5
Maryland	✓			✓		6
Massachusetts		✓	✓	✓	✓	9
Michigan			✓	✓		3
Minnesota		✓	✓	✓		7
Mississippi	✓		✓	✓		5
Missouri	✓		✓	✓		4
Montana	✓		✓	✓		5
Nebraska	✓		✓	✓		6
Nevada			✓	✓		3
New Hampshire	✓		✓	✓		4
New Jersey			✓	✓		6
New Mexico			✓			3
New York		✓	✓	✓		7
North Carolina	✓	✓	✓	✓		8
North Dakota	✓		✓	✓		6
Ohio			✓	✓		3
Oklahoma	✓		✓	✓		4
Oregon		✓	✓	✓	✓	7
Pennsylvania			✓	✓		4
Rhode Island		✓	✓	✓	✓	9
South Carolina	✓		✓	✓		6
South Dakota	✓		✓	✓		6
Tennessee	✓		✓	✓		5
Texas	✓		✓	✓		3
Utah	✓		✓	✓		6
Vermont		✓	✓	✓	✓	6
Virginia	✓	✓	✓	✓		8
Washington		✓	✓	✓	✓	7
West Virginia	✓		✓	✓		6
Wisconsin			✓	✓		3
Wyoming	✓		✓	✓		3
	26 States	14 States	47 States + D.C.	47 States + D.C.	8 States + D.C.	5 (average)

STATE-BY-STATE INFECTIOUS DISEASE PREVENTION AND CONTROL INDICATORS AND KEY FINDINGS

Scores	Color
2	
3	
4	
5	
6	
7	
8	
9	

SCORES BY STATE

9 (2 states)	8 (3 states)	7 (8 states)	6 (12 states & D.C.)	5 (6 states)	4 (8 states)	3 (10 states)	2 (1 states)
Massachusetts	Delaware	Arizona	California	Georgia	Alabama	Indiana	Alaska
Rhode Island	North Carolina	Colorado	D.C.	Idaho	Arkansas	Kansas	
	Virginia	Connecticut	Florida	Maine	Iowa	Kentucky	
		Hawaii	Illinois	Mississippi	Louisiana	Michigan	
		Minnesota	Maryland	Montana	Missouri	Nevada	
		New York	Nebraska	Tennessee	New Hampshire	New Mexico	
		Oregon	New Jersey		Oklahoma	Ohio	
		Washington	North Dakota		Pennsylvania	Texas	
			South Carolina			Wisconsin	
			South Dakota			Wyoming	
			Utah				
			Vermont				
			West Virginia				

INDICATOR SUMMARY

Indicator	Finding
1. Public Health Funding Commitment	19 states and Washington, D.C. increased or maintained funding for public health from Fiscal Year 2015 to 2016 to FY 2016 to 2017. *Source: publicly available state budget information; distributed to state officials for updates and verification.*
2. National Health Security Preparedness Index	33 states increased their overall preparedness scores based on the National Health Security Preparedness Index™ (NHSPI™). *Source: NHSPI*
3. Public Health Accreditation	30 states and Washington, D.C. have accredited state health departments. *Source: Public Health Accreditation Board*
4. Antibiotic Resistance	20 states and Washington, D.C. have 70 percent or more of hospitals reporting they meet core elements of Antibiotic Stewardship Programs. *Source: CDC*
5. Flu Vaccinations	20 states vaccinated at least half of their population (ages 6 months and older) against the seasonal flu during the 2016-2017 flu season (from July 2016 to May 2017). *Source: CDC*
6. Health System Preparedness	26 states participate in an Enhanced Nurse Licensure Compact (eNLC). *Source: National Council of State Boards of Nursing*
7. Climate Readiness	14 states have joined the United States Climate Alliance — a bi-partisan coalition of states committed to reducing greenhouse gas emissions consistent with the goals of the Paris Agreement. *Source: Climate Alliance*
8. Public Health Laboratories	47 state laboratories and Washington, D.C.'s laboratory provided biosafety training and/or provided information about biosafety training courses for sentinel clinical labs in their jurisdiction (from July 1, 2016 to June 30, 2017). *Source: Association of Public Health Laboratories 2017 annual survey*
9. Public Health Laboratories	47 state laboratories and Washington, D.C.'s laboratory reported having a biosafety professional (from July 1, 2016 to June 30, 2017). *Source: Association of Public Health Laboratories 2017 annual survey*
10. Paid Sick Leave	34 states and D.C. do not preempt localities from legally requiring paid sick days for workers. *Source: Family Values @ Work; National Partnership for Women & Families*

FEDERAL, STATE AND LOCAL PUBLIC HEALTH JURISDICTIONS

The federal role: Includes policymaking, funding programs, overseeing national prevention and response efforts, collecting and disseminating health information, building capacity and directly managing some select services and supporting biomedical research and production capabilities. Some public health emergency preparedness and response capabilities, such as the Strategic National Stockpile and the National Disaster Medical System, are federal assets managed by federal agencies that supplement state and local capabilities, particularly when surge capacity is needed to meet overwhelming needs.

State and local roles: Under U.S. law, state governments have primary responsibility for the health of their citizens. Constitutional police powers give states the ability to enact laws and issue regulations to protect, preserve and promote the health, safety and welfare of their residents. In most states, local governments are also charged with responsibility for the health of their populations. State and local health departments and first responders are the front line in addressing health issues during emergencies. Sometimes they are the lead organizations (for example, during an infectious disease outbreak) and sometimes they are in a supportive role when other agencies take the lead (for example, in responding to fires). Other state and local departments — such as public safety, environmental control or general emergency response agencies — play critical roles related to the protection of the health of the public. Certain of the indicators may involve measures of the capacities of those other agencies.

INDICATOR 1: PUBLIC HEALTH FUNDING COMMITMENT — STATE PUBLIC HEALTH BUDGETS

KEY FINDING: 19 states and Washington, D.C. increased or maintained funding for public health from FY 2015 - FY 2016 to FY 2016 - FY 2017.

19 states and Washington, D.C. increased or maintained public health funding from FY 2015-2016 to FY 2016-2017 (1 point).		31 states cut public health funding from FY 2015-2016 to FY 2016-2017 (0 points).	
California	South Carolina	Alabama	Nevada
Colorado	South Dakota	Alaska*	New Hampshire*
District of Columbia	Tennessee	Arizona	New Jersey
Florida	Virginia	Arkansas	New Mexico*
Georgia		Connecticut*	New York*
Hawaii		Delaware*	Ohio
Illinois		Idaho*	Oklahoma*
Kentucky		Indiana	Pennsylvania
Louisiana		Iowa*	Texas*
Maryland		Kansas*	Utah*
Massachusetts		Maine*	Vermont
Minnesota		Michigan	Washington
North Carolina		Mississippi	West Virginia*
North Dakota		Missouri*	Wisconsin*
Oregon		Montana	Wyoming
Rhode Island		Nebraska	

Source: Publicly available state budget information; distributed to state officials for updates and verification.

Notes: New Mexico did not respond to the data check TFAH coordinated with ASTHO that was sent out October 2017 – most recent publicly available information was used for the analysis in that case. States were given until December 6, 2017 to confirm or update information for their state.

*Budget decreased for second year in a row.

This indicator illustrates a state's commitment and ability to provide funding for public health programs that support the infrastructure and workforce needed to improve health in each state, including the ability to detect, prevent and control disease outbreaks and mitigate the health impacts of disasters. General public health capacity — as well as targeted emergency response resources — is needed to insure that core tools (such as those related to disease tracking and laboratory personnel) exist and surge capacity is readily available.

Every state allocates and reports its budget in different ways. States also vary widely in the budget details they provide. This makes comparisons across states difficult. For this analysis, TFAH examined state budgets and appropriations bills for the agency,

department, or division in charge of public health services for FY 2015 - FY 2016 and FY 2016 - FY 2017, using a definition as consistent as possible across the analyses of the two budget cycles, based on how each state reports data. TFAH defined "public health services" broadly to include all state-level health spending with the exception of Medicaid, Medicaid/State Children's Health Insurance Program (CHIP) or comparable health coverage programs for low-income residents and other health-related programs that states deem are unrelated.

Based on this analysis (adjusted for inflation), 19 states and Washington, D.C. increased or maintained their public health budgets, while 31 states made cuts. The median spending in FY 2017 was $38.13 per capita, which is approximately the same as last year.

Public health funding is discretionary spending in most states and, therefore, is at high risk for significant cuts during tight fiscal climates. States rely on a combination of federal, state and local funds to support public health activities, including disease prevention, immunization services and preparedness activities. The overall infrastructure of public health programs supports the ability to carry out all of their responsibilities, which includes chronic and infectious disease prevention, immunization services, injury prevention and health emergency preparedness.

It is important to note that several states that received points for this indicator may not have actually increased their spending on public health programs. The ways some states report their budgets, for instance, by including federal funding in the totals or including public health dollars within healthcare spending totals, make it very difficult to determine "public health" as a separate item.

This indicator is limited to examining whether states' public health budgets increased or decreased; it does not assess if the funding is adequate to cover public health needs in the states, and it should not be interpreted as an indicator or surrogate for a state's overall performance.

For additional information on the methodology of the budget analysis, please see Appendix A: Methodology for Select State Indicators. And for the federal grants to states via the Preparedness Health Emergency Preparedness cooperative agreements and the Hospital Preparedness Program (HPP), see Appendix B.

STATES' PUBLIC HEALTH BUDGETS		
	FY 2016-2017 State Public Health Budget	FY 2016-2017 Per Capita Public Health Spending
Alabama	$274,290,949	$56.40
Alaska	$84,857,300	$114.38
Arizona	$61,023,300	$8.80
Arkansas	$156,264,435	$52.29
California	$2,424,431,000	$61.77
Colorado	$278,276,006	$50.23
Connecticut	$104,214,695	$29.14
Delaware	$39,745,800	$41.75
D.C.	$94,923,000	$139.35
Florida	$387,656,410	$18.81
Georgia	$219,395,730	$21.28
Hawaii	$159,900,025	$111.93
Idaho	$151,217,000	$89.84
Illinois	$327,241,300	$25.56
Indiana	$84,205,745	$12.69
Iowa	$219,770,221	$70.11
Kansas	$35,179,495	$12.10
Kentucky	$185,502,795	$41.81
Louisiana	$98,660,306	$21.07
Maine	$28,006,490	$21.03
Maryland	$243,358,946	$40.45
Massachusetts	$364,200,373	$53.47
Michigan	$128,282,100	$12.92
Minnesota	$358,163,000	$64.89
Mississippi	$36,645,538	$12.26
Missouri	$34,979,581	$5.74
Montana	$25,246,757	$24.22
Nebraska	$85,688,198	$44.93
Nevada	$19,851,091	$6.75
New Hampshire	$29,976,434	$22.46
New Jersey	$233,629,000	$26.12
New Mexico*	$80,900,400	$38.88
New York	$1,722,043,754	$87.21
North Carolina	$148,298,428	$14.62
North Dakota	$36,404,687	$48.03
Ohio	$144,784,069	$12.47
Oklahoma	$162,020,000	$41.29
Oregon	$113,216,399	$27.66
Pennsylvania	$161,554,000	$12.64
Rhode Island	$60,906,278	$57.65
South Carolina	$119,916,820	$24.17
South Dakota	$31,734,355	$36.67
Tennessee	$336,532,700	$50.60
Texas	$602,084,601	$21.61
Utah	$95,347,100	$31.25
Vermont	$35,006,938	$56.05
Virginia	$320,760,606	$38.13
Washington	$301,352,000	$41.35
West Virginia	$104,749,777	$57.21
Wisconsin	$83,930,400	$14.52
Wyoming	$30,894,959	$52.77
National	**$11,667,221,290**	**$36.11**

Source: Publicly available state budget information, distributed to state officials for updates and verification; U.S. Census Bureau

* State did not respond to budget verfication request

INDICATOR 2: NATIONAL HEALTH SECURITY PREPAREDNESS INDEX™

KEY FINDING: 33 states had increased overall preparedness scores based on the National Health Security Preparedness Index™ between 2015 and 2016.[75]

33 states had increased overall preparedness scores based on the National Health Security Preparedness Index between 2015 and 2016. (1 point).		17 states and Washington, D.C. have overall preparedness scores that remained the same or declined based on the National Health Security Preparedness Index between 2015 and 2016. (0 points).	
Alabama (6.2)	New Jersey (6.8)	Alaska (5.9)	Maryland (7.5)
Arizona (6.0)	New York (7.4)	Arkansas (6.6)	Missouri (6.9)
Colorado (7.1)	North Carolina (7.3)	California (6.7)	Nevada (6.2)
Connecticut (7.3)	North Dakota (6.8)	D.C. (7.0)	New Hampshire (7.3)
Delaware (7.2)	Oregon (7.2)	Florida (6.8)	New Mexico (6.5)
Georgia (6.3)	Pennsylvania (7.0)	Indiana (6.5)	Ohio (6.5)
Hawaii (6.4)	Rhode Island (7.5)	Iowa (7.0)	Oklahoma (6.4)
Idaho (6.5)	South Carolina (6.4)	Kansas (6.5)	Texas (6.6)
Illinois (6.8)	South Dakota (6.5)	Kentucky (6.7)	Wyoming (6.3)
Louisiana (6.3)	Tennessee (6.8)		
Maine (7.4)	Utah (7.2)		
Massachusetts (7.3)	Vermont (7.8)		
Michigan (6.7)	Virginia (7.5)		
Minnesota (7.3)	Washington (7.1)		
Mississippi (6.3)	West Virginia (6.7)		
Montana (6.5)	Wisconsin (7.4)		
Nebraska (7.4)			

Source: National Health Security Preparedness Index

This indicator examines whether a state improved its National Health Security Preparedness Index™ (NHSPI) score from 2015 to 2016, which was developed as a new way to measure and track the nation's progress in preparing for, responding to and recovering from disasters and other large-scale emergencies. The Index showed gains in a total of 33 states between 2015 and 2016, while it declined in four states and remained unchanged in 14 states.

The NHSPI measures the health security preparedness of the nation by looking collectively at existing state-level data from a wide variety of sources. Uses of the Index include guiding quality improvement, informing policy and resource decisions, and encouraging shared responsibility for preparedness across a community.

NHSPI was developed by the Association of State and Territorial Health Officials (ASTHO) in partnership with CDC and more than 30 development partners —

including TFAH and the Robert Wood Johnson Foundation (RWJF) — and was first released in 2013. In 2015, the National Coordinating Center for Public Health Services and Systems Research at the University of Kentucky, with support from RWJF, took the lead for managing and maintaining the Index.

In 2016, the United States posted a fourth consecutive year of gains in health security for disease outbreaks, disasters and other large-scale health emergencies. The overall national average was a 6.8 out of a possible 10 in 2016. This is a 1.5 percent improvement from 2015, and a 6.3 percent improvement from 2013. State scores ranged from a low of 5.9 in Alaska to a high of 7.8 in Vermont. Generally, Northeastern states scored highest, while those in the Deep South and Mountain West scored lowest. If current trends continue, the average state will require nine more years to reach health security levels currently found in the best-prepared states, and

20 more years to reach a strong health security level of at least nine out of 10.[76]

The scores from the Index includes 134 individual measures, aggregated into six domains and 19 subdomains. The six domains encompass:[77]

- **Health Security Surveillance:** National score 7.9 out of 10. The ability to collect and analyze data to identify possible threats before they arise.

  - Sub-domains include: 1) strong passive and active surveillance to identify, discover, locate, and monitor threats, provide relevant information to stakeholders and monitor/investigate events related to medical countermeasures; and 2) the ability of agencies to conduct rapid and accurate laboratory tests to identify biological, chemical and radiological agents to address actual or potential exposure to all hazards, focusing on testing human and animal clinical specimens.

- **Community Planning and Engagement:** National score 5.8 out of 10. How communities mobilize different stakeholders to work together during times of crisis. Supportive relationships among community stakeholders — government agencies, community organizations and individual residents — enables communities to effectively work together during crises and recover faster in the aftermath.

  - Subdomains include: 1) collaboration across sectors primarily responsible for providing direct health-related services; 2) actions to protect at-risk populations, including children and the elderly, as well as those with physical/mental challenges, limited English proficiency and transportation limitations; 3) management and coordination volunteers during an emergency; and 4) social cohesion — the degree of connection and sense of "belongingness" among residents. This domain has improved 16.3 percent since 2013.

- **Incident and Information Management:** National score 8.2 out of 10. The ability to mobilize and manage resources during a health incident.

  - Subdomains include: 1) multi-agency coordination; 2) effective communication to the public; and 3) legal and administrative capabilities and capacities responsible for assisting in the execution activities, systems and decision-making.

- **Health Care Delivery:** National score 5.3 out of 10. The state of health care systems during everyday life, as well as in emergency situations.

  - Sub-domains include: 1) prehospital care provided by emergency medical services (EMS); 2) inpatient care defined as a minimum of one night in the hospital or other institution; 3) long-term care in a residential setting; 4) access to medical and mental/behavioral health services; and 5) clinical and nonclinical home care.

- **Countermeasure Management:** National score 7.0 out of 10. The ability to mitigate harm from biologic, chemical, or nuclear agents.

  - Sub-domains include: 1) the management, distribution and dispensing of medical materiel before and during an incident and the management of the research, development and procurement of medical countermeasures; 2) the effectiveness of countermeasure utilization, including community preparedness for usage and follow through of usage; and 3) non-pharmaceutical intervention to contain disease spread or exposure using community mitigation strategies.

- **Environmental and Occupational Health:** National score 7.0 out of 10. The ability to prevent health impacts from environmental or occupational hazards.

  - Sub-domains include: 1) the sufficient availability, access, use and protection of safe and clean food and water resources; and 2) the monitoring of air, water, land/soil and plants for hazards to assess past and current status and predict future trends.

NATIONAL HEALTH SECURITY PREPAREDNESS INDEX AND *READY OR NOT?*

The National Health Security Preparedness Index™ and the *Ready or Not?* report are complementary efforts to help identify areas of achievement and concern for the nation's preparedness for health threats — and to identify timely policy concerns and recommendations for change. NHSPI is focused on serving to guide quality improvement, inform policy and resource decisions and encourage shared responsibility for preparedness. *Ready or Not?* focuses on timely issues to raise awareness and educate policymakers, partners and non-traditional audiences about preparedness issues — and to provide recommendations for policy change.

INDEX FINDS DEEP INEQUITIES EXIST IN STATES' PREPAREDNESS FOR PUBLIC HEALTH EMERGENCIES

According to the release of the most recent NHSPI scores, despite improvements in nearly two-thirds of states, significant inequities in preparedness exist across the nation: a gap of 32 percent separates the highest state (Vermont, 7.8) and the lowest state (Alaska, 5.9). Generally, states in the Deep South and Mountain West regions—many of which face elevated risks of disasters and contain disproportionate numbers of low-income residents—lag behind Northeast and Pacific Coast states.

"Equal protection remains an elusive goal in health security, as rural and low-resource regions have fewer and weaker protections in place," said Glen Mays, PhD, MPH, who leads a team of researchers at the University of Kentucky in developing the Index. "Closing the gaps in preparedness among states and regions remains a national priority."

"Poverty and health insurance coverage are strongly linked to state health security levels as measured by the index. States with higher poverty levels have fewer public and private resources available to invest in health protections, and these states also face many competing demands on their resources. Federal aid helps to reduce differences in fiscal capacity across states, but federal preparedness funding falls far short in eliminating the health security gaps that exist between affluent and poorer states.

Health security is stronger among states that have achieved higher rates of health insurance coverage among their residents. Hospitals, physicians, and other healthcare providers are able invest more time and resources in health security activities when they face fewer obligations to provide free and discounted medical care for uninsured patients. When disasters occur, health insurance—along with property insurance and other forms of coverage — helps to spread the costs of recovery evenly across families, businesses, and governments. By spreading risk broadly across society, insurance coverage promotes resiliency and helps communities bounce back faster from adversity. Federal and state efforts to expand health insurance coverage under the Affordable Care Act and other health reforms have strengthened health security significantly, but these gains have accrued unevenly across the United States."[78]

30 states and Washington, D.C. public health departments have been accredited. (1 point.)		20 state public health department have not received accreditation. (0 points.)	
Alabama	Mississippi	Alaska	North Carolina
Arizona	Missouri	Georgia	Pennsylvania
Arkansas	Montana	Hawaii	South Carolina
California	Nebraska	Indiana	South Dakota
Colorado	New Jersey	Iowa	Tennessee
Connecticut	New Mexico	Kentucky	Texas
Delaware	New York	Louisiana	Virginia
D.C.	North Dakota	Michigan	West Virginia
Florida	Ohio	Nevada	Wisconsin
Idaho	Oklahoma	New Hampshire	Wyoming
Illinois	Oregon		
Kansas	Rhode Island		
Maine	Utah		
Maryland	Vermont		
Massachusetts	Washington		
Minnesota			

Source: Public Health Accreditation Board.

INDICATOR 3: PUBLIC HEALTH DEPARTMENT ACCREDITATION

KEY FINDING: 30 states and Washington, D.C. public health departments have been accredited.[79]

This indicator examines whether a state has been accredited by the Public Health Accreditation Board (PHAB).[80] PHAB — jointly funded by CDC and RWJF — is a non-profit, non-governmental organization that administers the national public health accreditation program. It aims to improve and protect the health of the public by advancing and ultimately transforming the quality and performance of the nation's state, tribal, local and territorial public health departments. The development of national public health accreditation has involved, and is supported by, public health leaders and practitioners from the national, tribal, state, local and territorial levels.

The goal of the voluntary national accreditation program is to improve and protect the health of the public by advancing the quality and performance of tribal, state, local and territorial public health departments. Accreditation is an important benchmark of a public health system capable of responding to a range of health threats, such as an identification and investigation of health hazards, educating the public, maintaining a competent workforce and serving as an expert resource.

As of November 21, 2017, a total of 211 health departments (30 state, 179 local, and 1 tribal), as well as one integrated local public health department system, have achieved five-year accreditation through the Public Health Accreditation Board[81] — together covering around 213 million people, or about 70 percent of the U.S. population. Forty-four states and D.C. have at least one accredited health department. Another 158 health departments are in process of obtaining accreditation.

According to PHAB, aspects of public health department accreditation include:

- The measurement of health department performance against a set of nationally recognized, practice-focused and evidenced-based standards;

- The issuance of recognition of achievement of accreditation within a specified time frame by a nationally recognized entity; and

- The continual development, revision and distribution of public health standards.

According to surveys of accredited health departments conducted for a recent report titled "Evaluating the Impact of National Public Health Department Accreditation—United States, 2016," in the August 12, 2016 **Morbidity and Mortality Weekly Report,** the "overwhelming majority of respondents agreed or strongly agreed that accreditation stimulated quality and performance improvement opportunities within the health department, allowed the health department to better identify strengths and weaknesses, helped the health department document the capacity to deliver the three core functions of public health and the 10 Essential Public Health Services, stimulated greater accountability and transparency within the health department and improved the management processes used by the leadership team in the health department, among other benefits."[82]

INDICATOR 4:
ANTIBIOTIC RESISTANCE

Key Finding: 20 states and Washington, D.C. have 70 percent or more of hospitals meeting core elements of the Antibiotic Stewardship Program (as of 2016).[83]

20 states and Washington, D.C. have 70 percent or more of hospitals reporting meeting Antibiotic Stewardship Program core elements (1 point.)		30 states have less than 70 percent of hospitals reporting meeting Antibiotic Stewardship Program core elements. (0 points.)	
Alaska (71%)	Nevada (89%)	Alabama (64%)	Montana (48%)
Arizona (72%)	New Jersey (76%)	Arkansas (63%)	Nebraska (56%)
California (81%)	New York (75%)	Colorado (63%)	New Hampshire (38%)
D.C. (75%)	North Carolina (79%)	Connecticut (69%)	New Mexico (62%)
Delaware (75%)	Rhode Island (75%)	Georgia (59%)	North Dakota (39%)
Florida (75%)	South Carolina (70%)	Idaho (59%)	Ohio (66%)
Hawaii (72%)	Utah (77%)	Iowa (38%)	Oklahoma (56%)
Illinois (70%)	Virginia (81%)	Kansas (40%)	Oregon (52%)
Indiana (72%)	Washington (70%)	Kentucky (59%)	Pennsylvania (66%)
Maryland (84%)	West Virginia (75%)	Louisiana (50%)	South Dakota (46%)
Massachusetts (72%)		Maine (62%)	Tennessee (67%)
		Michigan (59%)	Texas (58%)
		Minnesota (41%)	Vermont (33%)
		Mississippi (50%)	Wisconsin (59%)
		Missouri (59%)	Wyoming (41%)

Source: CDC Antibiotic Patient Safety Atlas. Puerto Rico rate: 43%. Data not available for Guam and U.S. Virgin Islands.

Inappropriate use of antibiotics has contributed to one of the biggest threats to public health: antibiotic resistant pathogens or "superbugs."[84] Superbugs are turning bacterial infections that were once easily treated — like *Salmonella* and *Klebsiella* — into deadly diseases. More than 2 million people in the United States are annually infected by superbugs and at least 23,000 die.[85] Superbugs cause $20 billion in annual direct costs and an additional $35 billion in productivity losses.[86]

CDC and other experts have warned that without concerted and timely action, superbugs are expected to continue to grow dramatically. One of the most focused and effective areas of efforts to reduce over and misuse of antibiotics is through hospital-based programs that focus on responsible and informed practices.[87, 88] Antibiotic Stewardship Programs (ASPs) are aimed at optimizing the treatment of infections and reducing adverse events associated with antibiotic use. The programs help improve quality of care and can help save money. Eight high-risk antibiotic resistant superbugs are often acquired in healthcare settings, including *Clostridium difficile* infections (CDI), a potentially deadly diarrhea that causes at least 250,000 infections and 14,000 deaths each year in hospitalized patients.[89, 90] It is estimated that between 20 percent and 50 percent of all antibiotics prescribed in U.S. acute care hospitals are either unnecessary or inappropriate.[91] Reducing the use of high-risk antibiotics by 30 percent can lower CDIs by 26 percent and other healthcare associated infections as a short-term benefit, and in the long-term lower risk for antibiotic resistance. On any given day, one in 25 people in the hospital has an HAI, and over the course of a year, around 75,000 people with healthcare-associated infections die during their hospitalizations.[92]

Starting in 2014, CDC has recommended that all acute care hospitals implement Antibiotic Stewardship Programs. This indicator examines if 70 percent or more of acute hospitals in a state report meeting the core elements of Antibiotic Stewardship Programs, which include:

- Leadership Commitment: Dedicating necessary human, financial and information technology resources;

- Accountability: Appointing a single leader responsible for program outcomes. Experience with successful programs show that a physician leader is effective;

- Drug Expertise: Appointing a single pharmacist leader responsible for working to improve antibiotic use;

- Action: Implementing at least one recommended action, such as systemic evaluation of ongoing treatment need after a set period of initial treatment (i.e. "antibiotic time out" after 48 hours);

- Tracking: Monitoring antibiotic prescribing and resistance patterns;

- Reporting: Regular reporting information on antibiotic use and resistance to doctors, nurses and relevant staff; and

- Education: Educating clinicians about resistance and optimal prescribing.

As of 2016, 20 states and Washington, D.C. have had 70 percent or more of acute hospitals report meeting this objective (of hospitals reporting to National Healthcare Safety Network (NHSN)).[93] Reporting data to NHSN is important for tracking and setting patient safety policies and for transparency. Rates range from a high of 89 percent in Nevada to a low of 33 percent in Vermont.

Antibiotic Stewardship in Nursing Homes

4.1 MILLION
Americans are **admitted to** or **reside in nursing homes** during a year[1]

UP TO **70%**
of nursing home residents **received antibiotics** during a year[2,3]

UP TO **75%**
of antibiotics are **prescribed incorrectly***[2,3]

CDC recommends
7 CORE ELEMENTS
for antibiotic stewardship in nursing homes

Leadership Commitment ● Accountability
Drug Expertise ● Action ● Tracking
Reporting ● Education

*incorrectly = prescribing the wrong drug, dose, duration or reason
[1] AHCA Quality Report 2013.
[2] Lim CJ, Kong DCM, Stuart RL. Reducing inappropriate antibiotic prescribing in the residential care setting: current perspectives. Clin Interven Aging. 2014; 9: 165-177.
[3] Nicolle LE, Bentley D, Garibaldi R, et al. Antimicrobial use in long-term care facilities. Infect Control Hosp Epidemiol 2000; 21:537–45.

Centers for Disease Control and Prevention
National Center for Emerging a Zoonotic Infectious Diseases

Source: CDC

INDICATOR 5: FLU VACCINATION RATES

KEY FINDING: 20 states vaccinated at least half of their population (ages 6 months and older) against the seasonal flu from July 2016 through May 2017.

20 states vaccinated at least half of their population (ages 6 months and older) against the seasonal flu from July 2016 to May 2017. (1 point.)		30 states and Washington, D.C. did not vaccinate half of their population (ages 6 months and older) against the seasonal flu from July 2016 to May 2017. (0 points.)	
Connecticut (52.7%)	New Jersey (49.1%)	Alabama (43.9%)	Missouri (46.4%)
Colorado (49.9%)*	New Mexico (49.2%)	Alaska (39.1%)	Montana (42.2%)
Delaware (51.2%)	New York (49.8%)	Arizona (41.8%)	Nevada (36.1%)
Hawaii (49.2%)*	North Carolina (50.8%)	Arkansas (46.2%)	North Dakota (46.9%)
Iowa (51.3%)	Pennsylvania (53.3%)	California (48.0%)	Ohio (46.6%)
Maine (49.9%)*	Rhode Island (55.4%)	D.C. (48.3%)	Oklahoma (47.2%)
Maryland (53.5%)	South Dakota (53.9%)	Florida (43.3%)	Oregon (40.0%)
Massachusetts (50.3%)	Virginia (50.5%)	Georgia (42.8%)	South Carolina (47.4%)
Minnesota (51.7%)	West Virginia (49.6%)	Idaho (39.5%)	Tennessee (43.9%)
Nebraska (52.3%)		Illinois (41.8%)	Texas (43.5%)
New Hampshire (50.4%)		Indiana (43.6%)	Utah (43.4%)
		Kansas (43.9%)	Vermont (47.3%)
		Kentucky (45.0%)	Washington (48.3%)
		Louisiana (41.6%)	Wisconsin (43.7%)
		Michigan (44.2%)	Wyoming (38.9%)
		Mississippi (40.1%)	

Source: CDC, Flu Vaccination Coverage, United States, 2016-2017 Influenza Season
* States with rates of 49 percent or higher were rounded up.

Vaccination is the best prevention against the seasonal flu. CDC recommends everyone ages 6 months and older get vaccinated annually, yet fewer than half of Americans ages 6 months and older were vaccinated against the flu during last three flu seasons (2014 to 2015, 2015 to 2016 and 2016 to 2017).

This measure provides important context for a state's preparedness for pandemics or other major disease outbreaks by measuring rates of a vaccine that is recommended every year and across the lifespan. In addition to protecting Americans from the seasonal flu, establishing a cultural norm of vaccination, building vaccination infrastructure and establishing policies that support vaccinations can help ensure the country has a strong system in place to be better able to vaccinate all Americans quickly during a new pandemic or unexpected disease outbreak.

This indicator examines whether at least half (50 percent) of a state's population (ages 6 months and older) was vaccinated against the flu during the 2016-2017 season. The U.S. Department of Health and Human Services (HHS) has set a goal for the nation to vaccinate 70 percent of adults and 70 percent of children as part of the Healthy People 2020 initiative.[94] This indicator uses 50 percent as a marker of showing progress toward achieving this goal.

The highest flu vaccination coverage was 55.4 percent in Rhode Island and the lowest was 36.1 percent in Nevada. Twenty states vaccinated 50 percent or more of their population or higher and 47 states and Washington, D.C. vaccinated 40 percent or higher. Nationally, 46.8 percent of Americans ages 6 months and older were vaccinated.[95]

- Flu vaccination coverage levels were significantly higher for children (59.0 percent) compared to adults (43.3 percent).

- The lowest vaccination coverage was among adults ages 18 through 49 at 33.6 percent.

- 65.3 percent of persons 65 or older were vaccinated.

Vaccination is particularly important for people who are at high risk of more severe flu-related illnesses, including young children (especially those with neurologic conditions and other special health care needs), pregnant women, people with certain chronic health conditions (such as respiratory disease, heart disease and cerebrovascular diseases) and people 65 years and older. For example, 70 percent to 85 percent of all flu-related deaths occur in persons 65 and older.[96] If all seniors received the flu shot, flu cases among this vulnerable population could drop an estimated 15 to 25 percent.[97, 98]

Each year, millions of Americans get the flu — ranging from around 9 to 36 million people, depending on the severity and strain in different years. In

recent years, flu-related deaths ranged from a low of 12,000 (2011-2012 flu season) to a high of 56,000 (2013-2014 flu season). Flu-related hospitalizations ranged from a low of 140,000 (2011-2012 flu season) to a high of 710,000 (2014-2015 flu season).[99, 100, 101]

In addition to its health effects, flu has a serious impact in terms of healthcare and worker absenteeism costs. Seasonal flu can often result in a half day to five days of work missed, which affects both the individual and his or her employer. Annually, the flu leads to approximately $87.1 billion in economic losses each year — including $10.4 billion in direct costs for hospitalizations and outpatient visits and $76.7 million in indirect costs.[102] One study projected that an increase of vaccinations by 5 percent would prevent more than 500,000 illnesses and nearly 6,000 hospitalizations.[103]

According to a CDC survey of healthcare personnel, about one-fifth (21.4 percent) of healthcare workers were not vaccinated against the flu during the 2015-2016 season.[104] Healthy People 2020 has set a target of 90 percent of healthcare workers vaccinated each flu season.[105] Among healthcare workers, vaccination coverage was highest among healthcare personnel working in hospitals (92.3 percent) and lowest among those working in long-term care settings (68 percent). Flu vaccination coverage levels were higher among healthcare professionals whose employers required vaccination (96.7 percent). In settings with no employer requirement for vaccination, coverage was higher where vaccination was offered on-site at no cost for one day (73.8 percent) or multiple days (80.3 percent) and lowest among personnel working in settings where vaccine was neither required, promoted, nor offered on-site (45.8 percent).[106]

NO MORE EXCUSES
THERE ARE MANY PLACES TO GET YOUR FLU VACCINE.

Anyone can get the flu, and it can be serious. Every year, protect yourself and those around you by getting a flu vaccine.

DOCTOR'S OFFICE   SCHOOLS   PHARMACIES   RETAIL STORES

GROCERY STORE   PEDIATRICIAN'S OFFICE   HEALTH DEPARTMENT   WORKPLACE

MEDICAL CENTER   DRUG STORE   CLINICS   COMMUNITY CENTER

For more information, visit http://www.cdc.gov/flu

Source: CDC

Seasonal flu vaccinations reduce hospitalizations and deaths. CDC estimates that the seasonal flu vaccine prevented more than 27,000 flu-associated deaths in the United States during the four flu seasons from 2010-2011 to 2013-2014 — representing a 16 percent reduction in deaths than would have occurred in the absence of a flu vaccination during that time frame.[107] For the 2015-2016 season, CDC estimates the seasonal flu prevented 5.1 million illnesses, 71,000 hospitalizations and about 3,000 deaths.[108]

Under the Affordable Care Act (ACA), all vaccines routinely recommended by the Advisory Committee on Immunization Practices (ACIP), including flu shots, are covered when provided by in-network providers in group and individual non-grandfathered private health plans and for the Medicaid expansion population with no co-payments or cost sharing, but states are still able to determine coverage and cost-sharing for their traditional Medicaid population. As of 2013, all state Medicaid programs, with the exception of Florida, incorporate some level of vaccination coverage benefit — 36 programs routinely covered recommended vaccines for adult beneficiaries in accordance with ACIP recommendations, and 17 of these programs (17/36) also prohibited copayments.[109] Medicare Part B covers annual flu vaccinations for beneficiaries with no co-pay.

INDICATOR 6: ENHANCED NURSE LICENSURE COMPACT

KEY FINDING: 26 states participate in an Enhanced Nurse Licensure Compact.

26 states participate in an Enhanced Nurse Licensure Compact (1 point)		24 states and Washington, D.C. do NOT participate in an Enhanced Nurse Licensure Compact (0 points)	
Arizona	Nebraska	Alabama	Minnesota
Arkansas	New Hampshire	Alaska	Nevada
Delaware	North Carolina	California	New Jersey
Florida	North Dakota	Colorado	New Mexico
Georgia	Oklahoma	Connecticut	New York
Idaho	South Carolina	D.C.	Ohio
Iowa	South Dakota	Hawaii	Oregon
Kentucky	Tennessee	Illinois	Pennsylvania
Maine	Texas	Indiana	Rhode Island
Maryland	Utah	Kansas	Vermont
Mississippi	Virginia	Louisiana	Washington
Missouri	West Virginia	Massachusetts	Wisconsin
Montana	Wyoming	Michigan	

Source: National Council of State Boards of Nursing

The Nurse Licensure Compact (NLC),[110] launched in 2000 by the National Council of State Boards of Nursing, allows a registered nurse and licensed practical/vocational nurse to have a single multistate license that permits them to practice—physically, telephonically and electronically—in all compact states. This allows standing reciprocity across states without an emergency declaration or any other sort of special circumstances.[111]

In non-NLC states, nurses are considered covered personnel under the Emergency Medical Assistance Compact (EMAC), but EMAC must be triggered by an emergency declaration by a governor and a request for assistance through the EMAC Operations System, at which point resources are agreed upon by the requesting state and the assisting state(s). Responders under EMAC must be deemed "employees of the state" to receive immunity and licensure reciprocity and medical volunteers are not covered under EMAC protections.[112]

The Enhanced Nurse Licensing Compact (eNLC) went into effect July 20, 2017 and will be fully implemented on January 19, 2018. The eNLC replaces the original NLC and adds extra protections. It requires that all member states implement criminal background checks for all applicants upon initial licensure or

licensure by endorsement, which will help remove barriers that have kept other states from joining in the past.[113]

In order to be eligible for a multistate license, a nurse must meet the following criteria:[114]

1. Meets the requirements for licensure in the home state (state of residency);

2. a. Has graduated from a board-approved education program; or

   b. Has graduated from an international education program (approved by the authorized accrediting body in the applicable country and verified by an independent credentials review agency);

3. Has passed an English proficiency examination (applies to graduates of an international education program not taught in English or if English is not the individual's native language);

4. Has passed an NCLEX-RN® or NCLEX-PN® Examination or predecessor exam;

5. Is eligible for or holds an active, unencumbered license (i.e., without active discipline);

6. Has submitted to state and federal fingerprint-based criminal background checks;

7. Has no state or federal felony convictions;

8. Has no misdemeanor convictions related to the practice of nursing (determined on a case-by-case basis);

9. Is not currently a participant in an alternative program;

10. Is required to self-disclose current participation in an alternative program; and

11. Has a valid United States Social Security number.

This indicator examines which states participate in the eNLC. Currently, 26 states participate, allowing nurses to legally practice across state lines with other states that are part of the eNLC. The ability for nurses to be able to work across state lines can be a tremendous benefit during disasters or disease outbreaks, when affected communities may experience severe workforce shortages. The eNLC benefits both nurses and states by:

- Allowing nurses flexibility and mobility;
- Driving standardized licensure requirements;
- Enabling states to act jointly and collectively;
- Facilitating continuity of care; and
- Allowing different boards of nursing to build relationships and improve processes by learning from one another.

14 states* are members of the Climate Alliance. (1 point.)	36 states and Washington, D.C. are not members of the Climate Alliance. (0 points.)		
California	Alabama	Louisiana	North Dakota
Colorado	Alaska	Maine	Ohio
Connecticut	Arizona	Maryland	Oklahoma
Delaware	Arkansas	Michigan	Pennsylvania
Hawaii	D.C.	Mississippi	South Carolina
Massachusetts	Florida	Missouri	South Dakota
Minnesota	Georgia	Montana	Tennessee
New York	Idaho	Nebraska	Texas
North Carolina	Illinois	Nevada	Utah
Oregon	Indiana	New Hampshire	West Virginia
Rhode Island	Iowa	New Jersey	Wisconsin
Vermont	Kansas	New Mexico	Wyoming
Virginia	Kentucky		
Washington			

*Puerto Rico is also a member. Source: U.S. Climate Alliance

INDICATOR 7: UNITED STATES CLIMATE ALLIANCE

KEY FINDING: 14 states have joined the United States Climate Alliance — a bi-partisan coalition of states committed to reducing greenhouse gas emissions consistent with the goals of the Paris Agreement.[115]

Extreme weather events — which have major implications for health — are becoming more and more common in the United States. Different regions of the country face different health threats due to climate change — including those related to sea-level rise and associated flooding, prolonged drought and water insecurity, infectious disease outbreaks, hurricanes and other severe weather and extreme heat events.[116, 117] Pounding rains cause devastating floods, extended droughts threaten agriculture and massive wildfires threaten homes and businesses. There are an increasing number of severe weather-related disasters, and 2017's hurricane season exceeded imagination. Three massive hurricanes decimated U.S. communities — Harvey in Houston, Irma in Florida and U.S. Virgin Islands and Maria in Puerto Rico and U.S. Virgin Islands, displacing families and putting human health at risk.

In addition, the U.S. has suffered the worst wildfire season in years. California's years-long drought officially ended in 2017. While a huge relief for the state's dwindling water supply, the resulting vegetation growth would eventually become lush kindling for wildfires — killing 42 people in Northern California's wine country. Montana and the Northwest also suffered greatly with blazes in 2017 — spewing plumes of smoke across the country. These particles in the air can be especially dangerous for children, people over 65, pregnant women or people with lung or heart conditions.[118]

Climate and weather-related events can impact human health in a wide range of ways. Factors like potential changes in water quantity and quality, air quality, average and extreme temperatures and insect control are all important public health concerns. Certain zoonotic and vector-borne diseases, as well as food and waterborne diseases, may increase in incidence and spread as changes in temperature and weather patterns allow pathogens to expand into different geographic regions. For instance:

- The presence and number of rodents, mosquitoes, ticks and other insects and animals that can carry infectious diseases (disease vectors) rise in warmer temperatures. As extreme temperatures increase in severity and duration, the geographic and spatiotemporal patterns of diseases ranging from West Nile virus and Zika to Lyme and other tick-borne diseases to encephalitis are expected to shift.[119]

- Climate change may affect the timing of birds' migration and boost the spread of diseases they carry. Wild birds can be infected by a number of microbes that can be transmitted to humans. In addition, birds migrating across national and continental borders can become long-range carriers of any bacteria, virus or parasite they harbor. Birds rapidly spread West Nile virus after it first emerged in 1999. By 2012 the virus had been reported in humans, mosquitoes and birds in 48 states.[120]

- Changing weather patterns put people in different regions at increased risk for different types of diseases. For instance, coastal areas are at increased risk for flooding and the coastal Southeast is at higher risk for hurricanes.[121, 122]

- The rise in extreme weather events and natural disasters also leads to a more fertile environment for the spread of infectious diseases and germs. For instance, cryptosporidiosis

outbreaks, which cause diarrheal disease, are associated with heavy rainfall, which can overwhelm sewage treatment plants or cause lakes, rivers and streams to become contaminated by runoff containing waste from infected animals. Experts also believe that an El Niño occurrence may have contributed to increases of cholera.[123] Communities recovering from a disaster may see food or waterborne illnesses associated with power outages or flooding, as well as infectious disease transmission in emergency shelters.

In response to the U.S. federal government's decision to withdraw the United States from the Paris Agreement on climate change, Governors Andrew Cuomo, Jay Inslee, and Jerry Brown created the United States Climate Alliance. The Alliance is a bi-partisan coalition of states committed to the goals of the Paris Agreement — a 26 percent to 28 percent reduction in greenhouse gas emissions below 2005 levels by 2025.[124]

Impact of Climate Change on Human Health
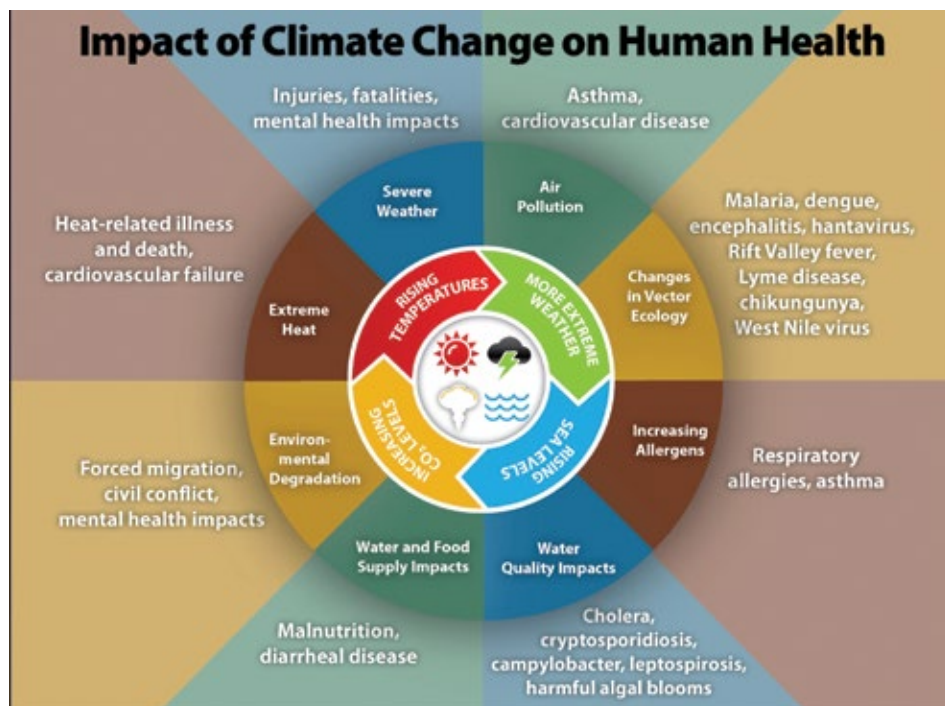
Source: CDC

Fourteen states and Puerto Rico have joined the Climate Alliance, representing more than 36 percent of U.S. population and accounting for more than $7 trillion dollars in combined economic activity— enough to be the world's third largest country. These states have already been leading the U.S. in combating climate change through policies that encourage investment in clean energy, energy efficiency and climate resilience, resulting in a 15 percent reduction in greenhouse gas emissions between 2005 and 2015 alone.[125]

THE LANCET COUNTDOWN: TRACKING PROGRESS ON HEALTH AND CLIMATE CHANGE[126]

The Lancet Countdown is an international, multi-disciplinary research collaboration, dedicated to tracking progress on health and climate change from 2016 to 2030. It aims to report annually on a series of indicators across five themes:

1. The health impacts of climate change;

2. Health resilience and adaptation;

3. Health co-benefits of mitigation;

4. Finance and economics associated with health and climate change; and

5. Political and broader engagement.

2017 Report highlights:

- Annual weather-related disasters have increased by 46% from 2000 to 2013.

- From 2007 to 2016, an average of 306 weather-related disasters were reported per year.

- Between 2000 and 2016, the number of vulnerable people exposed to heatwave events has increased by around 125 million, with a record 175 million more people exposed to heatwaves in 2015.

- In Southeast Asia, 1,900,570 people died prematurely as a result of ambient air pollution in 2015.

- The vectorial capacity for the transmission of dengue fever by *Aedes aegypti*, has increased an estimated 9.4 percent since 1950.

- Economic losses resulting from climate-related events have been increasing since 1990, totaling $129 billion in 2016.

CLIMATE AND HEALTH RISKS

In 2016, Climate Central and ICF developed States at Risk: America's Preparedness Report Card — a state-level preparedness scorecard for climate-related threats.[127] The five weather-related threats examined were extreme heat (48 states), drought (36 states), wildfires (24 states), inland flooding (32 states) and coastal flooding (24 states). Each state was evaluated based only on the threats it faces. Some states face fewer threats, while others, like Florida, Texas and California, are at risk from multiple weather-related disasters.

Extreme heat: Despite being the most pervasive — and deadly — threat, states are the least prepared for extreme heat. The combination of heat and humidity in the Southwest and Gulf Coast is projected to cross into dangerous zones for human health within the next decade. By 2050, 11 states are projected to have an additional 50 or more heat wave days per year, two will have an additional 60, and Florida is expected to have an additional 80 more days (which is a fifth of the year). Extreme heat has killed more than 1,200 Americans in the last 10 years, more than any other form of extreme weather during that time. Those most vulnerable to extreme heat are people living in poverty, experiencing homelessness, under the age of 5 or over the age of 65 and those with mental illness. Alaska faces a unique threat from heat — permafrost thaw — which can cause enormous damage to buildings and infrastructure constructed on top of it.

Summer drought: Texas is threatened by summer droughts more than any other state by a significant margin.

However, by 2050, Colorado, Idaho, Montana, New Mexico, Texas, Michigan, Wisconsin, Minnesota and Washington are projected to face a greater summer drought threat than Texas does today.

Wildfires: The number of large wildfires out west has doubled since the 1970s and in some states, the rate has increased fourfold. Fighting wildfires now accounts for more than half of the annual budget of the U.S. Forest Service, up from 16 percent just 20 years ago. Texas, California, Arizona and Nevada face the greatest threat from wildfires. In those four states, more than 35 million people live in the high threat zone — the wildland-urban interface — which is the point where nature and development converge. Florida, North Carolina and Georgia combine for another 15 million people at risk, and four southeastern states — Arkansas, Alabama, Louisiana and Mississippi — all face above average increases in wildfire risks by 2050.

Inland flooding: Risks depend on many factors — precipitation (locally or far away), soil saturation, topography and flood protections like levees and dams. Florida and California have the largest vulnerable populations at risk with 1.5 million and 1.3 million people living in the inland FEMA 100-year floodplain, respectively. Georgia is third most at risk with 570,000 people. More than half of all states assessed (17 out of 32) have taken no action to plan for future climate change-related inland flooding risks or implemented strategies to address them.

Coastal flooding: Rising sea levels put all 24 coastal states at risk for flooding — none more than Florida and Louisiana. By 2050, 4.6 million people are projected to be at risk (living in the 100-year coastal floodplain) in Florida and 1.2 million in Louisiana. More states are prepared for coastal flooding than for any other threat, but despite Florida's enormous vulnerability, it is among the least prepared for coastal flooding.

INDICATORS 8 AND 9: PUBLIC HEALTH LABORATORIES

KEY FINDING: 47 state laboratories and Washington, D.C.'s laboratory provided biosafety training and/or provided information about biosafety training courses for sentinel clinical labs in their jurisdiction (from July 1, 2016 to June 30, 2017.)

47 state laboratories and Washington, D.C.'s laboratory provided biosafety training and/or information about biosafety training courses for sentinel clinical labs in their jurisdiction (from July 1, 2016 to June 30, 2017.) (1 point).			3 state laboratories did not provide biosafety training and/or information about biosafety training courses for sentinel clinical labs in their jurisdiction (from July 1, 2016 to June 30, 2017.) (0 points).
Alabama	Louisiana ^	Ohio^	California
Alaska	Maine	Oklahoma	Kentucky
Arizona^	Massachusetts	Oregon^	Maryland
Arkansas^	Michigan	Pennsylvania	
Colorado	Minnesota	Rhode Island	
Connecticut	Mississippi	South Carolina	
Delaware^	Missouri^	South Dakota	
D.C.	Montana^	Tennessee^	
Florida^	Nebraska^	Texas	
Georgia^	Nevada	Utah^	
Hawaii	New Hampshire	Vermont	
Idaho^	New Jersey	Virginia	
Illinois^	New Mexico	Washington	
Indiana	New York	West Virginia	
Iowa^	North Carolina^	Wisconsin	
Kansas^	North Dakota	Wyoming	

Note: ^Provided both training and information.

Source: Association of Public Health Laboratories 2017 survey

Key Finding: 47 state laboratories and Washington, D.C.'s laboratory reported having a biosafety professional (from July 1, 2016 to June 30, 2017.)

47 state laboratories and Washington, D.C.'s laboratory reported having a biosafety professional (from July 1, 2016 to June 30, 2017). (1 point).			3 state laboratories reported not having a biosafety professional (from July 1, 2016 to June 30, 2017). (0 points).
Alabama	Louisiana	Oklahoma	Alaska
Arizona	Maryland	Oregon	Maine
Arkansas	Massachusetts	Pennsylvania	New Mexico
California	Michigan	Rhode Island	
Colorado	Minnesota	South Carolina	
Connecticut	Mississippi	South Dakota	
D.C.	Missouri	Tennessee	
Delaware	Montana	Texas	
Florida	Nebraska	Utah	
Georgia	Nevada	Vermont	
Hawaii	New Hampshire	Virginia	
Idaho	New Jersey	Washington	
Illinois	New York	West Virginia	
Indiana	North Carolina	Wisconsin	
Iowa	North Dakota	Wyoming	
Kansas	Ohio		
Kentucky			

Source: Association of Public Health Laboratories 2017 survey.

Public health laboratories are essential to quickly identifying and diagnosing new outbreaks and tracking ongoing outbreaks.

Labs require highly expert staffing, extensive safety measures, specialized equipment, reagents and other biological materials to use for testing and enough capacity to test for a large threat or multiple threats at once. They have ongoing responsibilities, such as testing water and environmental conditions, as well as responding to emergencies and novel threats, such as an outbreak of Salmonella or a suspicious white powder that could potentially be used as an act of bioterrorism.

Since 2001, public health labs have created networks to be more efficient and effective, so that every state has a baseline of capabilities but does not have to invest the resources required to maintain every type of state-of-the-art equipment or staffing expertise. For example, samples can be shipped to facilities with the needed expertise as quickly and safely as possible.

The Laboratory Response Network for Biological Threat Preparedness (LRN-B) includes clinical diagnostic and research labs with a hierarchy of different capabilities that form an integrated, supporting network capable of rapidly responding to an outbreak and/or bioterrorism attack, including:[128]

● National laboratories — including those operated by CDC, U.S. Army Medical Research Institute for Infectious Diseases (USAMRIID) and the Naval Medical Research Center (NMRC) — are responsible in their role in the LRN-B for specialized strain characterizations, bioforensics, select agent activity and handling highly infectious biological agents;
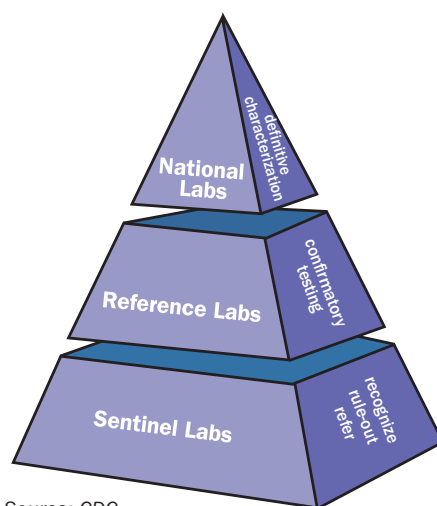
Source: CDC

● Reference laboratories are responsible for investigation and/or referral of specimens. They are made up of more than 100 state and local public health, military, international, veterinary, agriculture, food- and water-testing laboratories; and

● Sentinel laboratories provide routine diagnostic services, rule-out and referral steps in the identification process. While these laboratories may not be equipped to perform the same tests as LRN Reference laboratories, they can test samples.

Labs not only help detect and diagnose problems, the information they provide helps public health officials track the emergence and spread of different outbreaks and is an essential part of monitoring disease threats and understanding how to control them.

In 2010, CDC began funding 57 state, local and territorial health departments to encourage increased electronic reporting of lab results to help make reporting faster and more complete.[129] Data collected since then show various improvements. By the end of July 2013, 54 of the 57 jurisdictions were getting some laboratory reports through Electronic Laboratory Reporting (ELR),

and 62 percent of laboratory reports were being received through ELR compared to 54 percent in 2012.

CDC's Epidemiology and Laboratory Capacity for Infectious Diseases (ELC) Cooperative Agreement distributes resources to U.S. health departments to detect, prevent and control infectious disease threats. Funding awards are used to strengthen epidemiological, laboratory and health information systems capacity at state, local and territorial levels. Zika supplemental awards through ELC cooperative agreements also supported the U.S. Zika Pregnancy Registry to monitor pregnant women with Zika and their infants and to help jurisdictions sustain Zika prevention and surveillance efforts through the next mosquito season.[130]

These indicators examine two important components of ensuring safety in laboratories. First, according to an annual survey conducted by the Association of Public Health Laboratories (APHL), for the time period of July 1, 2016 to June 30, 2017, 47 state labs and Washington, D.C reported that they provided biosafety training and/or information about biosafety training courses for sentinel clinical labs in their jurisdiction. In addition, 47 state labs and Washington, D.C. reported that they have a professional committed to biosafety on staff.

According to the Occupational Safety and Health Administration (OSHA), there are over 500,000 lab workers in the United States. These workers can be exposed to a range of chemical, biological and radiological hazards. While lab safety is governed by myriad regulations at the national, state and local level, OSHA has developed standards and published guidance over the years to improve safety.[131]

4 BIOSAFETY LAB LEVELS

BSL1

BSL1
1. controlled access
2. hand washing sink
3. sharp hazards warning policy
4. personal protective equipment
5. laboratory bench
6. autoclave

BSL2

BSL2
1. controlled access
2. hand washing sink
3. sharp hazards warning policy
4. physical containment device
5. personal protective equipment
6. laboratory bench
7. autoclave

BSL3 (WITH RISK-BASED ENHANCEMENTS)

AIR TIGHT (WHEN DISINFECTING)

AIR TIGHT (WHEN DISINFECTING)

BSL3
1. self-closing double-door access
2. controlled access
3. personal shower out
4. sharp hazards warning policy
5. hand washing sink
6. sealed penetrations
7. physical containment device
8. powered air purifying respirator
9. laboratory bench
10. autoclave
11. exhaust HEPA filter
12. effluent decontamination system

BSL4

AIR TIGHT

AIR TIGHT

BSL4
1. self-closing double-door access
2. controlled access
3. sharp hazards warning policy
4. hand washing sink
5. sealed penetrations
6. physical containment device
7. positive pressure protective suit
8. laboratory bench
9. autoclave
10. chemical shower out
11. personal shower out
12. supply and exhaust HEPA filters
13. effluent decontamination system

● Required safety equipment   ● Risk-based enhancements

www.cdc.gov/24-7

Source: CDC

Many workers handle a variety of biological hazards, including bloodborne agents, research animals and federally-regulated select agents (e.g., viruses and bacteria) and toxins that have the potential to pose a severe threat to public health and safety. Select agents and toxins — as well as other infectious agents and toxins — must be properly stored and handled to ensure the safety of the worker, his or her immediate environment and the larger public as a whole.

A biosafety program requires consistent use of good microbiological practices, use of primary containment equipment and proper containment facility design.[132] One of the primary elements of lab safety is the correct use of

personal protective equipment (PPE) — the protective gear laboratory workers wear to keep them safe as they carry out their jobs. These include respirators, goggles and disposable gloves. In working with the infectious agents and toxins that are regulated federally, workers must use PPE and agents must be properly stored and handled. PPE is selected based on the hazard to the worker and must be properly fitted, maintained in accordance with manufacturing specifications and properly removed and disposed of or cleaned to avoid contaminating the worker, others or the environment.[133]

Properly maintained Biosafety Cabinets (BSCs) are another key component of laboratory safety; they provide an

effective containment system for safe manipulations of biological agents that may produce infectious aerosols.[134]

It is also important to have well-trained laboratorians and labs that have adequate and up-to-date equipment to be able to respond when new threats arise. Strong trainings help ensure that appropriate biosafety precautions are taken. In the past several years, labs have had to respond to emerging threats, such as Zika, Chikungunya, Dengue and Ebola. It is also important to have enough trained staff to be able to test for emerging problems — including to meet surge needs when the labs get an influx of samples, such as some states were managing in response to Zika.

MEANINGFUL USE OF ELECTRONIC HEALTH RECORDS

Meaningful Use is defined as "the use of certified electronic health record (EHR) technology in a meaningful manner (for example electronic prescribing); ensuring that the certified EHR technology is connected in a manner that provides for the electronic exchange of health information to improve the quality of care; and that in using certified EHR technology the provider must submit to the Secretary of HHS information on quality of care and other measures."

One public health objective for meaningful use is electronic lab reporting, transmitting laboratory reports to public health agencies on reportable conditions. Its benefits include improved timeliness, reduction of manual data entry errors and reports that are more complete. The vision for ELR — as determined

by a task force comprised of experts from CDC, the Council of State and Territorial Epidemiologists (CSTE) and the Association of Public Health Laboratories — is that "all labs (public and private) conducting clinical testing identify laboratory results that indicate a potential reportable condition for the jurisdictions they serve, format the information in a standard manner and transmit appropriate messages to the responsible jurisdiction; all jurisdictions can and do receive and utilize the data."[135]

Through the Medicare and Medicaid Programs Electronic Health Records Incentive Program, Centers for Medicare and Medicaid Services (CMS) is providing incentive payments to eligible hospitals, providers and critical access hospitals that adopt and successfully

demonstrate meaningful use of certified EHR technology.[136] The Program consists of three stages with increasing requirements for participation.

- Stage 1 established requirements for the electronic capture of clinical data, including providing patients with electronic copies of health information.

- Stage 2 focused on advancing clinical processes and encouraged the use of certified EHR technology (CEHRT) for continuous quality improvement at the point of care and the exchange of information in the most structured format possible.

- Stage 3 in 2017 and beyond, focuses on using CEHRT to improve health outcomes.

INDICATOR 10: PAID SICK LEAVE LAWS

KEY FINDING: Eight states and Washington, D.C. have paid sick leave laws or do not preempt localities from legally requiring paid sick days for workers.[137]

8 states and Washington, D.C. have paid sick leave laws. (1 point.)	42 states do not have paid sick leave laws and/or preempt localities from legally requiring paid sick days for workers. (0 points.)		
Arizona	Alaska	Louisiana	North Carolina
California	Alabama	Maine	North Dakota
Connecticut	Arkansas	Maryland	Ohio
D.C.	Colorado	Michigan	Oklahoma
Massachusetts	Delaware	Minnesota	Pennsylvania
Oregon	Florida	Mississippi	South Carolina
Rhode Island*	Georgia	Missouri	South Dakota
Vermont	Hawaii	Montana	Tennessee
Washington**	Indiana	Nebraska	Texas
	Iowa	Nevada	Utah
	Idaho	New Hampshire	Virginia
	Illinois	New Jersey	West Virginia
	Kansas	New Mexico	Wisconsin
	Kentucky	New York	Wyoming

Sources: National Partnership for Women & Families.
* Takes effect July 2018.
** Takes effect January 2018.

Nearly one in three private-sector employees cannot earn paid sick days for their own illness or injury or to care for an ill family member. And low-wage workers are much less likely to have access to paid sick leave than highly paid workers.

Paid sick days help reduce the spread of contagious illnesses and diseases and increase access to preventive care among workers and their families. When workers without paid sick time get sick, they face the impossible choice of going to work and potentially infecting others or staying home and risking losing their jobs. Individuals without paid sick leave were three times more likely to forgo medical care for themselves and 1.6 times more likely to forego medical care for their family compared to adults with paid sick leave benefits.[138]

Employees who are sick and possibly contagious in the workplace enable the spread of illness among co-workers and customers alike, and the very industries and occupations that require frequent contact with the public are some of the least like to provide paid sick days. For instance, more than four in five restaurant workers do not have a single paid sick day, and three-fourths of personal care and service workers, including child care workers, do not have paid sick days.[139] This increases the chance of infectious diseases spreading through contact with food, co-workers and the general public — and can threaten the productivity and safety of America's businesses.

Paid sick days help to ensure workers can comply with science-based guidance on controlling the spread of an outbreak. According to a 2010 report, almost 26 million employed Americans age 18 and older may have been infected with the H1N1 influenza in 2009, and nearly eight million people took no time off work while infected.[140] Another recent study found that

providing employees who have the flu with one or two paid sick days to recover could reduce workplace infections by up to 40 percent[141] while another estimates that seasonal flu results in $18.9 billion per year in indirect costs attributable to lost productivity.[142]

Paid sick days also improve access to preventive care by giving employees the ability to take time to go to a clinician and to ensure their children get routine check-ups and immunizations. A 2012 CDC report found that workers without paid sick time are less likely to get screened for cancer.[143] There are clear signs that delaying or skipping necessary preventive care can result in poor health outcomes and more costly care for the more than 37 million American workers who lack paid sick days.

This indicator examines if states have paid sick days laws — which eight plus Washington, D.C. have. A number of

cities and counties have also passed sick leave laws, including: San Francisco, Santa Monica, Berkeley, Emeryville, Oakland and San Diego in California; Seattle, Spokane and Tacoma in Washington state; New York City; Jersey City, Newark, Irvington, Passaic, East Orange, Paterson, Trenton, Montclair, Bloomington, Elizabeth, Plainfield, Morristown and New Brunswick in New Jersey; Philadelphia and Pittsburgh in Pennsylvania; Chicago, Cook County in Illinois, and Minneapolis and St. Paul in Minnesota.[144]

Sixteen states have actually passed "preemption laws," which prevent local jurisdictions from instituting their own laws or legal requirement to provide paid sick leave to workers, including: Alabama, Arizona, Florida, Georgia, Indiana, Kansas, Louisiana, Michigan, Mississippi, Missouri, North Carolina, Ohio, Oklahoma, Oregon, Tennessee and Wisconsin.[145]

A Potentially Unhealthy Mix: How Workplace Practices Can Either Enhance or Exacerbate Health Preparedness

By: Michael T. Childress, MA, research associate at the Center for Business and Economic Research, Gatton College of Business and Economics, University of Kentucky; and member of program management office team for the National Health Security Preparedness Index.

The National Health Security Preparedness Index measures the nation's health security and preparedness—that is, the nation's ability to prepare for, respond to, and recover from large-scale health threats. The Preparedness Index measures health security from a broad, multi-sectoral perspective using nearly 140 measures from more than 50 different sources. Here we examine three of these measures: paid time off (PTO), telecommuting, and high-speed internet access from home, in the context of health security, preparedness and equity. These factors have at least three things in common: they enhance compliance with social distancing policies used in infectious disease outbreaks; they highlight the private-sector role in the nation's health preparedness; and they bring to the fore important equity issues. For prime working-age adults between 25 and 54 years old, an estimated 81 percent have broadband access at home, approximately 62 percent have some form of PTO, and about 30 percent can telecommute when they are away from their usual workplace. However, there are significant differences based on income and education levels, with individuals at lower income and education levels reporting lower percentages of PTO, broadband access, and telecommuting. Our analysis of individual-level U.S. Census data reveals statistically significant independent effects of education and income on whether an individual has PTO, broadband at home, or can telecommute. This analysis illustrates how the less advantaged can be affected differently by disease outbreaks, disasters, and large-scale emergencies—and how workplace practices can either exacerbate or ameliorate health security.

Rationale

Social distancing policies, such as school closures and self-quarantine measures, were used during the 2014 Ebola outbreak and the 2009 H1N1 influenza (flu) pandemic to thwart the spread of disease. The efficacy of this approach, however, is largely determined by the extent to which individuals adhere to it. The Centers for Disease Control and Prevention estimates that almost 18 of the 26 million H1N1 infected workers in the fall of 2009 took days off from work, but the remaining 8 million workers did not and likely infected another 7 million co-workers.[146]

Broadband access facilitates the continuity of operations during emergencies that can limit the adverse economic impact of disasters. There was, for instance, a citywide closure of Boston after the 2013 Marathon bombing, but some businesses stayed open with teleworkers and experienced limited financial losses. Similarly, health department staff were able to work remotely to maintain critical communications and surveillance activities.

These three factors—PTO, telecommuting, and high-speed internet access from home—can enhance the likelihood individuals will adhere to social distancing and quarantine measures.[147] PTO and telecommuting are two of 17 item measures within the Preparedness Index domain of Countermeasure Management.[148] PTO is an indicator of preparedness and resilience, because it enables one to shelter in place or evacuate during an emergency without experiencing the economic hardship of lost income. Likewise, the ability to telecommute and household access to high-speed internet are vital because, like PTO, if one can work at home, remain economically productive, and shelter in place, it enhances individual security and community resilience.[149] Also, as one of 13 measures in the Incident & Information Management domain,[150] household broadband access reflects the degree to which one can receive timely and up-to-date information during a public health emergency. The Pew Research Center reports that four in ten Americans often get their news online, highlighting the reliance on the internet for staying informed.[151]

Factors Affecting PTO, Telecommuting, & Household Broadband Access

Based on our analysis of prime working age adults from 25 to 54 years old, an estimated 62 percent of workers have some form of PTO,[152] about 30 percent can telecommute when away from their usual workplace,[153] and an estimated 81 percent of households have broadband in the home.[154] However, there are significant differences based on income and education levels, with individuals at lower income and education levels showing comparatively lower percentages.

The numbers in Table 1 illustrate some of the significant differences in these

TABLE 1—Estimated Gross and Net Percentage of Workers (25 To 54 Years) With Paid Time Off, Households With Broadband, and Telecommuters						
	Paid Time Off		Household Broadband		Telecommuters	
Wages & Salary	**Gross**	**Net**	**Gross**	**Net**	**Gross**	**Net**
1st Quartile (lowest)	25%	55%	58%	62%	12%	18%
2nd Quartile	58%	58%	76%	77%	20%	24%
3rd Quartile	71%	69%	88%	86%	32%	31%
4th Quartile (highest)	73%	67%	95%	90%	47%	41%
Education						
Less than High School	33%	44%	55%	61%	9%	15%
High School	53%	56%	70%	73%	15%	18%
Some College	52%	61%	83%	83%	25%	27%
Bachelors or Higher	70%	69%	93%	88%	44%	40%
Race						
White (non-Hispanic)	57%	61%	83%	81%	31%	30%
Non-White (non-Hispanic)	55%	59%	74%	77%	26%	30%
Residence						
Non-Metro	54%	60%	76%	78%	19%	25%
Metro	58%	61%	81%	81%	31%	30%
Age						
Under 40	58%	58%	81%	81%	30%	31%
Over 40	65%	64%	81%	80%	29%	29%
Gender						
Female	55%	58%	80%	81%	26%	26%
Male	59%	63%	81%	80%	34%	34%

factors across income and education levels. The "gross" numbers, explained in detail below, represent the overall percentages for everyone in that category. We can see, for example, that those without a high school diploma are much less likely to have PTO (33 percent) than those with a bachelor's degree or higher (70 percent), and workers in the lowest income group (25 percent) are much less likely to have PTO than those in the highest income group (73 percent).

Similarly, individuals with higher income and education levels are more likely to have household broadband and are more likely to telecommute. Individuals, for instance, in the highest income quartile are 1.6 times more likely to have household broadband (95 percent) than those in the lowest income quartile (58 percent)—and are four times more likely to telecommute (46.8 percent compared to 11.7 percent). Likewise, there are

big differences across education levels. Those with a bachelor's degree or higher are 1.7 times more likely to have household broadband (93 percent) than those without a high school diploma (55 percent)—and are 4.9 times more likely to telecommute (44.2 percent compared to 9.1 percent).

Within each of the education and income groups described above, the individuals and households might be quite different from each other and only share membership in the group on the basis of that one factor. That is, among those with a bachelor's degree or higher there will be members from every income group, both genders, many ages, and all races and ethnicities. We call these the "gross" percentages. However, because so many factors are correlated—like income, education, race, gender, and location of residence—the gross differences do not reveal how much of a digital divide, for example, is due to

income (because higher education is associated with higher income), education (since lower income is correlated with lower education), or location of residence (since individuals in metro areas tend to have higher income and educational attainment).

To better address the equity issues represented by the gross differences described above, it is necessary to isolate and identify the "net" differences. Multiple regression analysis allows us to assess the independent or net effects of these factors.[155] The net effect is an estimate of how individuals and households differ along a single dimension while holding all other factors constant. For example, comparing two individuals with the same education, race, age, gender, and residence— but from different income groups—allows us to estimate the effect of income on whether one has PTO, telecommutes, or has household broadband access. Knowing whether the root cause of the inequity is primarily due to a lack of income, education, or where someone lives can suggest whether the best public policy approach might be subsidizing internet access, launching an information campaign explaining the benefits of broadband, or providing the last mile of wired infrastructure.

The differences in the "net" percentages across income and education groups are significant and important (see Figures 1 and 2). Someone with a bachelor's degree is nearly 1.6 times more likely to have PTO (69 percent v. 44 percent), more than 1.4 times more likely to have high-speed internet at home (88 percent v. 61 percent), and about 2.6 times more likely to telecommute (40 percent v. 15 percent), assuming all other factors *ceteris paribus*, compared to the lowest education category, and we see similar patterns across the income quartiles.

Discussion

Inequality—in both opportunity and outcome—is becoming the defining zeitgeist of our era. We typically think about inequality in the context of income, but equity and health also go hand-in-hand. Alonzo Plough, PhD, MPH, chief science officer and vice president of Research, Evaluation, and Learning at the Robert Wood Johnson Foundation, for example, recently described how extreme weather events can have a disproportionate impact on "children, the elderly, people with chronic health conditions, the economically marginalized and communities of color."[156] And others have raised concerns about the disproportionate vulnerability of lower-income Americans to the Zika virus.[157] While there are many ways in which this relationship can manifest itself, research and analysis confirm what common

Figure 1: Estimated Relationship Between Income and Paid Time Off, Broadband at Home, & Telecommuting (net effect of income, ages 25 to 54 years)
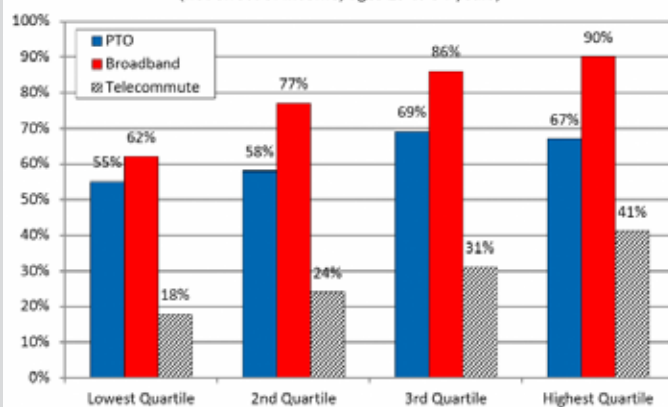
Figure 1: Estimated Relationship Between Income and Paid Time Off, Broadband at Home, & Telecommuting (net effect of income, ages 25 to 54 years)
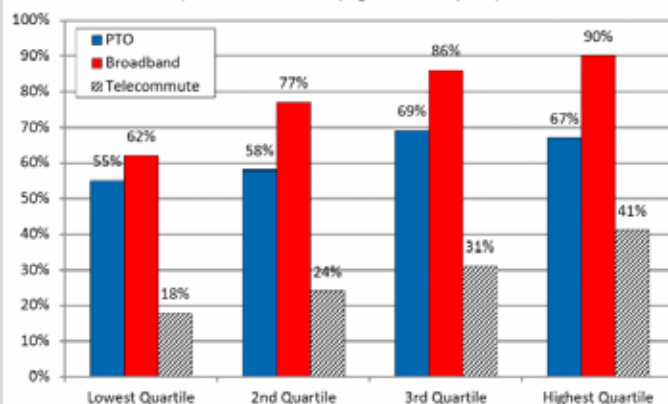
sense suggests: the less-advantaged are affected differently by disease outbreaks, disasters, and large-scale emergencies.

We illustrate here how lower levels of education and income are associated with a decreased likelihood (both in terms of gross and net percentages) that one will enjoy the benefits of PTO, have household broadband access, or telecommute. Understanding the root causes of these differences and addressing the inequities will enhance health security, preparedness, and community resilience. However, understanding the root causes is not sufficient—community leaders from the private, public, and nonprofit sectors must work together to tackle the root causes of these inequities. By doing so, the health security of the entire community will be enhanced.

National Health Security Issues and Recommendations

The nation's health security policy needs to be built to expect new emergencies. Health crises are not a question of if, but when. Being prepared requires maintaining a stronger steady defense that is able to more effectively manage ongoing public health needs while being ready to be able to respond to emerging and emergency priorities.

Investments have helped significantly improve many areas of preparedness over the past 16 years, but they have fallen short of what is needed to address some major gaps and ensure a consistent and strong level of readiness across the country. In addition, budget cuts have eroded gains, including sustaining some basic capabilities.

TFAH has identified a set of concerns and recommendations for improving America's preparedness for health emergencies, including:

A. **Reforming Baseline Abilities to Diagnose, Detect and Control Health Crises: Foundational Capabilities;**

B. **Supporting Stable, Sufficient Funding for Ongoing Emergency Preparedness and Funding a Permanent Public Health Emergency Fund for Immediate and "Surge" Needs During an Emergency;**

C. **Supporting Global Health Security;**

D. **Improving Federal Leadership Before, During and After Disasters;**

E. **Innovating and Modernizing Infrastructure, Including Wide Implementation of Faster Diagnostics, Biosurveillance and Medical Countermeasures;**

F. **Maintaining a Robust, Well-Trained Public Health Workforce;**

G. **Rebooting and Developing a New Strategy for Hospital and Healthcare Emergency Preparedness — Including Surge Capacity for Major Emergencies;**

H. **Readying for Climate Change and Weather-Related Threats;**

I. **Supporting Community Resilience — for Communities to Better Cope and Recover from Emergencies — With Better Behavioral Health Infrastructure and Capacity;**

J. **Stopping Superbugs and Antibiotic Resistance;**

K. **Improving Vaccination Rates — for Children and Adults; and**

L. **Protecting Food and Water Safety.**

> "Simply put, the Nation does not afford the biological threat the same level of attention as it does other threats: There is no centralized leader for biodefense. There is no comprehensive national strategic plan for biodefense. There is no all-inclusive dedicated budget for biodefense. The Nation lacks a single leader to control, prioritize, coordinate and hold agencies accountable for working toward common national biodefense. This weakness precludes sufficient defense against biological threats." [158]
>
> — *A National Blueprint for Biodefense: Leadership and Major Reform Needed to Optimize Efforts, 2015.*

> "The world remains under-prepared to prevent, detect, and respond to infectious disease outbreaks, whether naturally occurring, accidental, or deliberately released. Distance alone no longer provides protection from disease outbreaks. Infectious disease and pathogens can move from one point on earth to almost any other place in the world within 36 hours." [159]
>
> — **Admiral Tim Ziemer,** Senior Director for Global Health Security at the National Security Council, 2017.

SELECT FEDERAL PUBLIC HEALTH PREPAREDNESS ACTIVITIES AND ACTIONS

THE PANDEMIC AND ALL-HAZARDS PREPAREDNESS ACT (PAHPA)

The Pandemic and All-Hazards Preparedness Act — passed into law in 2006 — aims "to improve the Nation's public health and medical preparedness and response capabilities for emergencies, whether deliberate, accidental, or natural." PAHPA amended the Public Health Service Act to establish within HHS a new Assistant Secretary for Preparedness and Response (ASPR); provide new authorities for a number of programs, including the advanced development and acquisitions of medical countermeasures; and establish a quadrennial National Health Security Strategy.

Major program areas:

- Biomedical Advanced Research and Development Authority (BARDA) and Medical Countermeasures;
- Emergency Support Function (ESF) #8: Public Health and Medical Response: Domestic Programs;
- Emergency Support Function #8: Public Health and Medical Response: International Programs;
- Public Health Emergency Preparedness and Hospital Preparedness Program Grants;
- At-Risk Individuals;

- National Health Security Strategy (NHSS);
- Situational Awareness: Surveillance, Credentialing, and Telehealth; and
- Education and Training

In 2013, Congress reauthorized PAHPA through the Pandemic and All-Hazards Preparedness Reauthorization Act (PAHPRA) in order to build on HHS's national health security work. PAHPRA reauthorized funding for public health and medical preparedness programs, such as the Hospital Preparedness Program and the Public Health Emergency Preparedness Cooperative Agreement, amended the Public Health Service Act to grant state health departments greatly needed flexibility in dedicating staff resources to meeting critical community needs in a disaster, authorized funding through 2018 for buying medical countermeasures under the Project BioShield Act, and increased the flexibility of BioShield to support advanced research and development of potential medical countermeasures. PAHPRA also enhance the authority of FDA to support rapid responses to public health emergencies and the Shelf-Life Extension

Programs for state and local Medical Counter Measure stockpiles.

Major program areas:

- National Health Security Strategy
- Assistant Secretary for Preparedness and Response
- National Advisory Committee on Children and Disasters
- Modernization of the National Disaster Medical System
- Temporary reassignment of State and local personnel during a public health emergency
- Improving State and local public health security
- Hospital preparedness and medical surge capacity
- Enhancing situational awareness and biosurveillance
- Enhancing medical countermeasure review
- Accelerating medical countermeasure advanced research and development

PAHPA is up for reauthorization again in 2018. Congress will be considering what public health authorities need to be revised to prepare the nation for emerging threats.

CDC'S 15 PUBLIC HEALTH PREPAREDNESS CAPABILITIES[160]

Since 2011, CDC has focused on 15 core capabilities in six domains as the basis for state and local public health preparedness to assist health departments in their strategic planning, including:

Biosurveillance

- **Public health laboratory testing** is the ability to conduct rapid and conventional detection, characterization, confirmatory testing, data reporting, investigative support and laboratory networking to address actual or potential exposure to all hazards, including chemical, radiological and biological agents in clinical, food and environmental samples.

- **Public health surveillance and epidemiological investigation** is 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 public health emergencies.

Community Resilience

- **Community preparedness** is the ability of communities to prepare for, withstand and recover from public health incidents in the short and long term, through engagement and coordination with emergency management, health care organizations and providers, community and faith-based partners, and state and local governments.

- **Community recovery** is the ability to collaborate with community partners following an incident to plan and advocate for the rebuilding of public health, medical and mental/behavioral health systems to a functioning level or better.

Incident Management

- **Emergency operations coordination** is the ability to direct and support a public health or medical incident by establishing a standardized, scalable system of oversight, organization and supervision consistent with jurisdictional standards and practices and with the National Incident Management System.

Information Management

- **Emergency public information and warning** is the ability to develop, coordinate and disseminate information, alerts, warnings and notifications to the public and incident management responders.

- **Information sharing** is the ability to conduct multijurisdictional, multidisciplinary exchange of health-related information and situational awareness data among all levels of government and the private sector in preparation for and in response to public health incidents.

Surge Management

- **Fatality management** is the ability to coordinate with other organizations 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 and survivors.

- **Mass care** is the ability to coordinate with partner agencies to address the public health, medical and mental/behavioral health needs of those affected by an incident and gathered together. This capability includes ongoing surveillance and assessment as the incident evolves.

- **Medical surge** is the ability to provide adequate medical evaluation and care during events that exceed the limits of the normal medical infrastructure, and to survive a hazard impact and maintain or rapidly recover operations that were compromised.

- **Volunteer management** is the ability to coordinate the identification, recruitment, registration, credential verification, training and engagement of volunteers to support the public health agency's response.

Countermeasures and Mitigation

- **Medical countermeasure dispensing** is the ability to provide medical countermeasures in support of treatment or prophylaxis to the identified population in accordance with public health guidelines and/or recommendations.

- **Materiel management and distribution** is the ability to acquire, maintain, transport, distribute and track medical materiel during an incident and to recover and account for unused medical materiel, as necessary, after an incident.

- **Non-pharmaceutical interventions** is the ability to take actions (other than vaccines or medications) that people and communities can use to slow the spread of disease.

- **Community mitigation** is the ability to slow the spread of disease through the implementation of non-pharmaceutical interventions and threat-appropriate travel and border health measures.

- **Responder safety and health** is the ability to protect public health agency staff responding to an incident and support the health and safety needs of hospital and medical facility personnel, if requested.

In 2017, CDC began a process to refine the 15 capabilities, with input from awardees and other stakeholders.

Through its annual *Public Health Preparedness National Snapshot*, CDC highlights national, state and local progress in the 15 public health preparedness capabilities as the basis for state and local public health preparedness. Its 2016 report highlights how CDC strengthens the nation's health security to save lives and protect against public health threats within the context of its 2014-2015 Ebola response and its three overarching priorities: 1) improving health security at home; 2) protecting people from public health threats; and 3) strengthening public health through collaboration. Each state profile reflects the five capabilities with the largest Public Health Emergency Preparedness cooperative agreement investments.[161]

HEALTHCARE PREPAREDNESS CAPABILITIES: NATIONAL GUIDANCE FOR HEALTHCARE SYSTEM PREPAREDNESS[162]

The Hospital Preparedness Program grants to 62 State and territory departments of public health support the building of healthcare capabilities outlined in *Healthcare Preparedness Capabilities: National Guidance for Healthcare System Preparedness 2017-2022.* The program is managed by ASPR, which provides programmatic oversight and works with its partners in State, territorial, and municipal government to ensure that the program's goals are met or exceeded. Funding awards help state and local governments, healthcare coalitions, and ESF #8 planners identify gaps in preparedness, determine specific priorities, and develop plans for building and sustaining four national stakeholder-created and vetted healthcare-specific capabilities, to enable the healthcare delivery system to prepare for and response to emergencies that impact the public's health. These include:

1. **Foundation for Health Care and Medical Readiness.** The goal of this capability is to support the community's healthcare organizations and other stakeholders, coordinated through healthcare coalitions, to have strong relationships, identify hazards, and address gaps through planning, training, exercising and managing resources.

2. **Health Care and Medical Response Coordination.** The goal is for coalitions, healthcare organizations and relevant agencies in their jurisdictions to plan and collaborate to share information, resources and strategies to deliver medical care during emergencies.

3. **Continuity of Health Care Service Delivery.** The goal is for healthcare organizations to provide uninterrupted care to all populations, have a well-trained healthcare workforce and a return to operations.

4. **Medical Surge.** Healthcare organizations and coalitions should coordinate resources to provide care when demand exceeds available supply.[163]

A. Reforming Baseline Abilities to Diagnose, Detect and Control Health Crises: Foundational Capabilities

Americans deserve and should expect basic health protections, no matter where they live. Yet, while there have been many improvements in national health security, funding has been unstable and insufficient to maintain baseline capabilities and meet the changing threats facing our communities. As a result, the public health services and the funding of these programs vary dramatically from state to state and among communities and territories.

While many public health agencies are able to prepare for and respond to many small scale emergencies, such as foodborne outbreaks and some types of natural disasters, the fluctuation in funding has harmed the government's ability to respond to significant health crises and leaves first responders without adequate tools and systems and a shaky foundation to build upon when significant emergencies arise. In addition, unstable funding means that public health must reorient its resources and operations when a major disaster hits, resulting in gaps in basic public health functions.

A leading recommendation by the Health and Medicine Division of the National Academies of Science, Engineering and Medicine (formerly the Institute of Medicine) and other experts is to establish and maintain a clear, consistent set of key foundational capabilities that focus on performance outcomes in exchange for increased flexibility and reduced bureaucracy.[164, 165]

These foundational capabilities would help support preparedness and readiness, helping provide a stronger, more consistent core foundation for public health activities in states and localities. The foundational capabilities approach would complement and help provide a backbone to build and expand the capabilities that are supported by

PHEP, HPP, FEMA and other homeland security grants and public health programs for states.

The expert-defined foundational services should include: 1) communicable/infectious disease prevention; 2) chronic disease and injury prevention; 3) environmental public health; 4) maternal, child and family health; and 5) access to and linkage with clinical care.[166, 167]

In addition, 30 state, 179 local, and one tribal health department have been accredited through the voluntary national accreditation program (as of November 2017) — a measurement of health department performance against a set of nationally recognized, practice focused and evidence-based standards.[168] The Public Health Leadership Forum has recommended that there should be financing mechanisms to help all states and localities achieve accreditation and the ability to deliver foundational public health services, either directly or through cross-jurisdictional collaboration.[169]

The defined foundational capabilities include:

- Assessment (surveillance, epidemiology and laboratory capacity);

- Developing policy to effectively promote and improve health;

- Using integrated data sets for assessment, surveillance and evaluation to identify crucial health challenges, best practices and better health;

- Communicating with the public and other audiences to disseminate and receive health-related information in an effective manner, including health promotion opportunities, access to care and prevention;

- Mobilizing the community and forging partnerships to leverage resources (including funding);

- Building new models that integrate clinical and population health;

- Cultivating leadership skills, along with organization, management and business skills, needed to build and sustain an effective health department and workforce to effectively and efficiently promote and improve health;

- Demonstrating accountability for what governmental public health does directly and for those things that it oversees through accreditation, continuous quality improvement and transparency; and

- Protecting the public in the event of an emergency or disaster, as well as responding to day-to-day challenges or threats, with a cross-trained workforce.

RECOMMENDATIONS:

● **Prioritizing and fully funding a foundational capabilities approach for public health departments at all levels of government.** The foundational capabilities model is key to strengthening preparedness for public health emergencies and focuses on core functions of modern public health — such as a modern laboratory, workforce and surveillance capabilities — as well as organizational efficiency and coordination. This means changing siloed grant and budget structures that often fund different aspects of these core capabilities separately and do not focus on performance, capabilities or outcomes for the overall integrated, coordinated system. For example, many current grants for epidemiological, laboratory and surveillance support are administered separately and for specific diseases.

A foundational capabilities model also includes flexibility for communities to build upon the basics to meet their specific needs and concerns, contingent on additional available resources. Jurisdictions that meet foundational capabilities could be given greater flexibility in their use of federal support for core public health functions. Ensuring the workforce is well trained to carry out these capabilities and that a mechanism for continuous quality improvement and stable, sufficient funding are in place are all inherent to the success of this model.

VISION FOR A BASELINE PUBLIC HEALTH SYSTEM: To Address Emergencies and Ongoing Health Concerns		
Laboratory Capacity	Epidemiology/Investigations	Surveillance & Data/Information Systems
Trained, Expert Workforce + Research/Evidence-Informed Strategies		
Accountability + Continuous Quality Improvement		
Sustained, Stable Funding		

EXAMPLES OF STATES ADOPTING FOUNDATIONAL CAPABILITIES

A number of states, including Colorado, Oklahoma and Washington, have taken steps to move toward a foundational capabilities approach within the state and local public health departments.

For instance, Washington State has engaged stakeholders (such as hospitals, community health organizations, service providers and laboratories) to partner with public health departments and improve or increase health information exchange; reviewed state public health laws to identify governing power and regulations across jurisdictions; reviewed funding streams to determine what mandatory services may or may not be attached to funding; identified which services can be provided by state health departments versus local health departments; and engaged with policy makers to gain support of legislative changes needed to fully develop and implement foundational public health services.[170] The state's Department of Health estimated it would require an additional $21.8 million and local health jurisdictions in the state would need an additional $78.0 million (2013 dollars) (totally $99.9 million statewide) to fully and effectively implement foundational capabilities.[171]

Ohio has also been developing strategies for implementing foundational capabilities and has moved forward to consolidate some local health departments and cross-jurisdictional services and programs and to prioritize funding streams.[172, 173] Colorado legally defined foundational "minimum quality standards," and within two years has shown significant increases in the delivery of several programs and service areas.[174]

The Public Health Cost Estimation Work Group has developed a methodology to help state and local health departments determine the cost of adopting foundational capabilities and the data will be used to generate national estimates.[175, 176]

KEY CDC HEALTH SECURITY PROGRAMS

- **CDC's Epidemic Intelligence Service (EIS):** EIS officers serve as expert "disease detectives" who conduct investigations, research and surveillance — in the United States and abroad. EIS is a two-year post-graduate training program for physicians, nurses, veterinarians and PhD-trained scientists and other health professionals.[177]

- **Public Health Emergency Preparedness Cooperative Agreement Program:** PHEP provides formula-based cooperative agreement funds to states, territories and urban areas to build and sustain the ability to prepare for and respond to all types of major health emergencies.[178] PHEP focuses on 15 key capability areas, including community preparedness; community recovery; emergency operations coordination; emergency public information and warning; facility management; information sharing; mass care; medical countermeasure dispensing; medical materiel management and distribution; medical surge; non-pharmaceutical interventions; public health laboratory testing; public health surveillance and epidemiological investigations; responder safety and health; and volunteer management.[179]

- **Strategic National Stockpile:** The stockpile is a national repository of antibiotics, chemical antidotes and other medicines and medical supplies for use during a major disease outbreak, bioterror or chemical attack or other public health emergency.[180] Medical countermeasures in the SNS are kept in secure locations around the country and can be delivered to the affected area within a clinically-relevant time frame. The federal government also can employ systems to work with some private pharmaceutical distribution companies and pharmacies to be able to distribute vaccines or medicines during an outbreak.

DIVISION OF STRATEGIC NATIONAL STOCKPILE
AMERICA'S EMERGENCY MEDICAL SUPPLIES TO PROTECT THE PUBLIC'S HEALTH

To prepare and support partners and provide the right resources at the right time to secure the nation's health

THE STRATEGIC NATIONAL STOCKPILE (SNS) contains

>$7 billion

worth of medicines and medical supplies

SNS HAS THE ABILITY TO RESPOND TO:

Bacterial and viral diseases

Pandemic influenza

Radiation/nuclear emergency

Chemical attacks

Natural disasters

CS256096B

THE STRATEGIC NATIONAL STOCKPILE

Managed Inventory
Includes specific medicines, vaccines, and supplies for a defined need

CHEMPACK
Forward-placed containers of nerve-agent antidotes that can be used to respond to a chemical attack

Federal Medical Station
Rapidly deployable reserve of beds, supplies, and medicines to accommodate 50–250 people with health-related needs and low-acuity care

12-hour Push Package
50 tons of emergency medical resources that can be delivered anywhere in the U.S. within 12 hours

CHEMICAL ANTIDOTES · ANTITOXINS · VACCINES · ANTIVIRAL DRUGS · ANTIBIOTICS · MEDICAL SUPPLIES

The SNS holds medical supplies unavailable from other sources and specially designed for unusual or rare threats

90% of the U.S. population is within one hour of a CHEMPACK location

PARTNERSHIPS IN PREPAREDNESS

CDC's Strategic National Stockpile works with state and local health departments, as well as the private sector, to ensure that medicine and supplies get to the people who need them most during an emergency.

HOW?

Practice: Leading training courses and exercises to prepare state and local partners to receive, distribute and dispense SNS resources during an emergency.

Send in the SNS Experts: If needed, multiple teams of experts are prepared to deploy to locations receiving SNS resources.

Community Resilience: Create relationships between public health and community partners to support optimal distribution of medical counter-measures (MCM) in the U.S. healthcare supply chain during public health emergencies.

CDC
Centers for Disease Control and Prevention
Office of Public Health Preparedness and Response

- **Epidemiology and Laboratory Capacity:** ELC is a cooperative agreement to provide funding and technical assistance for cross-cutting as well as disease-specific epidemiology, laboratory and surveillance systems capacity. Funding supports all 50 states, eight U.S. territories and six cities to strengthen workforce and disease detection systems.[181] The funding has allowed states to maintain modern capabilities and speed the detection of outbreaks and health threats. Zika supplemental awards through ELC cooperative agreements also supported the U.S. Zika Pregnancy Registry to monitor pregnant women with Zika and their infants and to help jurisdicitons sustain Zika prevention and surveillance efforts through the next mosquito season.[182]

- **WHO Influenza Collaborating Center:** CDC's Influenza Division has served as a WHO Collaborating Center for Surveillance, Epidemiology and Control of Influenza in Atlanta, Georgia since 1956 and is the largest global resource and reference center supporting public health interventions to control and prevent pandemic and seasonal influenza. It also plays a major role in year-round surveillance for early detection and in identification of changes in seasonal influenza viruses, influenza viruses that may have pandemic potential, and those with antiviral susceptibility. CDC also supports the WHO Collaborating Center for Implementation of International Health Regulation Core Capacities and for International Monitoring of Bacterial Resistance to Antimicrobial Agents.

- **National Notifiable Diseases Surveillance System (NNDSS):** The system is a nationwide collaboration that enables all levels of public health — local, state, territorial, federal and international — to share notifiable disease-related health information allowing health officials to monitor, control and prevent the occurrence and spread of selected infectious and non-infectious diseases and conditions.[183] NNDSS has undergone an initiative to modernize the systems and processes used to receive nationally notifiable disease data that will improve public health decision making and interventions by providing more comprehensive and higher quality data in a timelier manner. NNDSS data was used by CDC-EOC for the first time to monitor for increases of disease in the areas affected by Hurricane Harvey.

- **National Syndromic Surveillance Program:** This program is a collaboration among public health agencies for timely exchange of syndromic data to improve national situational awareness and responsiveness to hazardous events and disease outbreaks.[184] Syndromic surveillance uses syndromic data and statistical tools to detect, monitor and characterize unusual activity for further public health investigation or response. Syndromic data include patient encounter data from emergency departments, urgent care, ambulatory care and inpatient healthcare settings. In addition to these data sources, HHS Disaster Medical Assistance Team (DMAT) data was transmitted to CDC's syndromic surveillance infrastructure (the BioSense Platform) for the first time in 2017 to support situation awareness for Hurricanes Harvey, Irma and Maria. Though these data are being captured for different purposes, they are monitored in near real-time as potential indicators of an event, a disease, or an outbreak of public health significance.

B. Supporting Stable, Sufficient Funding for Ongoing Emergency Preparedness — and Funding a Permanent Public Health Emergency Fund for Immediate and "Surge" Needs During an Emergency

Natural disasters, infectious disease outbreaks and other public health emergencies can strike at any time and have devastating public health impacts. Infectious diseases alone — including the regular seasonal flu — cost the country more than $120 billion each year.[185] Baseline funding for public health and healthcare preparedness and response is not sufficient to address ongoing needs, yet alone emerging problems. Over the past 15 years, federal funds to support and maintain baseline state and local preparedness have been cut by about one-third (from $940 million in FY 2002 to $667 million in FY 2017) and hospital emergency preparedness funds have been cut in half ($515 million in FY 2004 to $255 million in FY 2017).[186]

As crises arise, they pull funding, personnel and attention from ongoing needs. Major crises may cause enough disruption to demonstrate the need for emergency supplemental funding. This type of support usually is considered after an emergency has reached a critical mass, but the funds are often too little to address all of the needs and expenses and get delayed in bureaucratic processes. One of the biggest problems is the effect on the workforce. Budget cuts over time — or when money is diverted during an emergency — lead to layoffs of highly trained public health experts, many of whom cannot be hired back with short-term emergency funds.

The 2017 hurricanes demonstrated that the nation is well-prepared for disasters in many areas, but has little ability to mount an effective public health response when the infrastructure is devastated. The devastation in U.S. territories has left residents of Puerto Rico and the U.S. Virgin Islands at risk for outbreaks caused by unsafe water and food, and long-term health problems caused by mental and physical trauma — all with limited access to healthcare. These crises illustrate the

Strategic National Stockpile Medical Logistics Support
2017 Hurricane Maria

Puerto Rico

$4.2 MILLION in supplies

6	Federal Medical Stations with 1,500 beds total
$2.1 million	vaccines for public health needs
$543,600	additional medical supplies purchased
177,000	bottles of water
42,000	meals ready to eat

10,000 sq. ft. of warehouse operations in P.R.

115 Stockpile **personnel** working the response

19 total **flights** with supplies

343+ tons of **cargo**

Source: CDC

need for both underlying public health capacity and a surge of resources after disaster strikes.

Public health and healthcare professionals are first responders, like police, firefighters and FEMA personnel. However, under the current systems and approach, they do not currently have the ongoing support — resources, supplies and training — needed to be able to be able to effectively manage crises. Maintaining a steady public health system is analogous to having a ready military defense — where the country maintains a standing, trained force on a consistent basis, but additional resources and support are needed to fight a war.

CDC OFFICE OF PUBLIC HEALTH PREPAREDNESS AND RESPONSE FUNDING TOTALS AND SELECT PROGRAMS															
	FY 2002	FY 2003***	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014^	FY 2015^^	FY 2016^^^	FY 2017 (est.)
CDCTotal*	$1,747,023,000	$1,533,474,000	$1,507,211,000	$1,622,757,000	$1,631,173,000	$1,472,553,000	$1,479,455,000	$1,514,657,000	$1,522,339,000	$1,415,416,000	$1,329,479,000	$1,231,858,000	$1,323,450,000	$1,352,551,000	$1,405,000,000	$1,401,708,000
State and Local Preparedness and Response Capability**	$940,174,000	$1,038,858,000	$918,454,000	$919,148,000	$823,099,000	$766,660,000	$746,039,000	$746,596,000	$760,986,000	$664,294,000	$657,418,000	$623,209,000	$655,750,000	$661,042,000	$668,200,000	$666,634,000
SNS	$645,000,000	$298,050,000	$397,640,000	$466,700,000	$524,339,000	$496,348,000	$551,509,000	$570,307,000	$595,661,000	$591,001,000	$533,792,000	$477,577,000	$535,000,000	$534,343,000	$575,000,000	$573,653,000

* CDC Total also includes CDC Preparedness and BioSense

** May include Public Health Emergency Preparedness (PHEP) cooperative agreements, All Other State and Local Capacity, Centers for Public Health Preparedness, Advanced Practice Centers (FY2004-09), Cities Readiness Initiative, U.S. Postal Service Costs (FY 2004), and Smallpox Supplement (FY 2003)

***FY2003 included one-time supplemnetal funds of $100 million for the smallpox vaccination program. Source: https://fas.org/sgp/crs/homesec/RL31719.pdf

^ FY2014 numbers are enacted levels. Beginning in FY14, CDC moves funds from each budget line to the Working Capital Fund for business services, resulting in different operating budgets from enacted levels Source: http://www.cdc.gov/fmo/topic/wcf/index.html

^^ Totals do not include Ebola funding

^^^In FY2016, CDC transfered money away from CDC preparedness program for the immediate Zika response. That money was replaced by the FY 2016 Zika Response and Preparedness Act (P.S. 114-223).
Source FY2017: https://www.cdc.gov/budget/documents/fy2017/fy-2017-cdc-operating-plan.pdf   Source FY 2016: https://www.cdc.gov/budget/documents/fy2016/fy-2016-cdc-operating-plan.pdf
Source FY 2015: https://www.cdc.gov/budget/documents/fy2015/fy-2015-cdc-operating-plan.pdf
Source: FY 2014: http://docs.house.gov/billsthisweek/20140113/113-HR3547-JSOM-G-I.pdf
Source: FY 2012-13: http://www.cdc.gov/fmo/topic/Budget%20Information/appropriations_budget_form_pdf/FY2013_CDC_Full-Year_CR_Operating_Plan.pdf
Source: FY 2010-11: U.S. Centers for Disease Control and Prevention. "2011 Operating Plan." http://www.hhs.gov/asfr/ob/docbudget/2011operatingplan_cdc.pdf
Source: FY 2002-09: http://www.cdc.gov/phpr/publications/2010/Appendix3.pdf

OFFICE OF ASSISTANT SECRETARY FOR PREPARDNESS AND RESPONSE FUNDING TOTALS AND SELECT PROGRAMS															
	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015^^	FY 2016	FY 2017 (est.)
ASPR totals	--	--	--	--	$632,000,000	$694,280,000	$632,703,000	$788,191,000	$891,446,000	$913,418,000	$925,612,000	$897,104,000	$1,054,375,000	$1,112,559,000	$1,402,628,000	$1,399,410,000
HPP^	$135,000,000	$514,000,000	$515,000,000	$487,000,000	$474,000,000	$474,030,000	$423,399,000	$393,585,000	$425,928,000	$383,858,000	$379,639,000	$358,231,000	$254,555,000	$254,555,000	$254,555,000	$253,958,000
BARDA**				$5,000,000	$54,000,000	$103,921,000	$101,544,000	$275,000,000	$304,948,000	$415,000,000	$379,639,000	$415,000,000	$415,000,000	$415,000,000	$511,700,000	$510,499,000
BioShield Special Reserve Fund	--	--	$5,600,000,000*	--	--	--	--	--	--	--	--	--	$255,000,000	$255,000,000	$520,000,000	$508,803,000

* One-time Funding

^ HPP moved from HRSA to ASPR in 2007

** BARDA was funded via transfer from Project BioShield Special Reserve Fund balances for FY2005-FY2013

^^ Totals do not include Ebola funding

Source FY 2017: https://www.hhs.gov/sites/default/files/fy-2017-phssef-operating-plan.pdf Source FY 2016: https://www.hhs.gov/about/budget/phssef-operating-plan/index.html?language=en
Source FY 2015: https://www.hhs.gov/about/budget/fy2015/phssef-operating-plan/index.html
Source FY 2014: http://www.hhs.gov/budget/fy2015/fy2015-public-health-social-services-emergency-budget-justification.pdf
Source FY 2013: http://www.hhs.gov/budget/fy2015/fy2015-public-health-social-services-emergency-budget-justification.pdf

Source FY 2012: http://www.hhs.gov/budget/safety-emergency-budget-justification-fy2013.pdf
Source FY 2010-11: http://www.hhs.gov/asfr/ob/docbudget/2011operatingplan_phssef.pdf
Source FY 2008-09: http://www.hhs.gov/asfr/ob/docbudget/2010phssef.pdf, p. 8
Source FY 2007: http://www.hhs.gov/budget/09budget/budgetfy09cj.pdf, p. 288
Source FY 2006: http://www.hhs.gov/asfr/ob/docbudget/2008budgetinbrief.pdf, p. 109
Source BARDA FY 2005-06: http://www.hhs.gov/asrt/ob/docbudget/2010phssef.pdf, p. 45.
Source HPP FY 2005: http://archive.hhs.gov/budget/07budget/2007BudgetInBrief.pdf, p. 20
Source HPP FY 2004:http://archive.hhs.gov/budget/06budget/FY2006BudgetinBrief.pdf, p. 16
Source HPP FY 2003: http://archive.hhs.gov/budget/05budget/fy2005bibfinal.pdf, p. 16
Source HPP FY 2002: http://archive.hhs.gov/budget/04budget/fy2004bib.pdf, p. 14

RECOMMENDATIONS:

- **Supporting stable, sufficient funding for ongoing preparedness and public health capacity.** There is a need to rethink how health security is funded — to maintain a steady, ongoing defense as well as having the ability to quickly ramp up to meet surge needs and cover the costs when major new emergencies arise. Public health programs require stable and sufficient funding to be able to address ongoing public health and healthcare readiness priorities.

- **Funding a permanent Public Health Emergency Fund and expedited emergency spending processes to be ready when crises arise.** In addition to ongoing investments, the federal government needs immediate, flexible funds to respond to significant crises. Delays in appropriation of emergency funds for Zika, for example, meant health departments, healthcare providers and researchers were ill-equipped to respond to a complex, multipronged outbreak, while federal agencies were forced to reallocate funds from other important health programs, like the Ebola response and the all-hazards PHEP cooperative agreement. Supporting a standing Public Health Emergency Fund as a complement to ongoing funding streams is an important step to be able to provide "surge" resources and immediately and effectively respond to a new serious threat when it emerges. Federal agencies could release the emergency funds to aid the immediate state and local response and jumpstart research and development until additional funds arrive. And such a contingency fund, if deployed early in a crisis, could help prevent an event from becoming a disaster. Rules around a contingency fund should include transparency and accountability, including triggers and

guardrails that govern access to the fund. A Public Health Emergency Fund is currently authorized (section 319 of the Public Health Service Act (42 U.S.C. § 247d)) that allows the Secretary of HHS to access funds when a public health emergency is declared, but it is nearly empty and has not received resources since FY 1999.

- A standing response fund should meet the following principles: 1) the fund should not come at the expense of other health programs, either from cuts to discretionary health spending or by transfer. Strong national health security requires both preparedness and response, and a response fund should supplement, not supplant existing programs. 2) The fund should serve as an interim bridge between underlying capacity-building funds and emergency supplemental funds, if needed. The existence of an emergency fund would not preclude the need for future emergency supplemental funding. 3) Such a fund would need to be maintained and replenished at a funding level sufficient to respond to an emerging public health threat. There should be

automatic replenishment, outside of discretionary budget caps. 4) A response fund should only be tapped for acute public health emergencies, not ongoing health needs or existing programs. The President's Council of Advisors on Science and Technology (PCAST) recommends a response fund of at least $2 billion, contingent upon authorization of the President or joint agreement of the secretaries of HHS and DHS.[187]

- A standing Public Health Emergency Fund would complement, but cannot replace ongoing funds to support baseline preparedness. This Fund would need to be paired with continued support for preparedness through programs like PHEP and HPP and funding for medical countermeasures development, as well as cross-cutting programs that support capacity. Without this base of support, the cost of ramping up quickly during an emergency is significantly higher than if a solid foundation is maintained. And in major disasters, supplemental funds are often still needed to support the long-term needs — such as vaccine development — to contain an emergency after the initial response has concluded.

PHEP/HPP Funding Over Time

Line chart showing CDC State & Local Preparedness & Response (blue line) and ASPR Hospital Preparedness Grants (red line) from FY03 to FY18 (PBR). Y-axis ranges from $- to $1,200,000,000 in increments of $200,000,000. "Proposed" with orange arrows pointing to FY18 values. Legend: CDC State & Local Preparedness & Response; ASPR Hospital Preparedness Grants.
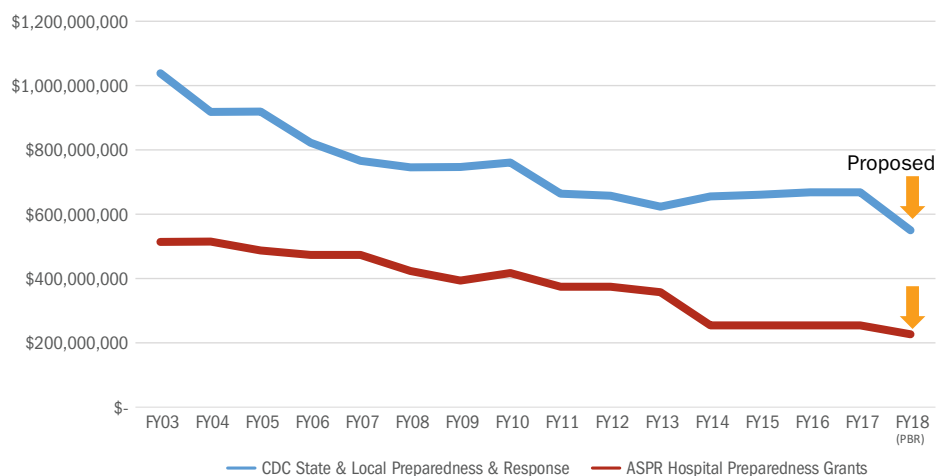
- Existing structures for funding public health — at the federal and state level — are also not built for supporting an emergency response. Health emergency response funding — whether through a permanent fund or supplemental dollars — requires greater speed and flexibility than is often allowable under existing federal and state authorities and practices. CDC and other grant making health agencies should be given the needed authority to distribute emergency funding to partners as quickly as possible after approval by Congress (or through disbursement from an emergency fund). In the midst of a crisis, HHS agencies — as well as states — should have authorities to use flexible hiring, contracting and transaction mechanisms. A recent announcement from CDC seeks to expedite emergency response funding to state and local health departments through the establishment of an "approved but unfunded" list so that CDC can fund emergencies more rapidly and reduce administrative burden associated with response by having approved applications in place before the need arises.[188] CDC will activate funding when it determines a public health emergency has occurred or is imminent so health departments can quickly set up response operations.[189] Other HHS agencies should establish a similar mechanism for grantees and national organizations that are critical to emergency responses. Recovery funding, such as that provided through the Stafford Act, should also be allowed to be used to improve community resilience and "build back better," such as for flood-resistant and sustainable design.

- **Braiding of Grants.** The federal government can facilitate more efficient and effective response efforts by allowing states and grantees the flexibility to braid or blend funding streams that support recovery after an emergency or disaster. Braiding is coordinating funding and financing from various sources to support a single initiative or strategy, at the state, community or program-level. Braided funds remain in separate and distinguishable strands, to allow close tracking and accounting of expenses related to each separate funding source. These funding and resource allocation strategies use multiple existing funding streams to support a single initiative or strategy, such as a coordinated recovery effort in a way that produces greater efficiency and/or effectiveness. An associated waiver can provide flexibility around statutory, regulatory, or administrative requirements to enable a State, locality, or tribe to organize its programs and systems or provide services in ways that best meet the needs of its target populations. This flexibility could have implications in disaster recovery as grantees receive funding across federal agencies or funding lines, yet face gaps in coordinating between grants and meeting unexpected needs that fall through cracks between emergency support functions.

C. Supporting Global Health Security

Due to worldwide connectivity, diseases can travel around the world quickly if left unchecked.

Global health security — an effort to make the world safe from infectious disease and other health threats — is integral to the health of Americans and others around the world. The Ebola outbreak in West Africa illustrated the dangers that an infectious disease can pose in countries with little public health infrastructure. The costs in lives and money were much more severe than they would have been had the outbreak initiated in a country with a stronger health system — as illustrated in the rapid response to Ebola flare-ups in these nations after response systems were established. These responses are often complicated, with diplomatic, public health, healthcare, national security and economic components and implications. Outbreaks and other health emergencies can cause political and economic instability in a region, with global implications. These outbreaks can cause ripples in the U.S. economy, as American businesses are dependent upon trade, supply chain and travel with these regions. The Global Health Security Agenda (GHSA) is an international, multisector commitment by the United States and over 50 nations, international organizations and non-governmental stakeholders to build countries' capacity to protect against infectious disease threats before they become severe.[190]

WORLD BANK PANDEMIC SIMULATION

During its annual meeting in Washington in October 2017, the World Bank held its fourth pandemic simulation where global leaders practiced responding to a hypothetical outbreak scenario. The World Bank was motivated to hold these simulations by the inadequate early response to the 2014 Ebola outbreak in West Africa and the awareness that another global pandemic is inevitable. Recently, a pneumonic plague outbreak in Madagascar killed over 100 people, and in Uganda, one person died and hundreds of people were exposed to Marburg virus — a highly infectious hemorrhagic fever. The simulation focused on the hasty spread of information — and misinformation — on social media, and highlighted the need for accurate, real-time information sharing to stop outbreaks.[191]

RECOMMENDATIONS:

- **Maintaining a long-term investment in the Global Health Security Agenda (GHSA) framework and global preparedness and response programs.** The United States is a key partner in the GHSA and must maintain its leadership in the effort. The current U.S. funding commitment to GHSA, funded through the Ebola supplemental, expires in FY 2019. The United States has advocated for continuation of the GHSA through 2024, but that obligation must be backed by a funding commitment and a U.S. strategic plan that prioritizes support to build capabilities in low and middle-income countries, as outlined by PATH in a recent report on global pandemic prevention.[192] Important global health programs that seek to build local

public health capacity and response capabilities include CDC's Center for Global Health, the State Department, Department of Defense, ASPR and NIH. The GHSA should include commitments to advancing biosecurity and biosafety — as well as specific national or regional mechanisms to track progress and announce setbacks.

- **Prioritizing biosecurity and biosafety in global pandemic preparedness, as well as mechanisms to track progress.** Nuclear Threat Initiative (NTI) analyzed 39 published Joint External Evaluation (JEE) reports and found that 74 percent of assessed countries had limited or no capacity for a coordinated national biosafety and biosecurity system across all aspects of the government.[193]

U.S. Funding for Global Health Security (With Emergency Ebola and Zika Funding), FY 2006-FY 2018 Request
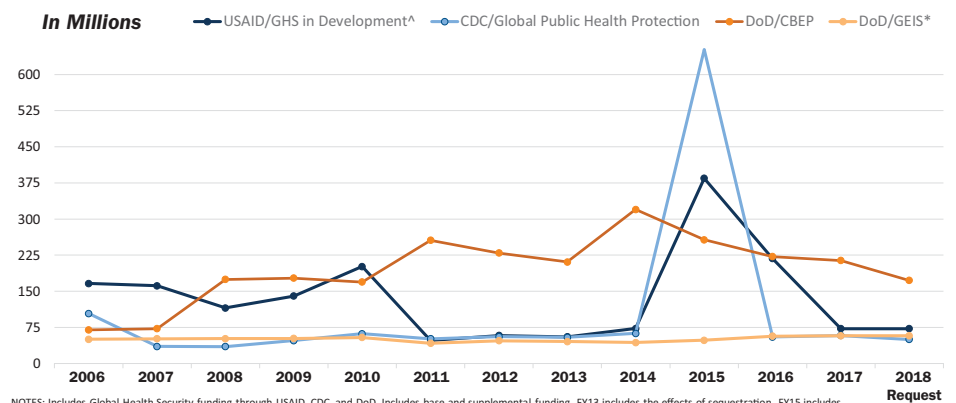
NOTES: Includes Global Health Security funding through USAID, CDC, and DoD. Includes base and supplemental funding. FY13 includes the effects of sequestration. FY15 includes emergency Ebola funding specifically directed to global health security through the USAID/GHP account and CDC; this funding is part of the $1 billion announced by the U.S. government that will be spent in 17 high-priority countries over five years (FY15-FY19). FY16 includes emergency Zika funding. FY17 is based on funding provided in the "Consolidated Appropriations Act, 2017" (P.L. 115-31) and is a preliminary estimate. For FY17, in addition to this funding, $70 million was provided for the USAID/GHP Emergency Reserve Fund for contagious infectious disease outbreaks "may only be made available if [prior to obligation] the Secretary of State determines and reports to the Committees on Appropriations that it is in the national interest to respond to an emerging health threat that poses severe threats to human health." For FY18, while the Administration is proposing to eliminate direct funding for Global Health Security through the USAID/GHP account, it is proposing a one-time transfer of $72.5 million for Global Health Security activities from unspent emergency Ebola funding in the USAID/IDA account. ^ indicates this was previously referred to as "Pandemic Influenza and Other Emerging Threats" (PIOET). * For FY18, GEIS funding request is not publicly available; total assumes level funding from FY17, which was $57.7 million.
SOURCES: Kaiser Family Foundation analysis of data from the Office of Management and Budget, Agency Congressional Budget Justifications, Congressional Appropriations Bills, U.S. Foreign Assistance Dashboard [website], available at: www.foreignassistance.gov, GEIS and AFHSC/AFHSB annual reports, communication with GEIS personnel, and IOM, Review of the DoD-GEIS Influenza Programs: Strengthening Global Surveillance and Response, 2008.

Source: Kaiser Family Foundation

In November 2016, President Obama signed an Executive Order Advancing the Global Health Security Agenda to Achieve a World Safe and Secure from Infectious Disease Threats.[194] The order was intended to strengthen the U.S. commitment to the GHSA, including roles and responsibilities of U.S. agencies like State, HHS and CDC, USDA and DoD; outlining responsibilities for the GHSA Interagency Review Council, tasked with issuing policy guidance for GHSA implementation; committing the United States to another Joint External Evaluation in three to four years, providing time for the United States to address gaps and challenges; and designating the National Security Council staff to serve as the convener for the Review Council. In October 2017, President Trump's Administration advocated for extending the Global Health Security Agenda to 2024.[195]

ONE HEALTH INITIATIVE: Unifying Human and Veterinary Medicine

Recognizing that human health, animal health and ecosystem health are inextricably linked, the One Health Initiative was developed as a global effort to promote and improve health by enhancing cooperation and collaboration across physicians, veterinarians and other scientific health and environmental professionals.[196] Worldwide, more than 850 leading scientists, physicians and veterinarians have endorsed the initiative. Some partners include: American Medical Association, American Veterinary Medical Association, American Academy of Pediatrics, American Nurses Association, American Association of Public Health Physicians, American Society of Tropical Medicine and Hygiene, CDC, USDA and the U.S. National Environmental Health Association. Some efforts include joint educational and communications efforts and improved coordination of tracking of health problems and concerns.
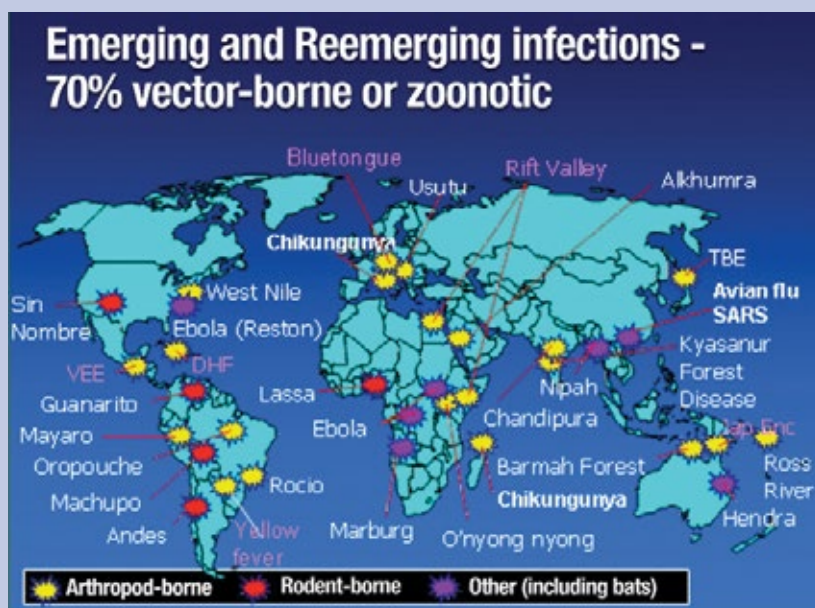
Source: One Health Initiative

D. Improving Federal Leadership Before, During and After Disasters

In addition to funding, recent disasters have illustrated gaps in federal leadership in the United States. In particular, emergencies that cross federal agencies' jurisdictions and/or have both an international and domestic component, such as the Ebola and Zika outbreaks, have demonstrated the lack of clear roles and responsibilities and the need for cross-cutting national leadership, as well as coordinated national/state/local leadership.

In June, the Johns Hopkins Center for Health Security convened a meeting of over 50 biosecurity experts from government, industry, and academia to solicit inputs to the forthcoming National Biodefense Strategy and Implementation Plan.[197] Discussion topics included the nation's biological threat landscape; existing programs, policies, and mechanisms for mitigating the broad spectrum of naturally occurring, accidental, and deliberate biological threats facing the nation; unmet challenges in global,

national, and subnational emergency preparedness and response efforts; and priorities for strengthening the national biodefense enterprise.

The group's key recommendations were:

- Improve biosurveillance capabilities and laboratory networks
- Perform risk assessments and characterize threats
- Strengthen emergency response capabilities, including decontamination efforts

- Build global capacities for bio-threat preparedness and response
- Prioritize prevention efforts
- Organize the U.S. government for biodefense
- Leverage private sector capabilities to counter biological threats
- Catalyze innovation in medical countermeasures research, development, trials, and delivery
- Strengthen healthcare system response and workforce

RECOMMENDATIONS:

- **Strengthening senior leadership on health security.** Many recent crises have jurisdictions across federal agencies, so there is an ongoing need for senior leadership and coordination for a government-wide approach to preparedness, response and recovery efforts. High-level leadership is needed to trigger and coordinate a multi-agency response, identify the lead agency and clear chain of command and be the ultimate arbiter for contested decisions.

- **Improving federal, state, local and interstate coordination during multi-agency responses.** At the federal level, in addition to senior leadership and engagement, there must be improved interagency synchronization and integration in response to health emergencies.

There must be better coordination across levels of government; agencies within government; regions, states and jurisdictions; and the public health, healthcare and other emergency responder sectors. This includes the need to review roles and responsibilities across the federal agencies (with national, state and local stakeholder participation) involved in emergency health response — including ASPR, CDC, CMS, the agencies within DHS, FDA, NIH and USAID — to ensure efforts are as efficient and effective as possible, roles/responsibilities are clear and bureaucracy is limited. For example, HHS and FEMA should clarify roles in how to address gaps between Emergency Support Functions. There have been reports of individuals with chronic medical

needs — rather than acute emergencies — falling through the cracks between state/territorial and between state/federal responsibilities. Additionally, there must be better use of existing authorities, such as roles outlined in the Public Health Services Act (PHS), and an agreed-upon framework for response — including the use of a Public Health Emergency Fund. The President's Council of Advisors on Science and Technology, in their 2016 report, recommended a new interagency entity charged with planning, coordination and oversight of biodefense activities across agencies, co-led by the Assistant to the President for Homeland Security and Counterterrorism, the Assistant to the President for Science and Technology and the Chair of the Domestic Policy Council.[198]

E. Innovating and Modernizing Infrastructure, Including Biosurveillance, Medical Countermeasure Development and Wider Implementation of Faster Diagnostics

A range of public health systems are outdated and have not kept pace with current technologies. Some key areas that are lagging include upgrading the biosurveillance systems to be real-time and interoperable; expanding research and development for medicines and vaccines to counter infectious diseases and bioterror threats; and supporting investments to be able to use and implement modern diagnostic technologies around the country.

- **Disease Surveillance.** U.S. health surveillance systems are often disjointed and out-of-date. Public health departments tend to each have different, unconnected systems tracking different health problems, which often contributes to a significant time lag in the collection, analysis and reporting of information, including of new infectious or foodborne illness outbreaks. Although, health departments are often burdened with redundant and siloed disease reporting systems, efforts are underway to standardized and harmonize data requirements that will create a more streamlined reporting and notification process, and lead to the retirement of outdated legacy systems

  - The lack of cross-cutting surveillance capacity has led to serious gaps in visibility on pressing health crises. For instance, there has been a lag in a number of communities in tracking and recognizing hepatitis C and hepatitis B outbreaks — stemming from a rise in injection drug use — which has exacerbated the spread of the disease and constrained the ability to use early containment and prevention strategies. A foundational capabilities approach could help address these types of gaps (see Section 2A for more on a foundational capabilities approach).

- **Medical Countermeasures Development.** The U.S. government has invested in the research, development and stockpiling of emergency medical countermeasures for a pandemic, bioterror attack, emerging infectious disease outbreak, or a chemical, radiological or nuclear event. A successful domestic medical countermeasure enterprise is an important aspect of preparing for new threats by building the science, policy and production capacity in advance of an outbreak, particularly since governments tend to be the only customers for certain medical countermeasure products, such as anthrax and smallpox vaccines.

- Congress created Project BioShield (in 2004) and authorized the Biomedical Advanced Research and Development Authority in 2006. HHS created a multi-agency Public Health Emergency Medical Countermeasures Enterprise (PHEMCE) partnership (in 2006) to speed the development of medical countermeasures by supporting advanced research, development and testing; working with manufacturers and regulators; and helping companies devise large-scale manufacturing strategies.[199] The Project BioShield Special Reserve Fund (SRF) was originally established as a $5.6 billion fund

over 10 years, to guarantee a market for newly developed vaccines and medicines needed for biodefense that would not otherwise have a commercial market. The investment has supported more than 190 new candidate projects. Twenty-three products supported by BARDA through Project BioShield have been added to the Strategic National Stockpile.[200] After the initial investment was depleted, Congress began funding BioShield by an annual appropriation for purchase of products, appropriating $510 million in FY 2017. The FDA also launched the Medical Countermeasures Initiative (MCMi) in 2010 to coordinate medical countermeasure development, preparedness and response.[201]

- Some recent advances via BARDA have included developing potential Ebola vaccine and therapeutic candidates and assisting in Zika vaccine and diagnostics advancements, a new anthrax vaccine and diagnostic, new broad spectrum antibiotics and pathogen reduction technologies for blood products.[202, 203, 204] Once a new medical countermeasure is developed, the FDA can expedite the ability to use the product if needed and if there is no other alternative available under the Emergency Use Authorization (EUA) authority.

- In 2016, ASPR released an updated PHEMCE Strategy and Implementation Plan for the next five years. Federal law requires them to send a five-year spend plan to Congress for the enterprise based on anticipated needs. However, recent budget requests and funding levels have not kept up with estimated needs, including replenishing expiring products already in the Strategic National Stockpile.[205]

- **Wider Implementation of Faster Diagnostics.** New technologies, such as whole genome sequencing, are increasingly used by CDC, the military and other state-of-the-art national laboratories to more quickly and effectively identify the reason for and extent of a disease outbreak. The leading current use of these technologies is in the area of foodborne illnesses — in some cases speeding up investigations by several days or being able to determine the cause of an outbreak that would not have been possible using the last generation of investigative tools.

  - Scientists are working on similar technologies for other pathogens. Other emerging technologies, such as metagenomics, hold the potential to advance the ability to better diagnose and track patients for diseases ranging from Zika to Ebola to new strains of antibiotic-resistant superbugs.

Being able to use and scale these advances around the country will require an investment to upgrade technology, as well as provide training to staff and conduct these different types of epidemiological (disease detective) investigations. The underlying public health system would also need to adapt to match a faster pace and different types of investigations and containment strategies. These scientific changes provide an important new opportunity to overcome longstanding gaps and problems within the system.

RECOMMENDATIONS:

- **Modernizing to real-time, interoperable disease surveillance.** One of the most fundamental components of disease prevention and control is the ability to identify and track new or ongoing outbreaks and threats. A national surveillance capability should be able to integrate data from human, environmental, and animal health to detect emerging threats. The President's Council of Advisors on Science and Technology recommends strengthening federal, state and local public health infrastructure for disease surveillance as part of the national biodefense strategy.[206]

  - Health information technology is transforming the way healthcare is delivered, and public health must adapt to take advantage of these advancements, envision public-private partnership in new ways and more effectively leverage healthcare data. New data systems and sources, electronic health records and electronic case reporting, electronic laboratory reporting, mapping systems, cloud-based disease reporting systems and relational databases have the ability to significantly improve the dissemination of real-time, interoperable and interactive information across public health, healthcare providers and other systems. It is also essential to ensure systems are built to protect privacy and incorporate strong cyber-security measures.

  - There is growing capability to connect health trends with risk factor data sources — to look at the impact of different factors on health and identify outbreaks or the potential causes of health problems in particular neighborhoods or local areas. Any new system should be able to classify health trends at the neighborhood or zip code level to identify concentrated health problems, outbreaks and/or contributing factors that cannot be discerned through county or state level data.
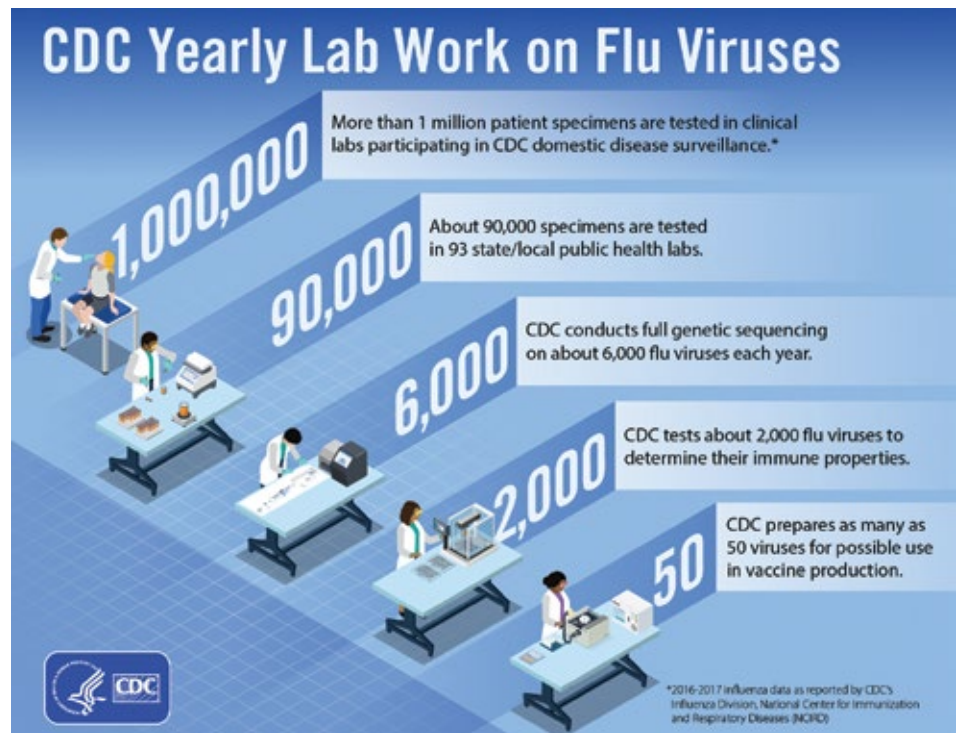
  - Achieving a modern biosurveillance system would boost identification and tracking of outbreaks and other health problems, while reducing the burden on state and local public health departments and healthcare providers. It will require an investment, including: upgrading hardware and software; maintaining these technologies around the country; standardizing efficient reporting standards and language; and hiring and training staff with computer science and information technology skills, including in how to use systems and to interpret data. In addition, there will need to be effective integration with electronic health records and electronic laboratory reporting. Supporting and

CDC Yearly Lab Work on Flu Viruses

More than 1 million patient specimens are tested in clinical labs participating in CDC domestic disease surveillance.*

1,000,000

About 90,000 specimens are tested in 93 state/local public health labs.

90,000

CDC conducts full genetic sequencing on about 6,000 flu viruses each year.

6,000

CDC tests about 2,000 flu viruses to determine their immune properties.

2,000

CDC prepares as many as 50 viruses for possible use in vaccine production.

50

*2016-2017 Influenza data as reported by CDC's Influenza Division, National Center for Immunization and Respiratory Diseases (NCIRD)

CDC

incentivizing real-time and two-way communications between healthcare providers and health departments are critical components. There are also significant barriers in changing the culture and practice of how disease surveillance is conducted at all levels of public health. Agencies may have to discontinue legacy systems, while public health may have to work with state lawmakers to address barriers in electronic disease surveillance while maintaining patient privacy.

- Funding at the federal, state and local level remains a significant challenge. From 2012 to 2014, the federal government released a series of biosurveillance strategies and road maps to help consolidate systems, eliminate redundancies and reduce unnecessary reporting burdens. These focus on the ability to integrate with electronic health record systems and other emerging health information technologies, including a call for partnerships across private and public healthcare systems and state and local public health departments.[207, 208, 209] However, most of these plans do not include funding estimates and there often is insufficient funding to carry out all of the aspects of these plans. Implementing a modern disease surveillance system will require up-front investments in technology and a trained workforce, as well as the political will to let go of legacy systems. There must also be a long-term funding strategy for federal, state and local public health to achieve the goal of a modernized system.

- GAO recommends that HHS complete a plan for establishing a nationwide, real-time public health situational awareness network, as required by PAHPRA of 2013, including measurable steps for progress and IT management processes.[210] A September 2017 GAO report found HHS still lacks the structure and mechanisms to plan, manage and oversee this type of network.[211]

- National Academy of Medicine's *Vital Directions for Health and Health Care* paper on "Information Technology Interoperability and Use for Better Health Care and Evidence" identified that "if managed more effectively, federal investment in HIT and public-health surveillance … could achieve better outcomes without necessarily requiring new resources."[212] To help improve the integration and alignment of public health and healthcare surveillance, they identified policy initiatives including that:

  - Public health departments should have the right workforce and technology to advance surveillance and epidemiological functions, including by aligning CDC programs to support foundational capabilities; and

  - Office of National Coordinator for Health Information Technology (ONC)] should set standards for the nation's HIT system that ensure better coordination with public health departments as they develop the capability to work in the HIT system, and that ONC should work with CDC and other public health agencies to ensure interoperability of their systems.

CDC'S SURVEILLANCE STRATEGY

In 2014, CDC released a new surveillance strategy to work towards consolidating systems, eliminating redundancies in reporting and reducing reporting burdens on state and local health departments in order to improve the speed, quality and accuracy of disease tracking. The strategy includes four major components: standardizing health data and exchange systems, enhancing situational awareness, accelerating electronic laboratory reporting and modernizing mortality surveillance systems.[213] One initiative is the NNDSS Modernization Initiative (NMI), which standardize the reporting format (HL7) for more than 100 nationally notifiable diseases, enhance CDC message validation, processing and provisioning system, and providing technical assistance to jurisdictions.[214] Standardizing and harmonizing the data will significantly reduce the burden of reporting on state and local health departments and, at a future date, will lead to the retirement of older, less efficient legacy systems. As of October 2017, guidance to state on how to package case data into the HL-7 message format is in production, test ready or in development for 95 percent of conditions. Currently, 16 of 57 reporting jurisdictions have implemented at least one of the new HL7 formatted message guides, and 8 of those 16 have implemented more than one.

SHARING DATA TO IMPROVE CLINICAL CARE AND PUBLIC HEALTH: THE DIGITAL BRIDGE INITIATIVE[215]

RWJF, the de Beaumont Foundation, Public Health Informatics Institute and Deloitte Consulting have convened a wide range of public health, healthcare and health information technology partners to develop the Digital Bridge initiative. The initiative aims to identify a consistent, nationwide and sustainable approach to using electronic health records data to improve public health surveillance. The effort focuses on advancing electronic case reporting (eCR) to move toward a more real-time, interoperable and secure process where reportable conditions, including a wide range of infectious diseases and infections, would be automatically generated from EHRs and transmitted to public health agencies.

Beginning in 2018 eCR will be a public health reporting measure that eligible hospitals and professionals may perform for credit under specific Medicare or Medicaid programs under Meaningful Use.[216] In order to be an effective reporting system, jurisdictional public health agencies must be ready to receive and interpret that data. In 2017, the Digital Bridge has been working to coordinate eCR implementation in seven sites to test technical specifications, demonstrate the viability of eCR for public health and healthcare, and determine what assistance health departments will need to receive and incorporate eCR data effectively.

RECOMMENDATIONS:

Incentivizing and supporting medical countermeasure research, development, stockpiling and distribution.

- Achieving a strong U.S. medical countermeasure enterprise — one that sufficiently supports research and development of vaccines, antivirals and other countermeasures — requires incentives for biopharmaceutical companies and researchers to continue research and development of medical countermeasures, particularly due to the limited funding for purchase under Project BioShield. Furthermore, unpredictable annual and short-term emergency funding runs counter to industry planning standards and creates uncertainty in long-term partnerships with the federal government. Project BioShield should receive multiyear funding to allow for improved planning and flexibility in procurement of MCMs.

- In addition, there should be ongoing funding to restock and upgrade the Strategic National Stockpile so medical countermeasures are available and unexpired when needed for patients.

- Gaps remain in MCM distribution and dispensing capabilities, especially for disasters that require an immediate medical intervention, such as an anthrax release. If health departments are not able to develop such capacity internally, they must have contingency plans to contract with and train private sector personnel for mass dispensing. These plans should include insurer support for medical countermeasure payment when appropriate. Furthermore, CDC should work with providers to develop a standardized template for distributing MCMs to children, people who are home-bound and other specific populations. Finally, HHS must monitor and assess MCM use nationally during emergencies.[217]

ALTERNATIVE MODELS TO SPUR RESEARCH AND DEVELOPMENT

- Global efforts in vaccine development are long, expensive processes. A recently formed collaboration — the Coalition for Epidemic Preparedness Innovations (CEPI) — seeks to provide an alternative model for funding vaccine development. The public, private and philanthropic partners seek to finance and coordinate vaccine development against priority threats, particularly when current markets are unlikely to pursue development. The partnership, which is in the start-up phase, is between the Government of India, Government of Norway, Wellcome Trust, Bill and Melinda Gates Foundation and World Economic Forum.[218]

- As part of the National Action Plan on Combating Antibiotic Resistant Bacteria (CARB), HHS partnered with academic and philanthropic entities (including BARDA, NIAID, the AMR Centre, Wellcome Trust, California Life Sciences Institute, MassBio, The Broad Institute, Boston University and RTI International) to form the Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator, or CARB-X, in July 2016. The partnership funds research and development of therapeutics, vaccines, diagnostics and devices as well as provides technical assistance for companies with promising solutions to antibiotic resistance.[219] BARDA has committed up to $250 million over five years and other entities have promised additional funding.[220] In its first year:

- $41.6 million was awarded in funding to the 18 projects with an additional $52.6 million if project milestones are met;

- 368 applications were reviewed from around the world and 18 projects selected in 6 countries;

- 60 world-leading experts sit on CARB-X's Science Advisory Board, making recommendations on which projects to support;

- 96 percent of CARB-X spending in year one went directly to fund scientific research; and

- Since its launch, CARB-X has established scientific standards and criteria to review applications, and built a network with its world-class partners.[221]

RECOMMENDATIONS:

● **Upgrading to modern molecular technologies.** Advances in diagnostic technologies, like DNA sequencing, allow scientists to identify the causes of outbreaks and connections between different cases more quickly. This helps identify how widespread an outbreak may be and guide treatment. However, historically the public health system has not had built-in mechanisms to support and incorporate developments in science and technology. Indeed, for many years, there had not been a meaningful investment toward upgrading many of the basic systems used by public health laboratories — which hampered the ability to incorporate new technology,

identify both emerging and ongoing health problems in a community and track patterns to better discover the causes and cures of diseases.

● New diagnostic technologies; changes in data-management capabilities to more quickly identify and track outbreaks and problems; and the ability to develop new vaccines, diagnostics and antivirals — particularly for emerging diseases — and to counter growing antibiotic-resistant threats all hold tremendous promise. This will not be realized unless there is continued investment and a fundamental change in how the country thinks about and

CDC'S ADVANCED MOLECULAR DETECTION (AMD) PROGRAM

CDC's Advanced Molecular Detection (AMD) program was established in 2014 to bring DNA sequencing ("next-generation sequencing" (NGS) which enables "whole-genome sequencing" (WGS)), bioinformatics and related technology into public health in the United States. With funding through the AMD program, these technologies are now being brought to bear against a wide range of infectious disease threats across the United States and are rapidly transforming the monitoring of these threats, as well as the response to outbreaks. CDC's AMD program works with other experts at CDC to ensure the U.S. has the infrastructure, including technology, needed to protect Americans from infectious disease threats. Four years ago, U.S. public health agencies were behind in the adoption of these technologies, but now they are now leading the world in many areas. The CDC AMD program develops

and pilots next-generation diagnostics and protocols with and for CDC and state and local public health labs. These tools are then leveraged across CDC to be brought to scale in public health labs nationwide. Rollout of NGS to all 87 PulseNet labs (which includes all 50 states and Washington, D.C.) is currently underway.

To explain the impact of the technology, CDC has said, "imagine doing a 10,000-piece jigsaw puzzle in the time it takes to finish a 100-piece puzzle. Apply that to infectious disease control, and that is AMD at work. Now imagine putting together that 10,000-piece puzzle when key pieces are missing, disease is spreading and people are dying. AMD gives CDC scientists the 'key pieces' to protect people from ever-changing infectious disease threats."[222]

AMD technologies are being used to identify emerging pathogens, improve vaccines, and develop faster tests.[223]

CDC is starting to scale broader use to public health labs, including state health laboratories, to be able to test for pathogens. With improved funding and reduced price points, the technology could be used to support disease investigations of many infectious diseases. While this means that more outbreaks are being detected earlier, it has also increased the need for epidemiologic investigators to look into sources of illness. On top of this, the revolution in sequencing technology and analysis is continuing, with sequencing costs decreasing, automation increasing and analytic methods improving, all of which are continuing to open up opportunities to prevent disease, intervene earlier in outbreaks and, ultimately, to save costs. Scaling these and other emerging technologies requires a long-term strategy and an investment in the technology and the training of scientists to use equipment effectively.

F. Maintaining a Robust, Well-Trained Public Health Workforce

Many leading experts and programs — including initiatives led by the Association of State and Territorial Health Officials, the National Association of County and City Health Officials (NACCHO), the Association of Public Health Laboratories, the de Beaumont Foundation, schools of public health and other expert groups — are focused on the need to recruit and retain a **next generation of public health workforce.**

The current state and local public health workforce is not large enough nor professionally diverse enough to meet community needs, and there are major gaps in the training and capabilities of the existing workforce to meet modern health problems.[224, 225]

- The public health workforce experienced significant job losses during the Great Recession, resulting in more than 51,000 job losses from 2008 to 2014;

- From 1980 to 2000, the ratio of public health workforce to the U.S. population has decreased dramatically from 220 to 158 per 100,000 people;

- 38 percent of state and local public health professionals plan to leave their government public health positions by 2020 — 25 percent of state public health employees plan on retiring and 13 percent plan on leaving their job;

- 48 percent of state and local public health professionals are over 50 years old, 15 percent are over 60 years old.

Some key issues raised in the Public Health Workforce Interests and Needs Survey (PH WINS) conducted by ASTHO and the de Beaumont Foundation to highlight the issues at hand:[226]

38 percent of state and local public health professionals plan to leave governmental public health by 2020

48 percent of state and local public health professionals are over 50 years old

- Retirements and high turnover rates present challenges in maintaining experience, leadership and continuity in core capabilities;

- Many public health jobs require highly-trained, specialized scientific skills — such as laboratorians and epidemiologists — and it is important to build career tracks that attract a new generation of experts and retention of expert professionals. Only 17 percent of the public health workforce has any kind of degree in public health;

- There is a need to expand training of skills and strategies for how to effectively address principal factors that influence health, such as for systems changes that incorporate health into housing and economic development and working effectively across diverse populations.

A wide range of reviews and assessment have demonstrated the vital importance and value of also specifically training for emergencies and disasters — to be prepared and understand roles and responsibilities.[227, 228, 229] Ongoing training, including drills and scenario exercises, help better prepare public health and healthcare professionals to respond efficiently and effectively during crises.

In June 2017, NACCHO released results of its second Preparedness Profile assessment conducted in June 2016.[230] Preparedness coordinators at local health departments (LHDs) were asked to respond to 18 closed- and open-ended questions about their LHDs' preparedness workforce, planning, and activities, including those around current and emerging threats, healthcare coalitions, administrative preparedness and the National Health Security Strategy.

Findings include:

- Approximately one-third of LHDs reported a decrease in preparedness staff, mainly among larger LHDs. Compared to 2015, 12 percent more LHDs reported staffing decreases.

- Most preparedness coordinators (73 percent) in large LHDs dedicate all their time to preparedness efforts, while preparedness coordinators in smaller LHDs spend their time working in a variety of public health areas.

- Most LHDs reported excellent partnerships with emergency management services, emergency management agencies, and hospitals. LHDs were least likely to report strong partnerships with pharmacies and local businesses.

- In both 2015 and 2016, the majority of LHDs reported being members of a regional healthcare coalition to plan and implement preparedness activities.

- LHDs most frequently selected terrorism-related events and accidental nuclear/radiation releases as the current threats they feel least prepared to address.

- Extreme weather and infectious diseases are the top global/emerging threats that LHDs are most concerned will affect their community in the future.

- Overall, the broadest range of activities conducted by LHDs in the past year were focused on medical countermeasure, community preparedness, and infectious disease topics. Conversely, LHDs most often report not conducting any preparedness activities in climate change/adaptation, cybersecurity, and counterterrorism and response.

- Approximately half (51 percent) of LHDs were not aware of the National Health Security Strategy, but this has decreased slightly from 2015.

RECOMMENDATIONS:

- **Bolstering efforts to recruit and retain trained and experienced public health professionals.** There needs to be a major push to ensure a strong public health workforce with the capabilities to detect, diagnose and track health problems as well as develop strategies to improve health and reduce chronic and persistent problems. This includes the need to maintain an ongoing workforce — job cuts over the past two decades have left major gaps in the workforce that must be addressed. A competent workforce requires being able to work with a wide range of partners and sectors to implement the strategies. Some priorities for workforce development include: systems thinking; communicating persuasively within and outside of public health; influencing and developing policy; business and financial management; the ability to be flexible and manage a changing environment; analytic and technical skills and informatics; information technology (IT) and computer science experts of various levels; and being able to work with diverse populations.[231] As technological and informatics needs of health departments increase, it will be especially challenging to sustain a public health workforce, particularly if public health funding remains unstable.

  - To help better train and maintain the workforce, NACCHO and ASTHO have recommended the implementation of a workforce development plan tied into quality improvement that is regularly updated based on training needs assessments and changing agency and community needs.[232, 233] Assessing optimal public health workforce needs should be considered as part of Community Health Needs Assessment reviews.

  - A 2013 CDC Public Health Workforce Summit Report identified multiple factors that lead to the public health workforce crisis, including the insufficient number of current workers across public health disciplines and insufficient investment in training and training evaluations.[234] Summit leaders called for public health agencies to develop a plan to recruit professionals to enter the public health workforce; including those with backgrounds in informatics, business and finance management and law; and for agencies to encourage mentorship between those in supervisory and non-supervisory positions to prepare mid-level staff for leadership positions.

  - Workforce recruiting should also focus on skill sets outside of traditional public health. Modern health crises require experts in communications and social media to ensure accurate, direct engagement with the public before and during emergencies. In addition to recruiting highly trained informaticians, HHS and health departments should be able to infuse the workforce with skilled technology specialists and data scientists with experience outside the traditional health sciences.

- **Easing barriers to hiring at the federal, state and local level.** In the midst of an emergency, it can be difficult to hire people quickly. Each state has its own rules for staffing and contracting, which may not align with priorities during an emergency response. HHS should provide guidance to states on effective policies to ease the hiring and contracting process during emergencies. HHS agencies should also have authority to make immediate offers to a range of emergency response staff, such as epidemiologists and logisticians, saving time during an emergency.

G. Rebooting and Developing a New Strategy for Hospital and Healthcare Readiness

HPP, administered by ASPR, was created after September 11, 2001, to help build capabilities in health system preparedness for major emergencies.[235, 236] The program is a vital lever in building the readiness of the healthcare system to prepare, respond to and recover from disasters and outbreaks.

HPP helps build regional coordination and collaboration between healthcare entities, such as hospitals, public health, emergency medical services and emergency management to ensure the healthcare system is able to save lives and provide care during and after emergencies. HPP is currently the only source of federal funding for health system readiness. The program's peak funding was $515 million in 2004 and has been cut over time to about $255 million in 2017. The program establishes regional healthcare coalitions (HCCs) that incentivize diverse and often competitive healthcare organizations with differing priorities to work together to focus on the common needs of the communities and regions that they serve.[237] Currently, there are over 475 HCCs nationwide, with more than 31,000 members.[238] These coalitions vary in size and capacity. HHS recently updated the healthcare preparedness and response capabilities that the healthcare system should achieve, including a greater focus on building a foundation for healthcare readiness, assessing risks and needs, training the workforce and ensuring preparedness is sustainable.[239] The vision for 2017 and beyond is to focus on operationalizing HCCs for effective response.

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RECOMMENDATIONS:

- **Bolstering the Hospital Preparedness Program.** There is wide variation and limited transparency in how well states and the coalitions within them are doing in achieving capabilities defined by HHS. While some have achieved notable successes, other coalitions are in nascent stages or lack buy-in from healthcare organizations with the region. In order to make HPP as effective as possible:

  - HPP must receive stable, robust funding to ensure the program can achieve its goals. The funding is important to support coalitions and build and sustain better coordination and connections across key healthcare, public health and other emergency responders before and during crises. There must be strong healthcare preparedness capabilities across the country — not just in a handful of states. Cutting preparedness in one state means neighboring states have to shoulder additional burden during a disaster;

  - ASPR should make certain performance measures come with transparency, accountability and quality improvement. HPP must focus funding and technical assistance on meeting gaps identified in those measures. ASPR should assess the performance of coalitions on an annual basis, publicly report results and develop strategies to strengthen ineffective coalitions. ASPR has created a Technical Resources, Assistance Center or Information Exchange (TRACIE) and has developed tools for coalition quality improvement, including a new course curriculum focused on healthcare coalition leadership, developed by ASPR and FEMA's Center for Domestic Preparedness.[240] While all coalitions should avail themselves of these resources, ASPR should continue to conduct targeted outreach to new and less effective coalitions; and

  - As the program — and the field of healthcare preparedness — matures, ASPR should continue to strengthen the focus of HPP on the readiness and responsiveness of the healthcare delivery system as distinct from public health preparedness. HPP should bolster both preparedness and response capacity to ensure the health care delivery system is integrated into jurisdictional incident response.

- **Exploring Innovative Mechanisms to Build Readiness.** With its limited funding base (current total hospital spending is around $971 billion per year), HPP cannot be the only driver of health system preparedness and response. While HPP should continue to play an important leadership, coordination and standard-setting role, there also need to be new models and additional resources to support and augment the program's basic functions and to engage the health delivery system and broader community into building and investing in better emergency health plans and strategies.

  - The recently finalized CMS emergency preparedness requirements for Medicare- and Medicaid-participating providers and suppliers is an important lever for building preparedness across the delivery system.[241] Healthcare facilities should use the rule as an impetus to engage with local healthcare coalitions and to leverage the collective assets of these coalitions. CMS and ASPR should work together to promote coordination between healthcare coalitions and facilities within the coalition's region in order to meet both CMS' requirements and ASPR's healthcare preparedness and response capabilities, such as the resources dedicated to the CMS rule on ASPR TRACIE. CMS and ASPR should coordinate to ensure compliance with the CMS rule includes meaningful planning and engagement, not just paper plans.

  - Another important preparedness asset could be value-based healthcare models, such as Accountable Care Organizations (ACOs).[242] Healthcare Ready has proposed ACOs, collaboratives to bring doctors, hospitals and other healthcare providers to join together and coordinate high quality care to Medicare patients. This model would help create a more resilient healthcare system by providing some care away from a centralized location (thus reducing surge in a disaster), promoting wellness and helping in coordinating care and tracking of vulnerable patients in an emergency.[243]

  - A number of additional levers can be further explored for engaging the health system, such as tax incentives, Medicare Shared Savings Program and Merit-Based Incentive Payment System, Joint Commission standards and National Quality Forum measures to help support preparedness and healthcare coalition participation.

  - States should clarify and ease healthcare volunteer response rules, including the Uniform Emergency Volunteer Health Practitioners Act (UEVHPA). As recommended in a recent National Academies of Science Engineering and Medicine (NASEM) report, "If licensed personnel, certified personnel, or those with special skills

are used to augment public health recovery resources, care should be taken to verify their credentials and skills before deployment. Disaster response plans should include provisions for the licensing and certification of incoming volunteer resources in two categories: those that are planned and those that are spontaneous."[244]

- State policies and practices governing the delivery of healthcare during emergencies — including contracting and hiring, healthcare and volunteer liability and adoption of crisis standards of care in the context of scarce resources — can vary from state to state. ASPR should conduct a review of barriers to healthcare response and recovery and provide guidance for states to clarify laws and policies regarding healthcare disaster readiness.

- Potential support mechanisms from broader community institutions, such as universities, businesses, economic and community development agencies and other prominent partners that benefit from stability and vitality of their neighborhoods can also serve as levers.[245] Non-profit hospitals should consider incorporating community-wide disaster planning participation into their community benefit efforts to reflect a recent change in Internal Revenue Service (IRS) rules that allows community resilience to count for community benefit.[246] And, communities could also investigate incorporating local health improvement partnerships into healthcare coalition planning efforts to ensure health needs and assets of communities are being considered in disaster planning.

- Not every individual hospital or facility requires the same preparedness capabilities, but a community

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should know its health needs will be met during a major emergency. The tiered Ebola response system demonstrated one model of creating regional hubs for care, although that system requires continuous funding beyond the initial starting funding in order to be maintained.[247] A standing regional network system would require continuous incentives and reimbursement to maintain supplies, workforce and ensure buy-in of hospital leadership. The Report of the Independent Panel on the U.S. Department of Health and Human Services Ebola Response also recommends HHS maintain a national network of identified treatment centers for urgent public health threats, including standardized requirements and protocols.[248] A standing system of regionalization could help to overcome barriers to meaningful preparedness planning — such as concerns over liability, loss of profit and competition between healthcare systems.

- **Public-Private Collaboration.** A number of examples of health emergencies have shown the importance of developing better collaborations between the private sector — including hospitals, pharmacies, suppliers and health systems — and public health agencies. This must include ongoing planning to be prepared for potential emergencies as well as for coordination during and after emergencies have happened. HHS should clarify who assesses medical needs from the private sector and how private sector responses are communicated and incorporated into the federal response structure. The Emergency Management Assistance Compact — which enables sharing of public resources across state lines — does not have a corollary for private sector medical needs and resources.

- **Building healthcare facilities' resilience for disasters.** All healthcare facilities — including nursing facilities — should be assessed for their resilience for

flooding, extended power outages, extended shelter-in-place scenarios, and excessive heat. Possible mechanisms include infrastructure investments, CMS conditions of participation and directing of disaster recovery dollars for disaster-resilient rebuilding. States should ensure facilities that serve medically vulnerable people — like nursing facilities and dialysis centers — are considered critical infrastructure. Regulators and payers should ensure the quality of these facilities before disasters strike and ensure standards are being met. There must be sufficient funding for appropriate state or local health regulators to inspect facilities such as nursing homes to ensure quality before disasters strike.

- **Meeting the disaster health needs of children.** The American Academy of Pediatrics recommends that both HPP and the Public Health Emergency Preparedness programs should be assessed to ensure they are meeting the needs of children, including full integration of the needs of children into performance measures for the program.[249] There also should be extended authority for the National Advisory Committee on Children and Disasters, an HHS advisory committee to counsel HHS on preparedness for children. According to Save the Children, the United States still lacks a coordinated national strategy to improve pediatric emergency transport and care in disasters, and no federal agency has been designated as the lead on pre-hospital emergency medical services preparedness.[250]

- **Private Sector Engagement.** The private sector owns roughly 85 percent of the nation's critical infrastructure,[251] yet is often excluded or only given nominal involvement in disaster planning and response. In many cases, the private sector will be integral to disaster response, through supply chains, services, and employee protection. The private sector needs to be fully engaged in disaster exercises and emergency operations responses. The National Center for Disaster Preparedness at Columbia University recommends federal technical assistance programs that can help local communities and private sector representatives connect with each other and navigate legal and logistical barriers to collaboration.[252]

NEW EMERGENCY PREPAREDNESS REGULATIONS FOR MEDICARE AND MEDICAID PROVIDERS AND SUPPLIERS

CMS finalized rules in 2016 that went into effect in November 2017 to establish consistent emergency preparedness requirements for healthcare providers participating in Medicare and Medicaid, increase patient safety during emergencies and establish a more coordinated response to natural and man-made disasters.[253]

After reviewing the previous Medicare emergency preparedness regulations for both providers and suppliers, CMS found that regulatory requirements were not comprehensive enough to address the complexities of emergency preparedness, including communication and coordination, contingency planning and training of personnel.

To ensure a consistent foundation of emergency preparedness across the healthcare system, Medicare and Medicaid-participating providers and suppliers must meet the following four industry best practice standards, as appropriate for their function:

1. Emergency plan: Based on a risk assessment, develop an emergency plan using an all-hazards approach focusing on capacities and capabilities that are critical to preparedness for a full spectrum of emergencies or disasters specific to the location of a provider or supplier.

2. Policies and procedures: Develop and implement policies and procedures based on the plan and risk assessment.

3. Communication plan: Develop and maintain a communication plan that complies with both federal and state law. Patient care must be well-coordinated within the facility, across healthcare providers and with state and local public health departments and emergency systems.

4. Training and testing program: Develop and maintain training and testing programs, including initial and annual trainings and conduct drills and exercises or participate in an actual incident that tests the plan.

HEALTH SECTOR RESILIENCE CHECKLIST FOR HIGH-CONSEQUENCE INFECTIOUS DISEASES—INFORMED BY THE DOMESTIC U.S. EBOLA RESPONSE[254]

CDC and the Johns Hopkins Center for Health Security developed an evidence-informed checklist that outlines action steps for medical and public health authorities—in partnership with nongovernmental organizations and private industry—to assess and strengthen the resilience of their community's health sector in the face of Ebola Virus Disease or other high-consequence infectious disease (HCID). The report includes specific checklists for public health agencies, healthcare organizations, EMS, and elected officials, but the overarching resilience actions are as follows:

Preparedness

- The organization has the trained personnel needed to prepare for and respond to a major outbreak.

- The organization partners with other organizations that may be involved in a response, such as through a Healthcare Coalition. Such partnerships provide a mechanism for information sharing, collaborative exercising and training, planning, and surge response.

- The organization has an all-hazards emergency response plan with annexes for infectious diseases and routinely exercises components of the plan with partners.

- The organization has incorporated lessons learned from the 2014 domestic Ebola response into ongoing organizational and community HCID planning.

Leadership

- The organization is prepared to identify a single leader early in the response.

Creative Flexibility

- The organization is prepared to adapt existing plans in the midst of a response in order to address the specific needs of the particular incident and adjust response activities as knowledge, facts, and resulting guidance evolve during the incident.

- The organization has practiced (through exercises) adjusting operational procedures during an outbreak in the context of new knowledge, uncertain science, and/or differences in professional opinions.

Command Structure

- The organization is prepared to use the familiar Incident Command System chain of command/command structure that is used for other events/responses.

- Incident Commanders have ready access to information on the roles and authorities of the federal, state, and local agencies during infectious disease emergencies.

- Incident Commanders are familiar with the larger incident command structure of the jurisdiction/state.

Public Trust

- The organization routinely engages community stakeholders—including community and faith-based organizations and local opinion leaders—to identify and address community health needs, thus building public trust in advance of an event and developing partnerships that can prove valuable in a crisis.

- The organization is reaching out to the media, public, and elected officials in advance of an event to educate them about HCID preparedness and response activities and policies.

- The organization has a strong risk communication capability and is prepared to mount a robust media and community outreach campaign during an event as part of a coordinated effort between the healthcare delivery system and state and local public health.

Managing Uncertainty

- The organization has established a decision-making process that incorporates the most current and authoritative information available, including a process for adjudicating conflicting information.

- The organization is committed to taking actions that are supported by scientific evidence and avoiding, wherever possible, actions that are taken "out of an abundance of caution."

- The organization is committed to being honest and transparent with the public in cases where there are genuine differences of professional opinion in the context of uncertain science.

Crisis & Emergency Risk Communication

- The organization has trained risk communicators to craft and deliver clear, consistent, honest, and transparent messages to the public (including the media) and response and non-response personnel. These individuals should have a solid background in communication science, and communication efforts should be coordinated between healthcare and local/state public health entities.

- The organization is prepared to use multiple communication approaches, including town hall meetings, websites, social media, guest spokespersons, and information call lines/centers to get information out to the public quickly and to provide the opportunity for the public and media to ask questions and voice concerns.

- The organization is prepared to monitor social media to rapidly identify and dispel rumors and correct misinformation.

The Private Sector's Role in Preparing for and Responding to Public Health Emergencies

By Nicolette A. Louissaint, Ph.D., Executive Director, Healthcare Ready

The private sector can often respond to rapidly changing circumstances nimbly and usually knows the communities they serve incredibly well. As such, amidst an emergency, there is opportunity for private organizations to step in and fill response gaps.

The public sector takes on an enormous burden and works tirelessly to respond to emergencies, and the private sector sees its role, especially when it operates in affected regions, to surge alongside the public sector, pivot nimbly and augment public efforts—thereby enhancing the public system's response efforts.

Often to take advantage of public and private sector expertise, there just needs to be a connection between the two.

For example, during the Hepatitis A outbreak in San Diego, public officials reached out to the private sector for help locating a significant amount of vaccines—since one of the solutions was to do a mass vaccination campaign.

Instead of suggesting they import or special order something (possibly at an extremely high cost), Healthcare Ready (HcR), my organization, checked the levels of vaccines in pharmacies in the area. We found the private sector had enough in stock to supply what was needed. Sometimes you just need to know how and who to ask.

As evidenced by this example, one important aspect of coordinating emergency response is sharing critical information. HcR is designated by the Department of Homeland Security as an information sharing and analysis center (ISAC). So, the private sector knows they can trust us with their proprietary information—and we won't share with any outside parties inappropriately.

This designation also gives us a fuller view of the resources in a community during an emergency. For example, during a flood, we can know where emerging challenges in the medical pipeline might be because roads are not accessible. We can inform the public sector and work on a solution to ensure vital supplies make it to the public workers who are saving lives.

The public sector knows we can provide them with accurate status of response supplies and what is or isn't happening along the supply chain. It's absolutely vital for the public sector to know what kind of relief they'll be getting and when and what might be missing so they can adjust on the fly.

What we've learned from 2017's hurricanes

After this hurricane season, we realized that the private sector can do a lot quickly by getting around bureaucracy to rapidly fill gaps to supplement public sector efforts.

When faced with an emergency response, we initially focus on resuming supply chain operation and work to support any patients who might be falling through the gaps that naturally

occur. The public sector can rely on us to gain insight into what the private sector sees—with us being a central hub coordinating private sector information.

One recent example: There was a small group of patients on St. Thomas who needed a specific drug that could only be prescribed every 30 days. The public sector folks asked us to look for ways to get the drug from Puerto Rico and onto a plane that was making routine trips between the islands after Hurricane Maria.

As we looked into that, we also were able to reach out to the pharmacies on St. Thomas that we knew had re-opened. And we asked them to speak with their distributors who supply them with medicine. We actually found that one pharmacy had the necessary medicine and it was already on the island. We just had to connect the dots.

While this sounds easy written down, there are many competing priorities and everything is in flux during an emergency response. With the public sector relying on the private sector for these kinds of responsibilities it can free them up to handle other vital activities.

How we can better use the private sector?

While there are many examples of public and private sectors working well together, too often the private sector is only looked at as a supplier, notably of money and medicine, which is frustrating because clearly the private sector wants to and can help in other ways.

This might seem like a minor problem—but if the public sector is only engaging with the private sector amidst a crisis or when money is needed, the relationships aren't developed that are necessary to work alongside one another during an emergency. A lot of

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emergency preparedness and response is about knowing the right organization or person to contact to obtain the life saving measure/supply you need.

Currently, in most places, states have just one Emergency Management Coordinator for the entire private sector—encompassing industries like transportation, healthcare, agriculture, food, etc. It really isn't feasible for the level of coordination needed to go through a single node.

As such, there should be a coordinator for each industry, setup in advance with regular meetings to fold private sector emergency capabilities into the public sector's response plans—so when a hurricane makes landfall we all know what to do.

H. Readying for Climate and Weather-Related Threats

Climate-related and extreme weather events have serious health consequences in the United States.[255] Health departments have an important role to play in helping communities adapt and prepare for the adverse effects of climate change, given their role in building healthy communities.

HOW CLIMATE CHANGE AFFECTS YOUR HEALTH

EXTREME WEATHER

Increased Flooding & Storms

More Intense Wildfires

Water Contamination

Property Loss

Infrastructure Damage

RESPIRATORY SYNDROME increases by 25% during wildfires

51% of WATER-BORNE OUTBREAKS followed extreme precipitation events

Extreme weather events led to **OVER 200 DEATHS** in the last two years

Water Borne Illness

Injury & Death

159 DEATHS from Superstorm Sandy in October 2012

VECTOR-BORNE DISEASES

Increased Flooding & Storms

Increased Duration of Warm Season

Changes in Precipitation

Changes in Median Temperature

Expanded Geographical Range

Changes in Vector Behaviors

42,000 CASES OF WEST NILE VIRUS in the U.S. since 1999, of which **more than 1,700** people have died

ABOUT 68% of California will have increased probability for West Nile virus by 2050

Incidences of **LYME DISEASE DOUBLED** from 1991 to 2013

Increased Cases of Vector-Borne Diseases such as, Lyme Disease, Malaria, Zika Virus, and West Nile Virus

As temperature rises, the range of **TICKS CARRYING LYME DISEASE** will expand

Source: APHA

Public health workers are trained to develop communication campaigns that both inform and educate the public about health threats and can use these skills to educate the public about climate change-related disease prevention and preparedness. In addition, public health departments are also on the frontlines when there is an emergency, whether it is a natural disaster or an infectious disease outbreak. These types of emergency preparedness and response skills are essential as extreme weather events and other effects of climate change become more common.

The 2017 hurricane season acutely demonstrated that natural disasters can have a tremendous public health impact. From injuries in the immediate aftermath of the storm to long-term mental health effects, recovering communities face a range of challenges. And, public health is integral as part of the frontlines of the preparation, response and long-term recovery. In areas recovering from storms, public health departments work long hours for weeks on end — leading to extremely high costs and detracting from ongoing work of the department, such as routine disease prevention.

In-between emergencies, public health can use data and find opportunities to engage more with at-risk populations (such as children, pregnant women, elderly, people with physical and intellectual disabilities and people with mental health conditions). For example, this could mean including members of at-risk populations in emergency drills, training first responders and emergency managers to understand the needs of at-risk populations and creating pilot programs with Medicare providers, home health organizations and others involved with the care of older adults. This should include addressing the health of our older population and having processes in place to maintain their connection to care during an emergency that might result in evacuations and/or loss of power.

RECOMMENDATIONS:

- **Preventing and preparing for the adverse impact of climate change on infectious disease outbreaks.** Every state should have a comprehensive climate change adaptation plan that includes a public health assessment and response. Public health and environmental agencies should work together to implement strategies that help track concerns, coordinate risk management and communications and prioritize key public health capabilities needed to address environmental health concerns. Climate change needs assessments should include an examination of what additional capacities are needed and identify vulnerable populations and communities.

- **Building resilience to climate-related health effects at the federal, state and local level.** Climate change preparedness should be a required element of PHEP and HPP plans and grants. Funding also should be significantly increased to build capacity at the federal, state and local level to understand the impact of climate change and apply this to long-range health planning.

- **Increasing funding for prevention and preparedness measures that promote health equity and help protect vulnerable populations from adverse climate effects.** Initiatives addressing the underlying causes of climate change can simultaneously provide important health equity benefits to vulnerable populations. Projects aimed at reducing greenhouse gas emissions through city planning initiatives promoting active transportation options, for example, can play an important role in reducing existing health inequities by increasing resilience, physical activity levels and social cohesion in communities most at risk.[256] Urban planning policies can also help vulnerable populations adapt to the predicted impacts of climate change. Policies ensuring buildings are constructed to resist extreme weather events, for example, could help mitigate the negative impacts for vulnerable populations located in areas heavily impacted by hurricanes or heavy rain.[257]

- **Maintaining funding for the CDC's Climate and Health Program at the National Center for Environmental Health.** The program was created in 2009 to translate climate change science to inform states and communities, create tools to build state and local capacity to handle extreme events happening today and in the future and lead efforts to mitigate the public health impacts of climate change and extreme weather.

- **Implementing the Clean Air Act (CAA) in an effective and timely manner.** The CAA protects American health against dangerous levels of air pollutants. Investments to comply with the CAA have provided $4-8 of economic benefits for every $1 spent on compliance.[258] Four major rules of the CAA alone would yield more than $82 billion in Medicare, Medicaid and other healthcare savings for America through 2021.[259]

- **Developing sustainable state and local mosquito and other vector control programs.** A review by ASTHO found that many states and local communities are challenged to develop and maintain vector control programs, but that these programs are a vital public health strategy to help control vector-borne diseases.[260] And a NACHHO assessment of Zika response among agencies in high-risk U.S. areas also found that 68 percent of those surveyed lacked competency in mosquito control and surveillance, including many in Texas and Florida.[261] The vector-borne disease program at CDC should be broadly expanded to support state and local capacity to prevent and detect mosquito-borne illnesses such as Zika, Dengue and West Nile Virus.

- **Increasing funding for the National Environmental Public Health Tracking Program at the National Center for Environmental Health at the CDC.** Health tracking is important to identify the link between environmental factors and their impact on health. The program should be expanded and fully funded to cover every state.

- **Improving coordination and moving to integration across medical care, public health and environmental agencies.** Public health agencies at all levels must work with environmental, homeland security and other agencies to undertake initiatives to reduce known health threats from extreme weather, food, water and air and educate the public about ways to avoid potential risks.

Local Public Health Preparedness and Response to Hurricanes and Other Emergencies: High Tech and High Touch

By Umair Shah, MD, MPH, Executive Director and Local Health Authority for Harris County Public Health

Harris County, Texas, is a large and rapidly growing community. We are the third largest county in the United States with 4.5 million residents spread over 1,700 square miles.

We are diverse in every sense of the word, making it vital to communicate in culturally competent ways. Additionally, since we are growing and people come from all over, they might not have experience with mosquito or hurricane seasons. We cannot assume our constituents, year after year, are the same. So we must continue to reach out to our community and educate.

That means we need adequate capacity within the department and a diverse team with a broad array of skills and experiences who continual drill and train.

To ensure we reach all our constituents, we are mobile—we take public health to the public. We've built health villages with large RV units—that focus on all aspects of health from mosquito abatement to dental services to immunizations.

We didn't stop there — we knew to be a trusted source during an emergency we must foster a real intimate sense of community.

I mention this because, day-to-day, we rely both on high tech and high touch. We must remember the importance of both. As much as we talk about technology, social media and sophisticated surveillance systems, we cannot lose the high touch of knocking on a door or stopping to share a story, laugh or cry.

At the end of the day, the high tech gets the visibility, but it's the high touch that allows the high tech to succeed.

This is the backdrop that all our preparedness activities take.

Being Prepared

Even preceding Hurricane Katrina, we made sure that every single Harris County Public Health employee had up-to-date Incident Command Systems (ICS) training—and new staffers get this training as part of initiation.

And, every year, we practice—drills, exercises, call down lists, etc.—making sure we can perform all the tasks we'll need to do during a response.

So, in reality, our response to Hurricane Harvey started more than a decade before the hurricane ever made landfall.

Hurricane Harvey

Before Harvey even hit, our preparedness director alerted staff and the executive team that a major response would be necessary. With this advanced warning, we put all assets in place before landfall.

We set up communications pathways and communicated to all staff, ensuring they were aware of what was coming and their roles and responsibilities.

Once we were in place, we turned to the community. Our communications team sent out messages before the storm about how to be prepared: get your kits ready; what will you do without power; what if you're displaced; how will you care for the elderly, children and pets; and many more.

Aside from those messages, we needed to make sure people avoided flood water—there could be any number of dangers from power lines to insects to animals to sewage to toxins.

I highlight talking to the public because we're all in this together. We can respond great from a systems perspective, but if, for instance, people lose access to medications or begin to eat unsafe foods, we could see infectious disease outbreaks or worsened chronic conditions.

In addition to communicating, building and leveraging partnerships is key to a good response.

For example, we worked with state public health and federal partners (the U.S. Air Force) to continue ground and aerial spraying for mosquitos to ensure there wouldn't be increased levels of Zika or dengue or chikungunya. All levels of government coordinated to ensure we maintained adequate control over mosquitos and other infectious diseases.

Harris County also sheltered a number of people. Our epidemiologists relied on outside experts and volunteers to help them go cot-to-cot to make sure there wasn't an infectious disease outbreak and that people maintained access to medicines—a high touch strategy.

This is just a small sample of all the activities we did to keep people safe. At the end of the day, a good response involves working across systems to ensure strong partnerships are in place.

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Going forward

I'm always struck by the fact that everyone talks about the importance of health during an emergency, but, when the emergency goes away, we often forget that we need to adequately resource public health agencies so they have the tools and resources to take on the next emergency.

It's about capacity.

I worry, one day, there will be an emergency that we haven't trained for enough and don't have adequate resources in place. Public health can't all of a sudden be ready to respond to a major emergency — we need to drill and train and have access to infrastructure and technology.

To better prepare for and respond to emergencies, we also must improve technology solutions, electronic surveillance activities, and infrastructure support. We need more epidemiologists and environmental toxicology experts. And, we need more social workers and community health workers to fan into the community and link folks with vital social services.

The best response features a combination of high tech and high touch. This is where our department shines day in and day out. We've never let one overtake the other.

Nationally, though, we can't rest on our laurels—the next storm could be different and we need to be ready and prepared.

Q/A with Celeste Philip, MD, MPH, Surgeon General and Secretary of the Florida Department of Health

TFAH: What are state public health responsibilities before a storm?

Dr. Philip: The Florida Department of Health (DOH) is designated as the lead agency for State Emergency Support Function 8 (ESF8), health and medical services. DOH coordinates the availability and staffing of special needs shelters; supports patient evacuation; ensures the safety of food and drugs; provide critical incident stress debriefing; and provides surveillance and control of radiological, chemical, biological and other environmental hazards.

DOH administers two statewide preparedness grants to build local capacity within the public health and health care community. The federal Public Health Emergency Preparedness grant supports all 67 county health departments (CHD) and public health laboratories in developing community preparedness, epidemiological surveillance and investigation, and medical countermeasure delivery. The Hospital Preparedness Program funds 10 health care coalitions to build capabilities for medical surge, continuity of health care delivery, and preparedness partnerships among local health care partners.

TFAH: What are state public health responsibilities after a storm?

Dr. Philip: ESF8 assesses and stabilizes the public health and medical system; supports the ongoing sheltering of persons with special medical needs; coordinates patient movement and evacuations of health care facilities; conducts public health messaging;

monitors, investigates and controls any threats to human health; and coordinates disaster behavioral health services with a sister agency.

During Hurricane Irma, ESF8 assisted with 76 patient movement missions that supported the transport of hospital, skilled nursing facility and assisted living facility clients. We conducted more than 1,000 post-impact facility inspections and more than 2,600 tests of public and private water systems and operated 113 special needs shelters.

TFAH: How do state health departments coordinate the public health response to a major storm?

Dr. Philip: Preparedness and response are driven by local leadership, personnel and assets. In Florida, each CHD coordinates and works directly with their local Emergency Management to meet the preparedness and response needs of their community. If the county Emergency Operations Center (EOC) cannot meet the local need, they request assistance through the state EOC via a web-based system that allows us to track and ensure completion of mission requests.

Based on these mission requests, the state ESF8 assesses regional and state assets. If the requested resources are not available in-state, ESF8 next looks to resources available from other states through the Emergency Management Assistance Compact (EMAC), or, in the case of a declared state of emergency, potential federal assets such as Disaster Medical Assistant Teams.

TFAH: Why are federal investments in public health critical on an ongoing basis?

Dr. Philip: During a major event, we are often shoulder-to-shoulder with our federal partners in the state EOC. This includes representatives from HHS, ASPR, and also FEMA who help to coordinate any requests we make for federal assistance.

Federal investment is critical for building a public health infrastructure that has the capacity to prepare for and recover from weather and other hazardous situations. If states are better prepared to respond, requests for federal assistance may be lessened. With the close succession of Hurricanes Harvey, Irma, and Maria, and wildfires in California, federal response agencies had to sustain their efforts across time and location which may not be feasible in the future.

TFAH: What federal programs and supports are critical for preparedness and response?

Dr. Philip: Both the PHEP and HPP statewide preparedness grants are important for public health preparedness and response. Preparedness programs in various HHS agencies hold meetings that provide training and networking opportunities for states.

TFAH: What is needed from the federal government to improve preparedness and response?

Dr. Philip: Knowing and having a relationship with our federal counterparts that will be deployed to the state EOC improves communication and manages expectations more effectively. A federal system that allows for tracking of deployed assets would improve situational awareness and real-time decision-making.

Better coordination of credentialing health care professionals between states would be helpful for patients who evacuate with their provider and for providers coming into disaster areas.

Streamlined and flexible funding to allow for nimble response as needed would greatly enhance public health's ability to be effective.

TFAH: What lessons did you learn from the most recent storm? Was there anything different or new that happened?

Dr. Philip: Hurricane Irma posed a unique challenge because the track was very unpredictable, meaning that more hospitals decided to evacuate and more residents decided to shelter. This storm at some points was 500 miles wide — which exceeded the width of our state. And, personnel could not be moved around in advance of the storm as the track changed to support other counties in the new path. EMAC, federal and contracted assets were mobilized to support sheltering operations but some counties had to wait until the storm passed to receive additional staffing.

Because of the surge in last minute registrations to special need shelters, comprehensive planning and placement for each registrant could not be conducted resulting in the shelter having to accept clients with medical needs that exceeded the shelters' level of care capacity.

Moving forward, we recognize a need to anticipate future storms that may impact much, or all of the state, a scenario not contemplated prior to Hurricane Irma. For DOH, statewide emergency response efforts could be bolstered by improving planning for our special needs residents, including better training and increased collaboration with other state agencies and the private sector to support Floridians with special needs.

Hurricane Katrina: What We Learned, Then and Now

By Karen DeSalvo, Former Acting Assistant Secretary for Health, US Department of Health and Human Services

There are a significant amount of vital lessons that need to and have been learned from the preparation for, response to, and recovery from Hurricane Katrina. One long-term lesson that I think is worth highlighting and has shown its importance during recent weather-related emergencies is the need for public health to take a significant leadership and coordinator role before, during and after an emergency.

In the immediate aftermath of Hurricane Katrina, it was evident that connections were missing—whether it be local public health to state officials, public health to first responders, or public health to the community.

Public health leaders simply weren't the chief health strategists for their communities. The field was focused on an important set of discrete responsibilities or programs but not on the need to build connections with community leaders, first responders and other critical infrastructure that could ensure people had safe places to go and access to medications and other critical supports.

With this realization, it was apparent public health had to connect more with the full gamut of organizations and people involved with an emergency response. And, since then, we have done so not only in New Orleans, but in communities across the country.

For example, during subsequent hurricanes in New Orleans, public health was able to work directly and quickly with hospitals and other care facilities to know if power was on and what beds and medications were available.

And, if you look at the response in Houston, you'll note that public health was everywhere. They were in communities meeting people and alerting them to potential dangers and infectious diseases, what food and water was safe, etc. And, they were all over social media in a culturally competent way, reaching more and more people.

If you compare the Houston Harvey response to Katrina, it should be apparent that one of the benefits in Houston was the high level of connectedness between public health and the community they serve.

How we can better prepare for the next emergency

In addition to public health continuing to be the coordinator for health for our communities in disaster and every day, to better respond to the next public health emergency, the nation needs to:

- Expand funding;
- Improve the foundational capabilities of public health;
- Better leverage technology;
- Increase training; and
- Focus on the underlying health and resiliency of our communities— particularly those who are most vulnerable.

We need more funding for public health—we need public health departments at the local and state levels to have the foundational capabilities required to respond to public health emergencies but also to help build resilience between events. These funds can't be categorical, they have to provide core funding that can be nimble for a community to address their biggest health needs. For instance, parts of California might be more prone to wildfires while the Gulf Coast needs to focus on hurricanes. If we don't have these capabilities in place, we're forcing our public health workers to just react, rather than prepare to respond.

We also need more funding to go directly to local health departments. States have a huge responsibility during an emergency and often can't funnel as many resources as you'd think to the local level. During Katrina, we saw this front and center.

While more funding is important, it must be paired with concrete expectations and accountability. Every single health department in the country should be accredited which will help ensure that they can stand up emergency operations when necessary.

When Katrina hit, we were using flip phones, Blackberries and an early version of Google maps. We've come a long way with technology in little over a decade, but our preparedness hasn't quite kept up. We must do better with technology.

We have a great start with this by better leveraging the Department of Health and Human Services' emPOWER, an online tool that houses and provides Medicare claims data to hospitals, first responders, and health officials to help map the electricity needs during an emergency. emPOWER enables responders to prioritize evacuations and can identify vulnerable populations who will need follow-up services. But it's limited to the Medicare population. This type of tool must be expanded to or created for Medicaid and, where appropriate, private payers. First responders and public health must have real-time population level data.

An additional reason more resources are needed is to increase drills and training that specifically focus on local leadership and the U.S. Public Health Service Commissioned Corps. Annually, public health workers should drill in a vulnerable area alongside

the Commissioned Corps—an invaluable resource. Currently, when the Commissioned Corps deploys to an emergency the connections with local responders aren't there and often the Commissioned Corps can be underutilized.

Lastly, we simply must do more to improve the resiliency of our communities. The healthier a group of people are, the better they respond to an emergency.

In-between emergencies, public health must use data and find opportunities to engage more with vulnerable populations. For example, this could include creating pilot programs with Medicare providers, home health organizations and others involved with the care of older adults. We must improve the health of our older population and, at the same time, have the processes in place that can maintain their connection to care during an emergency that might result in evacuations and/or loss of power.

The nation's preparedness has improved immensely since Hurricane Katrina—we must keep improving.

Ignore At Your Peril: Environmental and Occupational Dimensions of Health Security

Originally featured in the National Health Security Preparedness Index project, September 7, 2017

By Anna Goodman Hoover, PhD, MA is an assistant professor in the University of Kentucky College of Public Health Department of Preventive Medicine and Environmental Health, and Glen P. Mays PhD, MPH is the Scutchfield Endowed Professor of Health Services and Systems Research at the University of Kentucky College of Public Health.

Disasters always have environmental contributors and consequences. Hurricane Harvey provides the latest reminder of this fact as Gulf coast responders assess risks and resiliencies in the affected region's water and food supplies, sewage systems, industrial and hazardous materials sites, housing stock, and other elements of the natural and built environment. Protecting communities and responders during disasters requires anticipating environmental and occupational health risks in advance and containing them as they emerge.

The National Health Security Preparedness Index's Environmental and Occupational Health (EOH) domain tracks the nation's progress in this area, which appears underwhelming in recent years. The Index measures capabilities for maintaining the security and safety of water and food supplies and testing for hazards and contaminants in the environment. These measures reveal some concerning trends. Although geographic disparities are reflected in many areas tracked by the Index, variation across states is widest in EOH, with the leading state achieving protections 2.4 times greater than its lowest-scoring counterpart. Furthermore, more than 40 percent of all U.S. states have experienced declines in EOH protections since Index tracking began, while an additional 25 percent of states have held steady, seeing neither declines nor improvement. Yet during the same period, the United States has experienced improvements in most other health security domains tracked by the Index.

The National Conference of State Legislatures and the University of Kentucky's Index Program Office recently hosted a meeting of environmental and occupational health experts in Washington, DC to explore EOH domain trends. Meeting participants included representatives from the Centers for Disease Control and Prevention, the National Environmental Health Association, the National Institute of Environmental Health Sciences, the National Governors Association, the Association of State and Territorial Health Officials, the Association of Public Health Laboratories, the National Association of County and City Health Officials, state environmental health leadership, and community-based organizations. The meeting's purpose was threefold: 1) to identify specific policies, practices, and/or measurement issues contributing to variation and declines within the domain; 2) to discuss policy and practice implications for addressing potential drivers; and 3) to develop strategies for strengthening the domain in ways that can more accurately and completely measure environmental and occupational health contributions to health security.
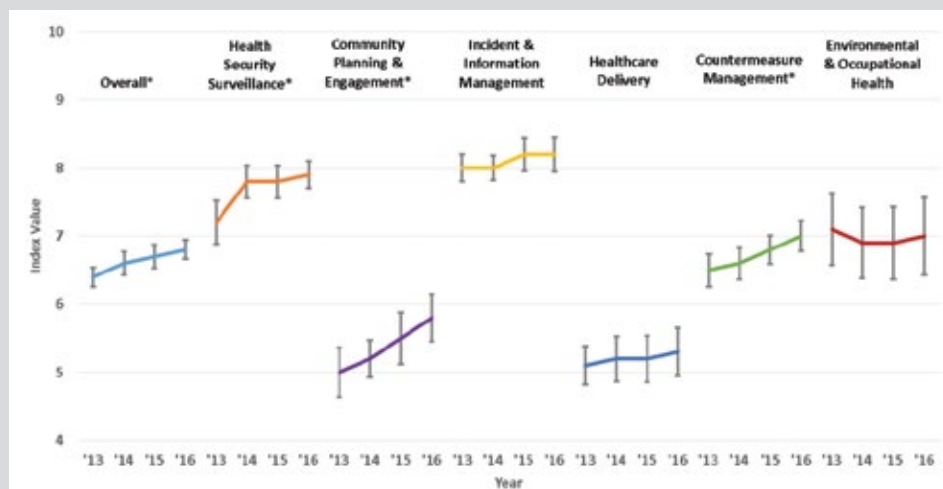
Local Public Health Responsibilities during Wildfire Emergencies

By Dr. Karen Relucio, Chief Public Health Officer, County of Napa

Responding to two wildfire events has taught me that public health has a significant role in wildfire emergency response. The role of public health includes shelter assessment, coordinating medical and mental health support in the shelter, ensuring environmental health and safety, and public health messaging.

During our first response in September 2015, there was a 75,000 acre fire that destroyed 1,300 structures, resulting in the evacuation of more than 1,000 people, which required us to open and support an evacuation center. The fire was predominantly in Lake County, which is adjacent to Napa County.

When something like this occurs, local public health works with our emergency management agency, fire and law, other County agencies and community partners to respond. Immediately, Napa County opened a shelter at the fairgrounds in Calistoga and stood up the emergency operations center.

Napa County Public Health took on the responsibility of assessing the health needs of most of the evacuees by using a modified community assessment for public health emergency response (CASPER). While Red Cross was on site, they only handled doing health assessments of the people that chose to stay inside the shelter. Surprisingly, we had many people show up in cars or RVs or with their own tents and with pets. Because animals were not allowed inside the building, they stayed outside on the fairgrounds property. It became our job to conduct health needs assessments of the majority of the 1,000 evacuees.

Additionally, our other role was providing medical support within the evacuation center. We worked with our local Federally Qualified Health Center, healthcare providers from our local medical centers and Medical Reserve Corps from Napa and neighboring counties to see patients. Most of the medical visits involved refilling medications and treating people who had respiratory issues from smoke inhalation or exacerbation of underlying health issues (diabetes, allergies and asthma). Thankfully, there were only a few people with slight injuries from the evacuation itself. We also provided flu and Tdap vaccinations.

It was also apparent that mental health needed to be addressed for the evacuees in a comprehensive way. We leaned on other local jurisdictions and nonprofits and were able to enlist a number of mental health professionals to come onsite. We quickly found that it was best to do more ad hoc checks and have the mental health professionals serve as support staff. They found it was easier to talk to folks—and avoid the stigma that might come with needing mental health services.

Another important aspect of our response was environmental health. These professionals ensured the shelter was safe and clean and that food was prepared and served safely. They went into the shelter and found donated food served potluck style, not at the appropriate temperature. In addition, there weren't enough hand washing

> Residential wildfire debris can include toxic materials such as asbestos, heavy metals, dioxins and polycyclic aromatic hydrocarbons that can be harmful to human health, and cleanup needs to be done carefully by experts.

stations or bathroom facilities and the pets of evacuees were relieving themselves in areas where people were walking. We felt this was a prime setup for a gastrointestinal virus outbreak, which would make the situation worse. Our folks figured out how to maintain the integrity of food, installed more portable toilets and hand sanitizing stations, and provided bags for pet waste.

Throughout the response, public health information included a smoke advisory, heat advisory, and repopulation safety for evacuees once they went back to their homes. We also had to ensure people knew they shouldn't sort through the debris without personal protective equipment.

This was great preparation for our recent fire in October 2017—which started at the same time our region was experiencing hurricane level winds of 50 to 90 miles per hour, resulting in rapid spread of the fire to our county and Sonoma County. The first 72 hours was focused on evacuations and safety.

We opened three different evacuation centers on that first evening and immediately began the plans for the type of medical coordination that we did in 2015. We also coordinated ambulance strike teams all over the region to help evacuate residential care and skilled nursing facilities.

In many ways our response was similar to 2015, except the scope of this emergency was much bigger and the recovery is much more complex. We had to declare a local emergency and a local health emergency to receive assistance for toxic ash and debris cleanup which is still in progress.

Residential wildfire debris can include toxic materials such as asbestos, heavy metals, dioxins and polycyclic aromatic hydrocarbons that can be harmful to human health, and cleanup needs to be done carefully by experts. At this point, debris cleanup is still underway.

Additionally, we opened a local assistance center to help those who have lost properties, homes, and jobs. And, there are many crews working on erosion control in burn areas around water reservoirs, as we are now having heavy rains and anticipate debris flow and possible water contamination.

While we have begun to create an almost turnkey response plan to wild fires, we could always be better prepared, especially for the recovery phase. And, we really need to know a lot more about the long-term health impact of wildfires. For instance, will we see cancer rates go up? Will health inequities be worsened due to loss of homes and income? If so, is that something public health can work to prevent during the response or in the aftermath?

We also need more information and research on the impact of toxic debris and additional long-term health consequences as a result of repopulating an area that has suffered wildfire damage. The only studies that come close to looking at long-term health impacts of fire debris are the 2001 World Trade Center attacks. We can speculate on health impacts based on knowing what is contained in ash but, to my knowledge, there hasn't been a long-term health impact study about residential wildfires. It is hard to make decisions and align future resources when we are uncertain about the long-term effects.

I. Supporting Community Resilience — for Communities to Better Cope and Recover from Emergencies — With Better Behavioral Health Infrastructure and Capacity

Another of the most difficult challenges in emergency health readiness is how to better prepare communities to mitigate impact and more quickly be able to recover when a disease outbreak, natural disaster or other emergency strikes.

SIX DOMAINS OF PREPAREDNESS

The **Public Health Emergency Preparedness Program** works to advance six main areas of preparedness so state and local public health systems are better prepared for emergencies that impact the public's health.

Community Resilience:
Preparing for and recovering from emergencies

Incident management:
Coordinating an effective response

Information Management:
Making sure people have information to take action

Countermeasures and Mitigation:
Getting medicines and supplies where they are needed

Surge Management:
Expanding medical services to handle large events

Biosurveillance:
Investigating and identifying health threats

Source: CDC

Hurricane Katrina provided one of the most enduring examples of how vulnerable members of a community — such as children, the elderly, people with underlying health conditions or disabilities, pregnant women and those who are lower-income and/or have limited-English proficiency — are often the most affected and least prepared and protected during emergencies.[262]

The next phase of preparedness efforts must prioritize how to improve the resilience of all communities. While building resilience is one of two overarching goals identified by HHS in the Biennial Implementation Plan for the National Health Security Strategy, there is not sufficient funding or other resources available to provide broad support for efforts.[263] Local health improvement partnerships could be one mechanism for helping to scale and diffuse strategies and engage additional funding support from the broader health, business and community sectors themselves.

Community infrastructure and design are also important for supporting resilience.[264, 265, 266] Public health should also be engaged in community planning and development, since having strategic infrastructure in place can help prevent and mitigate the impact of disasters — and infrastructure and community development — such as zoning and community design plans — have an ongoing impact on the health and well-being of the community. For instance, supporting greenspaces in communities helps provide buffers during flooding as well as recreational spaces to support safe, accessible opportunities for active living.

RECOMMENDATIONS:

- **Prioritizing the need to improve the ability of communities to be resilient — to be able to cope and recover from emergencies.**[267, 268] Public, private and nongovernmental stakeholders must work together to develop innovative approaches to build resilience, including leveraging the assets within the community.

- **Leverage federal, state and local health data and mapping to better anticipate and plan for the needs of the whole community, including by being able to** identify, plan for (and with), and respond to the needs of persons with access and functional needs.

- **Improving the overall health status of communities so they are in better condition to weather and respond to emergencies.** Initiatives and programs supported by the Prevention and Public Health Fund can assist in these efforts by promoting health and addressing underlying causes of health disparities.

- **Addressing health equity in disaster and recovery planning, with a focus on health outcomes.** Preparedness grants should assess and address gaps in resilience and preparedness for children, the elderly, people with underlying health conditions or disabilities and communities of color. Disaster preparedness and response needs to be applied equitably and ensure that all have access to resources.

- **Communities should have child-focused disaster planning, so the child-serving infrastructure in states — schools, child care, pediatric providers and facilities, nutrition, and housing — and emergency managers can prioritize the needs of children during disasters.**[269] Jurisdictions and public health agencies must also ensure that children with special needs, including physical and developmental disabilities, have access to appropriate care and services. FEMA should establish interagency agreements to provide disaster preparedness funding to state and local child-serving systems and child care facilities.[270]

- **Providing clear, accurate, straightforward guidance to the public in multiple languages, including formats for people with vision or hearing impairments, via trusted sources respecting different cultural perspectives and delivered via multiple media beyond the Internet, such as radio, racial and ethnic publications and television.**

- **Developing ongoing relationships between health officials and members of the community so they are trusted and understood when emergencies arise.**

- **Addressing ongoing behavioral health resources for communities, including integrating both mental health first aid and long term mental health treatment into disaster response and recovery strategies.** Survivors of natural disasters — especially children — may experience enduring mental health effects. In addition, those with underlying mental and behavioral health conditions could face disruptions in care and intensified mental illness. Recovery grants after disasters or a single, flexible grant funding mechanism should be targeted for delivery of mental health services and increased, long-term access to mental and behavioral health treatment. [271]

- **Disaster response research should include behavioral health impacts of disasters and best practices for assuring treatment.**

- **Engaging members of the community and community-based organizations directly in emergency planning efforts.**

- **Incorporating community resilience considerations into other resilience efforts at the local level.** For instance, building long-term community resilience should be integrated into efforts to address areas such as climate change adaptation, infrastructure resilience, continuity of operations, recovery from disasters and transportation and housing planning following a Health in All-Policies Approach. Communities should leverage various funding streams, such as from FEMA, U.S. Department for Housing and Urban Development (HUD), EPA and private grants to ensure resilience and planning efforts consider the health equity needs of the whole community.

- **Providing job-protected paid sick leave.** Nearly 40 percent of private-sector employees — more than 41 million workers — cannot earn paid sick days for their own illness or injury or to care for an ill family member.[272] When workers without paid sick leave get sick, they face the impossible choice of going to work and potentially infecting others or staying home and risking losing their jobs. Allowing employees to stay home when contagious is the most basic of outbreak prevention tactics, and being able to take off time to receive essential preventive services like immunizations and routine screening can save money in the future from lost productivity. Some of the very industries and occupations that require frequent contact with the public are some of the least like to provide paid sick days, enabling disease spread through contact with food, co-workers and the general public.

INFOSAGE — ELDER CARE NETWORK[273]

InfoSAGE, short for "Information Sharing Across Generations," is a new tool created by researchers from Harvard Medical School and Beth Israel Deaconess Medical Center that helps families of elderly patients communicate and manage caregiving outside of the hospital. Each network is built around one patient with connections to every member in their care network and it allows the patient to set different levels of access to maintain his or her privacy. Available online and via mobile app, the tool helps families keep track of appointments and tasks through a shared network calendar, as well the as names and dosing instructions of medications.

Business and Health Security: The Bottom Line on Preparedness

By: Glen P. Mays, PhD, MPH, Scutchfield Endowed Professor of Health Services and Systems Research at the University of Kentucky College of Public Health

In the midst of hurricane response and recovery efforts, the National Health Security Preparedness Index convened business and health experts for a robust virtual discussion about how disasters affect the economy, business and communities. We examined how company policies can support a healthy workforce and minimize the impact of unplanned absences, as well as how businesses can prepare for and quickly recover from a disaster.

Panelists Christopher Bollinger, University of Kentucky Gatton College of Business and Economics; Marc DeCourcey, U.S. Chamber of Commerce Foundation; Jennifer Esposito, Intel Corporation; and Lars Powell, Alabama Center for Insurance Information and Research at the University of Alabama, offered a range of perspectives on how the private sector plays a pivotal role in community preparedness and response.

Results from NHSPI clearly demonstrate that health security is not simply a governmental responsibility. Individual businesses and the private sector at large contribute to many of the health security measures that comprise the Index, such as by offering paid time off and telecommuting options for employees, promoting vaccination coverage in the workforce, supporting workers who train and volunteer for their local Medical Reserve Corps, and participating in emergency planning and exercises organized by regional healthcare coalitions and networks.

Panelists shared key insights for both health and business stakeholders as they consider strategies for strengthening health security and preparedness activities, including:

- The importance of leveraging the supply chain to prepare for events by

Figure: Webinar Attendees

- 17% Academia
- 12% Other
- 43% Government Public Health
- 9% Community nonprofits
- 19% Private sector
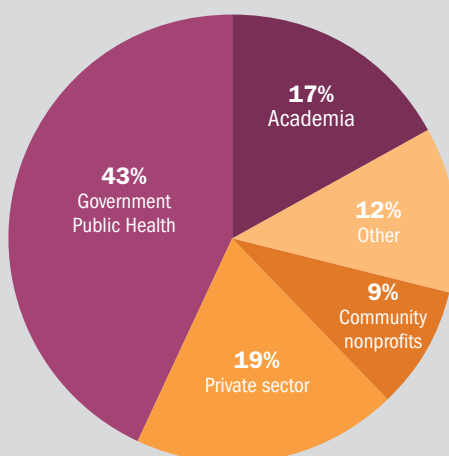
collaborating on contingency plans to avoid large-scale business disruptions;

- Increasing awareness about the need for preparedness plans among the business community, especially for small businesses with little influence over suppliers;

- How business can foster social cohesion—often business owners work closely in the community and will need to rise above competition to recover from an adverse event;

- Businesses as a catalyst for volunteerism in their workforce; and

- Harnessing technology to plan, respond, and recover, for both large and small companies.

We also know health security and preparedness require cross-sector

collaboration and a multipronged approach, and we were pleased that our participants joined from a variety of backgrounds. A plurality came from governmental public health, with significant representation from the private sector and academia.

The diversity of our attendees led to questions on a wide-range of topics, including:

- Global pandemics are arguably the only catastrophic threat that can simultaneously hit a business's employees, customers, and suppliers worldwide. Do you think most corporate CEOs are fully aware of the risk and adequately engaged in ensuring that all parts of the house (business continuity, HR, medical services) are resourced and supported? Are most companies doing drills?

- As a Public Health Emergency Preparedness Coordinator through a Health Department, where should the line be drawn between helping private businesses to prepare vs. just working towards community preparedness?

How do you handle the moral hazard aspect of private markets, like healthcare, that may see these regional treatment facilities as the primary source for handling high-consequence pathogens and therefore cut down on preparedness and training?

EXPERT COMMENTARY

Mental Health is Vital to Preparedness and Response

By Dr. Octavio N. Martinez, Jr., MD, MPH, MBA, FAPA, Executive Director, the Hogg Foundation for Mental Health at The University of Texas at Austin

The health effects from a public health emergency go way beyond the physical, taking an enormous mental toll in the immediate aftermath and the years following—and often can harm our children the most.

We must do more to know how to ensure mental health and physical health go hand-in-hand in response planning and efforts. We must also do a far better job of increasing our mental health workforce and ensuring and increasing access to mental health services both during and after an emergency.

Using Data to Plan for Maintaining Access to Mental Health Services

To prepare for any type of emergency, communities must be aware of vulnerable populations—typically children, the elderly and those who have an underlying medical condition or are mentally ill. We have gotten better at identifying where groups of these populations live.

And, we should also be able to access databases to predict what portion of a certain population might have substance use disorders, for example—and then understand what kind of continued treatment and medication are needed and where they might best be distributed.

Paired with this, we should be able to identify geographically which communities will have the hardest time bouncing back from an emergency and will need more resources.

While some neighborhoods might have good infrastructure and better access to

katz / Shutterstock.com

transportation and physical and mental health services, others will struggle. The neighborhoods that will struggle should be identified in advance and plans created to help them. And, we can create plans based on any number of scenarios: fires, floods, wind damage, loss of power, etc. If you combine all the knowledge and data together, you can then coordinate resources and everyone has a chance to be healthy.

Long-term Strategies to Improve Responses to Emergencies

We also must acknowledge that human connections are incredibly important. In-between disasters, preparedness work should focus on strengthening families and communities so they are resilient enough to weather an emergency.

For example, after Hurricane Katrina, New Orleans developed community leaders specifically focused on mental wellness, resilience and recovery. The gains in improved access to care and lessened stigma were noticeable—and these should help ensure responders and communities can work together to forge a better response during the next emergency.

While this is by no means a quick fix, taking a long-term approach to emergency preparedness and

community health will pay dividends in improved health of the entire population. We should bring this research to other cities and communities that will likely face similar events.

Additionally, psychological effects can take years to manifest and get under control—especially if there isn't access to mental health services. We learned from Hurricanes Katrina and Sandy that PTSD and suicidal ideation increased dramatically after these events. However, if we were able to step in earlier and connect individuals with mental health professionals, it's likely these issues and potentially other health issues (substance use disorders, increased anxiety, depression, etc.) could have been prevented or lessened.

Further, while we are getting better at recognizing that mental health is a key component to physical health, the workforce in this area is inadequate—and we've known this for a while, especially as the opioid epidemic has continued. By increasing our workforce and ensuring they have the right skill sets; we could help tackle the opioid epidemic and better prepare our communities to bounce back from a disaster.

Additional Research is Needed

The devil is often in the details and coordination among the various federal, state and local agencies, organizations and others must be improved. To do so, the nation has to prioritize funding into research and assessments post emergencies—so we can truly understand how these events affect the mental health and stability of a community at a population level.

While the National Institutes of Health has a Disaster Research Response Project, it needs to better include measures on mental health and substance use disorders. We must take each disaster as a learning opportunity that can prepare us for the next one and enable us to save more lives. Increasing research would also help build a network of behavioral health disaster experts.

First Responders

Our first responders and volunteers must be trained to identify and assist people who exhibit psychiatric symptoms, i.e., in "psychological first aid." And, going beyond this training, we know that mental health must be better integrated with the traditional health services.

Responders and volunteers must also be cared for—they are at risk for suffering secondary psychiatric distress themselves. We need better ways to monitor them during but also after the crisis to ensure they are receiving the appropriate interventions and care.

Part of the solution is increased mental health providers, which would serve many roles: keeping our first responders in good shape, filling gaps in mental health services and, by increasing access to care, hopefully preventing someone from developing a serious and chronic mental illness.

Quite simply, if we intentionally make mental health part of our preparedness and response systems it will have untold benefits for communities before, during and after an emergency—we will build resiliency and improve well-being.

J. Stopping Superbugs and Antibiotic Resistance

Antibiotics have been a groundbreaking achievement in public health, and have greatly reduced illness and death from infections. However, with widespread use over the years, antibiotics have become less effective and there has been the emergence of an increasing number infections that are resistant to antibiotics. Each year in the United States, more than 2 million people become infected and 23,000 die from bacteria that are resistance to antibiotics.[274]

Experts advise that antibiotic resistance and the rise and spread of superbugs will continue to grow, unless much greater action is taken. CDC has prioritized 18 organisms that that are urgent, serious or concerning antibiotic resistant threats — ranging from Methicillin-resistant Staphylococcus aureus (MRSA) to antibiotic-resistant gonorrhea. Eight of the organisms listed as urgent or serious threats are commonly linked with healthcare-associated infections, including *C. difficile*.[275]

- Experts have found that nearly one-third of the 154 million annual antibiotic prescriptions written in doctor's offices and emergency departments are unnecessary.[276] Many are prescribed for viral respiratory illnesses that inherently will not respond to antibiotics.[277]

- In addition, more than 80 percent of antibiotics sold in the United States are used in agriculture (including ionophores not used in human medicine).[278] Pathogens can develop antibiotic resistance when food animals — such as poultry, cattle or swine — are exposed to antibiotics.[279] They can spread to humans through consumption of food animal products, direct contact with infected animals or contact with environmental sources, such as water and soil contaminated by animal waste runoff.[280] Additionally, bacteria of animal origin can readily share resistance traits with other types of bacteria,

More than 30-Year Void in Discovery of New Types of Antibiotics

Source: Pew Charitable Trusts
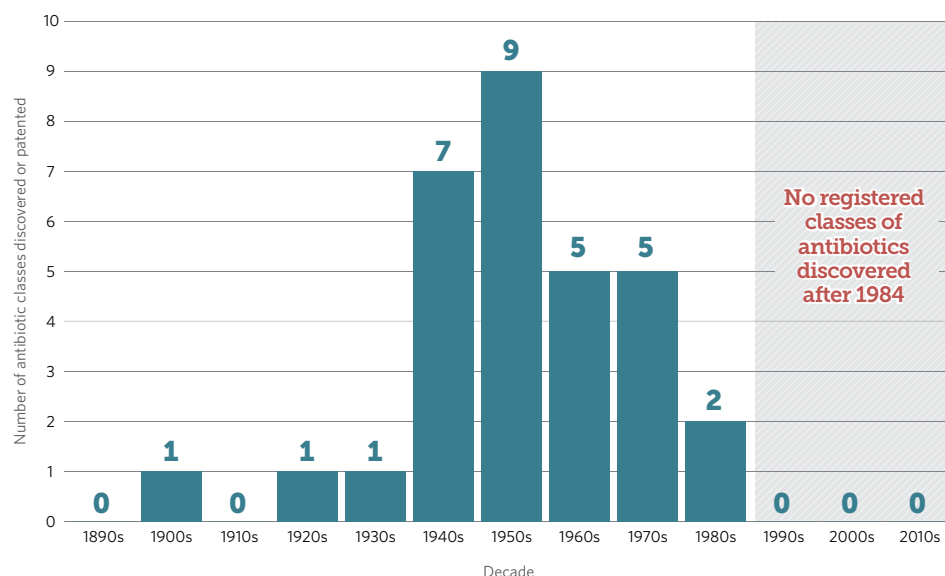
including those that make people sick, which has been demonstrated in test tubes, laboratory animals, and the gut of human volunteers.

- The lack of market incentives for pharmaceutical companies to invest in new antibiotic research and development and the difficulty of answering the scientific questions required to defeat the superbugs contribute to the problem. Antibiotics typically are used for a short period of time and at a low cost, compared to more profitable drugs. As of May, 2017, only 41 new antibiotics were in development, 11 of which had reached phase 3 testing and two of which had completed phase 3. [281] Historically,

about 60 percent of phase 3 drugs will be approved by the FDA.[282] The last time scientists discovered a truly new antibiotic that made it to market was in 1984. It has grown increasingly difficult to find new antibiotics, in large part due to scientific challenges. Overcoming these barriers is key to defeating some of the toughest bugs out there: drug-resistant Gram-negative bacteria.

- A number of efforts are also aimed at addressing scientific road blocks to advancing antibiotic research, such as the Shared Platform for Antibiotic Research and Knowledge, which is a dynamic information-sharing platform supported by The Pew Charitable Trusts.[283]

RECOMMENDATIONS:

- **Fully funding and implementing the Combating Antibiotic Resistant Bacteria (CARB) strategy, including CDC's Antibiotic Resistance Solutions Initiative.** The initiative is designed to fully implement the priority public health actions identified in the National Action Plan for Combating Antibiotic Resistant Bacteria, including slowing the emergence of resistant bacteria, preventing the spread of infections, and strengthening surveillance.[284]

- **Incentivizing the development of new antibiotics and new diagnostic tests for resistant bacteria.** There should be investment in antibiotic discovery science, early stage product development and research through BARDA, public-private partnerships such as CARB-X and other programs. Partners should also work together to develop a model of delinking antibiotic reimbursement from sales so drug developers are incentivized to innovate despite efforts to conserve antibiotics.[285]

- **Reducing overuse of antibiotics in agriculture.** The FDA should build on this year's elimination of antibiotic use for growth promotion and further increased veterinary oversight by enforcing requirements for the collection and publishing of species-specific use data, ensuring medically important antibiotics in food animals meet judicious use principles, ensuring adherence to requirements for veterinary oversight on the farm, promoting antibiotic stewardship programs and tracking the impact of these policies on trends in resistance and antimicrobial use in agriculture. Farmers and the food industry should stop using medically important antibiotics to promote growth and prevent disease in healthy animals, as recommended by the WHO.[286]

- **Funding research for non-antibiotic strategies in animal agriculture.** How animals are housed, fed, and raised affects their health and thus the need for antibiotics. Improving animal husbandry practices—such as the age at which pigs are weaned or the type of flooring used in animal areas—and adopting alternative interventions, such as vaccines, probiotics, or prebiotics, can reduce the risk of disease. Additional federal funding is needed to research, develop, and adopt husbandry practices and alternative interventions that reduce the need for routine antibiotics.

- **Reducing over-prescription of antibiotics through implementation of antibiotic stewardship.** The Centers for Medicare and Medicaid Services (CMS) should finalize and implement requirements for all CMS-enrolled facilities to have effective antibiotic stewardship programs that align with CDC's core elements guidance and work with public health to track progress in prescribing rates and resistance patterns. HHS should help develop quality measures that assure appropriate prescribing of antibiotics. HHS, CMS, accrediting organizations, healthcare facilities, medical schools and others should educate providers and patients about the harm of inappropriate prescribing.

- **Preventing and stopping the spread of infections and improve antibiotic use in every state.** CDC should continue expanding implementation of public health-healthcare prevention networks in every state to improve identification and response to all emerging threats and implement proven strategies in healthcare facilities to prevent infections and transmission across healthcare settings.

- **Strengthening surveillance and tracking of resistant bacteria and infections.** Congress and CDC must continue to invest in our public health infrastructure to enable the detection and control of drug resistant outbreaks. National programs to identify emerging patterns of both resistance and antibiotic use will quantify the magnitude of antibiotic use in the United States and inform new interventions. Requirement of data on antibiotic use and resistance will be essential for surveillance (i.e. NHSN modules for use and resistance). Sustained funding and continued support to state and local health departments implementing CDC's Antibiotic Resistance Laboratory Network (AR Lab Network) to provide rapid detection of and response to emerging resistance threats, next generation surveillance in ARLN/PulseNet laboratories and whole genome sequencing to rapidly uncover foodborne drug-resistant bacteria, including foodborne pathogens, as well as effective dissemination of data collected, will be critical for realizing the impacts of this initial federal investment in antibiotic resistance surveillance. There should be increased coordination between human health, animal health and agriculture — across public health agencies and USDA and state departments of agriculture.

- **Strengthen global commitments to antibiotic stewardship and surveillance.** As part of the Global Health Security Agenda, participating countries should commit to implementing regulations and performance targets for reducing overuse of antibiotics in humans and animals, preventing spread of resistant bacteria through infection prevention and control, safely sharing data on resistance patterns and detection of threatening pathogens, and funding less resourced countries for stewardship and surveillance.

Source: CDC

- **Preventing infection by improving vaccination rates for children and adults.** Despite their effectiveness, vaccination rates remain low in many communities across the United States — especially among adult populations — and reducing disease rates can lower the need for use of antibiotics. For example, viral respiratory infections, such as the flu, that are often mistakenly treated with antibiotics, would be reduced.[287] Federal, state and local health officials, in partnership with medical providers, health care systems and community organizations, should continue to expand assertive campaigns about the importance of vaccines, particularly stressing and demonstrating the safety, benefits and efficacy of immunizations. They also should rely on trusteed sources to do outreach to high-risk groups and to racial and ethnic minority populations where the misperceptions and mistrust about vaccines are particularly high. [288]

- **Healthcare Infection Prevention and Control.** Despite years of progress, healthcare providers do not routinely adhere to standard infection control practices that have been shown to prevent healthcare-associated infections and reduce transmission of highly resistant bacteria and resistant fungal infections like Candida auris. On any given day, one in 25 people in the hospital has an HAI, and over the course of a year, around 75,000 people with HAIs die during their hospitalizations.

  - Every hospital should have minimum baseline screening practices, including travel history; isolation capabilities to ensure patients and healthcare workers are safe from a potential threat; regular training on infectious control practices and use of protective gear; routine monitoring of adherence to important prevention practices, like environmental cleaning and hand hygiene; and procedures for removal and disposal of protective gear and waste.

- Collaborating on the detection and control of outbreaks. Each healthcare facility working alone cannot prevent, track or contain the spread of Superbugs. Public health needs to be the backbone organization in a state or region to coordinate prevention among competing or disparate healthcare systems and contain potential outbreaks, such as in the model supported by CDC's Antibiotic Resistance Solutions Initiative. Private healthcare also needs to be seen as part of a coordinated response, recognizing the importance of public health led efforts in implementing regional antimicrobial resistance control. Barriers to everyday coordination in the private healthcare system, such as competition, should be addressed and managed for emergency preparedness and response — which is one of the roles and values that HCC provides through regional coordination.

HEALTHCARE-ASSOCIATED INFECTIONS

Approximately 1 out of every 25 hospitalized patients will contract a healthcare-associated infection, which is an infection patients can get while receiving medical treatment in a healthcare facility.[289] Healthcare-associated infections not only happen in hospitals but can also occur in outpatient surgery centers, nursing homes and other long-term care facilities, rehabilitation centers, community clinics or physicians' offices.

A person's risk for an HAI, which includes a range of drug-resistant infections, increases if they are having invasive surgery, if they have a catheter in a vein or their bladder, or if they are on a ventilator or a prolonged course of antibiotics as part of their care.[290]

HAIs cost the country $28 billion to $33 billion in preventable healthcare expenditures each year.[291] Prevention and education efforts have been helping to decrease the rates of HAIs. CDC, the Centers for Medicare and Medicaid Services (CMS), states and medical providers have launched a series of provider education and prevention initiatives.[292] Many states are seeing decreases in HAIs. For instance, between 2008 and 2014, there were 50 percent fewer central line-associated bloodstream infections and 17 percent fewer surgical site infections related to 10 surgical procedures in in-patient healthcare settings.[293]

K. Improving Vaccination Rates — for Children, Teens and Adults

Vaccines are the safest and most effective way to prevent many infectious diseases. Some of the greatest public health successes of the past century — including the worldwide eradication of smallpox and the elimination of polio, measles and rubella in the United States — are the result of successful vaccination programs.[294] A model estimated that from 1994-2013 the Vaccines for Children program in the United States will have prevented as many as 322 million illnesses, 21 million hospitalizations and 732,000 deaths at a net savings of $1.38 trillion in societal costs.[295]

However, despite the recommendations of medical experts that vaccines are effective and that research has shown vaccines to be safe, on average, an estimated 45,000 adults and 1,000 children die annually from vaccine-preventable diseases in the United States.[296]

Millions of Americans are not receiving the recommended vaccinations. For instance, more than 2 million preschoolers do not receive recommended vaccinations; there have been outbreaks of measles, mumps and whooping cough around the country; vaccination gaps put teens and young adults at risk for HPV and bacterial meningitis; and more than 38 percent of seniors have not received the recommended pneumococcal vaccination.[297, 298, 299]

While many efforts focus on vaccines for children, it is also important to address the fact that currently, there is no real system or structure in place to ensure adults have access to or receive the vaccines they need unless they are part of institutions that have vaccine requirements, such as being enrolled in colleges or universities, serving in the military or working in a healthcare setting. Significant numbers of adults do not have regular well care exams, switch doctors or health plans often or only seek care from specialists who do not traditionally screen for immunization histories or offer vaccines. This makes it extremely difficult to establish ways for people to know what vaccinations they need and for clinicians to track and recommend vaccines to patients.

Improving the nation's vaccination rates would help prevent disease, mitigate suffering and reduce healthcare costs.

RECOMMENDATIONS:

- **Minimizing vaccine exemptions for school children.** States should enact and provide universal childhood vaccinations to ensure children receive required vaccinations to help protect themselves, their classmates and educators from diseases (except where immunization is medically contraindicated). Non-medical vaccine exemptions, including personal belief exemptions (PBE), enable higher rates of exemptions — and reduce vaccination coverage — in those states that allow them. School exemption rates should also be made publicly available so parents and educators understand the risks. The National Vaccine Advisory Committee (NVAC) recommends states with existing PBE policies should strengthen policies so that exemptions are only available after appropriate parent education and acknowledgement of risks to their child and the community.[300]

- **Boosting demand for vaccines.** Federal, state and local health officials, in partnership with medical providers and community organizations, should continue to expand assertive campaigns about the importance of vaccines, particularly stressing and demonstrating the safety and efficacy of immunizations. Targeted outreach should be made to high-risk groups and to racial and ethnic minority populations where the misperceptions about vaccines are particularly high.[301, 302] The NVAC adopted Adult Immunization Practice Standards should be adopted by all healthcare providers and systems to ensure all providers, including to assess immunization needs of their adult patients; strongly recommend needed immunizations to adults; properly administer these needed adult immunizations or refer their patients to providers who can administer these needed immunizations; and document administration of adult immunizations using an Immunization Information System. Training is also needed for providers to ensure they are able to effectively educate patients and make a strong recommendation for vaccines across the lifespan.

- **Making adult vaccinations routine, including regular screenings and referrals.** Private providers and health systems should have standing orders for vaccinations so every provider of care for adults can to assess the need for vaccinations, to recommend and directly administer and either provide directly or refer to another provider for vaccination. Vaccine locator systems should be enhanced to be integrated with other electronic health records to build a comprehensive vaccine referral system where providers can identify quantities of available vaccine and track whether the patient received the vaccine. A routine adult vaccination schedule should be established, where healthcare providers are expected to purchase, educate, advise about and administer immunizations to patients.

- **Expand access to vaccinations to reduced missed opportunities.** School-located vaccination clinics can be used to provide catch-up immunizations for school-entry, reach adolescents and young adults, and deliver seasonal influenza vaccination. An increasing number of adults receive vaccination through alternate locations including pharmacies and in the workplace. Obstetricians and midwives play a critical role in providing credible information to pregnant women and administering recommended vaccines.

- **Bolstering immunization registries and tracking.** Federal and state policymakers should take steps to facilitate reporting of immunization encounters and interoperability and data use between immunization registries and EHRs as well as between state and jurisdictional immunization registries. This will help track when patients receive vaccines, improve information sharing and data integrity across providers, remind providers to routinely provide recommended vaccinations, remind patients of needed vaccinations and address gaps. State health information exchanges or hub models that have supportive policies and procedures to encourage bi-directional data exchange may make this process simpler by encouraging integration of registry data with EHRs. Resources should be available to build capacity of Immunization Information Systems (IIS) and conduct outreach to encourage providers to participate in registries — and IIS systems should be linked to school vaccination reporting. States should also review and adapt statutes to require reporting or enable opting-out of adult registries.

- **Increasing provider education.** Parents and patients frequently identify healthcare providers as their trusted source for information about immunizations. Training is needed for healthcare providers to ensure they are able to effectively educate patients and make a strong recommendation for vaccination across the lifespan. Scientific improvements in vaccine manufacturing can quickly change the landscape of recommended immunizations. Professional healthcare associations should provide ongoing education and routine communication to their members. Medical, nursing, pharmacy and allied health schools

Source: CDC

should expand their training curricula on vaccines and vaccine-preventable diseases to strengthen a provider's ability to reduce missed opportunities by routinely assessing, recommending and administering immunizations.

- **Supporting expanded research and use of alternatives to syringe administration of vaccination.** Alternative delivery methods, such as intradermal patches, could help address issues around vaccine shortages, storage and stability, particularly for global vaccination efforts.[303, 304]

- **Ensuring first dollar coverage and access to all recommended vaccines under Medicaid, Medicare and private insurance.** All public and private payers should ensure that all ACIP-recommended vaccines are covered without cost sharing requirements. All insurance plans should consider pharmacies and other complimentary providers as important immunizers and should be considered in-network and receive equal payment for vaccine administration services for their adult and pediatric populations. State Medicaid programs are not currently required to offer all recommended adult vaccinations without co-payments. While some states offer coverage of all recommended vaccines, some do not. And, many have co-payments, which present a significant cost barrier. Medicare also does not consistently provide first dollar coverage for all vaccines, and the different policies dictate what is covered under Part B and Part D, leaving many seniors with gaps in coverage. Those who do

will likely face a co-payment that can vary by plan and vaccine, presenting a significant barrier for seniors.

- **Requiring on-time immunizations — based on the medically-recommended vaccines for a person's age and health status — as a quality measure for all health plans.**

- **Continuing support for vaccine programs:** The Vaccines for Children (VFC) and CDC's Section 317 immunization programs provide a safety net for individuals who are uninsured or remain outside of the traditional healthcare system, such as children who are eligible but not enrolled in Medicaid/State Children's Health Insurance Program (CHIP). The CDC immunization program's grants to states have also been key to building the immunization infrastructure, including enhancing registries, monitoring the safety and effectiveness of vaccines, responding to outbreaks and conducting surveillance, outreach and service delivery.

- **Making outbreak prevention part of the public health response to the opioid epidemic.** The opioid epidemic

has led to a surge of acute hepatitis B cases — a vaccine-preventable disease — with an increase of 20.7 percent in 2015 alone.[305] Public health and healthcare providers must include vaccination, testing and linkages to care for hepatitis B, hepatitis C and HIV as part of the response to the opioid epidemic.

- **Requiring universal immunization of healthcare personnel for all ACIP recommended vaccinations.** The Infectious Diseases Society of American (IDSA), the Society for Healthcare Epidemiology of American (SHEA) and the Pediatric Infectious Diseases Society (PIDS) support universal immunization of healthcare personnel (HCP) by healthcare employers (HCE) as recommended by ACIP. According to a joint policy statement by the three Societies, mandatory immunization programs are the most effective way to increase HCP vaccination rates.[306] The Societies also support requiring comprehensive educational efforts to inform HCP about the benefits of immunization and risks of not maintaining immunizations.

EXAMPLES OF VACCINE PREVENTABLE DISEASES

Anthrax, Sequelae of Hepatitis B Infection (including Liver Cancer), Diphtheria, *Haemophilus influenza* type b (Hib), Hepatitis A, Hepatitis B, Sequelae of Human Papillomavirus (including Cervical Cancer), Influenza (flu), Japanese Encephalitis,

Measles, Meningococcal disease, Mumps, Pertussis (Whooping cough), Pneumococcal disease, Polio, Rabies, Rotavirus, Rubella, Smallpox, Tetanus, Typhoid Fever, Varicella (Chickenpox), Yellow Fever and Zoster (Shingles).

L. Protecting Food and Water Safety

Every year, an estimated one in six Americans suffer from a foodborne illness.[307] Of those, around one million will suffer from long-term chronic complications, such as kidney failure or brain and nerve damage.[308] Foodborne illnesses are responsible for around 128,000 hospital visits and kill approximately 3,000 persons each year.[309] Young children, older adults, and people with compromised immune systems are most at risk for serious illness.

Norovirus is the most common cause of foodborne illnesses and outbreaks, causing an estimated 5.5 million illnesses and about 37 percent of outbreaks.[310] Foodborne norovirus outbreaks are most commonly due to the handling of ready-to-eat foods by infected persons who did not wash their hands after using the toilet. *Salmonella* is the leading cause of hospitalizations and deaths from foodborne disease in the United States, causing an estimated 19,000 hospitalizations and 378 deaths annually.[311] According to CDC data, the food categories responsible for the most outbreak-associated illnesses during 2015 were seeded vegetables (e.g. cucumbers), pork, and vegetable row crops (e.g. lettuce and spinach). *Salmonella* caused most of the illnesses in each of these three food categories. In 2017, *Cyclospora cayetanensi,* a microscopic parasite, has caused outbreaks of diarrheal illness linked to fecal contamination of imported produce items — 1,065 cases as of October 4th.[312]

According to the U.S. Department of Agriculture's (USDA) Economic Research Service, *E. coli* costs the United States over $271 million a year, and a 2015 study found that 15 foodborne pathogens alone are estimated to cost the country $15.5 billion in per year.[313] This estimate includes medical costs (doctor visits and hospitalizations) and productivity loss due to premature death and time lost from work.[314] Major outbreaks can also contribute

David Litman / Shutterstock.com

to significant economic losses in the agriculture and food-related industries, which contribute $985 billion to the U.S. gross domestic product (GDP) in 2014, a 5.7 percent share.[315] A 2011 CDC study found that *Salmonella* infections alone are responsible for an estimated $365 million in direct medical costs annually, and the number of infections had not decreased in the 15 years prior to the study.[316]

Most foodborne illnesses could be avoided with a stronger U.S. food safety oversight system. In 2015, FDA finalized several major rules implementing portions of the FDA Food Safety Modernization Act (FSMA):

- Preventive Controls for Human Foods and Preventive Controls for Animal Foods, which require covered facilities to analyze potential hazards and implement risk-based preventive controls in their production processes;

- Produce Safety, which establishes standards for growing, harvesting, packing and holding of produce; and the

- Foreign Supplier Verification Program for food importers to assure that imported food meets U.S. safety standards.[317]

The FY 2016 appropriations bills included an additional $104.5 million in new budget authority for implementing FDA food safety rules.[318]

In 2017, the Interagency Food Safety Analytics Collaboration (IFSAC) — a partnership created in 2011 between CDC, FDA and USDA — issued a new Food Safety Analytics Strategic Plan for 2017-2021. Its efforts focus on four priority pathogens: *Salmonella, E. coli* O157:H7, *Listeria monocytogenes,* and *Campylobacter*, which CDC estimates together cause 1.9 million cases of foodborne illness in the United States each year. The three goals of the new strategic plan are to improve the use and quality of new and existing data sources; improve analytic methods and models; and enhance communication about IFSAC progress.[319]

WATER SAFETY AND SECURITY

Waterborne illnesses also pose serious threats to America's health each year. While water-related illnesses are underreported, studies have reported estimates of nearly 82,000 annual hospitalizations, 477,000 annual emergency department visits, and nearly 7,000 deaths each year from diseases that can be transmitted by water.[320] From 2013-2014, 42 drinking-water associated outbreaks were reported to CDC, resulting in at least 1,006 cases of illness and 13 deaths.

There have been a number of recent major water crises that demonstrate the harmful impact that unsafe water can have on health and for communities when they do not have access to safe water. Some of these have required coordinated multisector emergency responses. For instance:

- In Puerto Rico, following Hurricane Maria, millions of residents lost access to clean drinking water, some for many weeks. Unclean water led to widespread acute medical problems, including vomiting, diarrhea, scabies and asthma.[321] There were at least 76 suspected cases of leptospirosis, a bacteria, including several deaths.[322]

- In Flint, Michigan, a change in the water supply in 2014 led to tens of thousands of residents exposed to high levels of lead and other toxins that are harmful to health, particularly the health of young children and babies during pregnancy. The CDC found that young children who drank the water had significantly high blood lead levels.[323]

- In Charleston, West Virginia in 2014, a chemical spill contaminated the water

supply for around 300,000 people, where many were unable to use their tap water for weeks to months.[324, 325]

In their annual Infrastructure Report Card, the American Society for Civil Engineers gave U.S. drinking water infrastructure a Grade D+ based on identified need to repair and maintain aging drinking water distribution pipes and water systems, and reduce the estimated 240,000 water main breaks that occur each year.[326] Security professionals also raise concerns about protecting water systems from potential biological and chemical terrorism attacks, including of agricultural water supplies and emphasize the importance of water for other community systems. A National Infrastructure Advisory Council report highlighted that nearly all critical infrastructure depends on water. Services are severely degraded within eight hours after loss of drinking water; nearly all healthcare functions are degraded within two hours.[327]

According to CDC, lead exposure remains a health concern for young children in the United States. Risk varies across the country, but because there are often no obvious symptoms, the exposure frequently goes unrecognized. In addition, only around 10 percent of schools with their own water systems are required to test for lead (350 of which failed lead tests from 2012 to 2015), and federal law does not require schools using local public water suppliers to test the water.[328] Even low levels of lead in children's blood have been shown to affect intelligence, ability to pay attention and academic achievement.

Security professionals also raise concerns about protecting from potential biological and chemical terrorism attacks on water supplies, including of agricultural water supplies.

RECOMMENDATIONS:

- **Fully funding and implementing the FDA Food Safety Modernization Act.** Sufficient funding should be devoted at the federal and state levels to be able to implement and enforce the law. FDA should ensure public health is the top priority as it implements FSMA prevention-based rules. FDA should also track implementation of these rules to ensure that proposed exemptions do not increase risk from foodborne illness.

- **Moving toward a more unified government food safety approach.** The federal government currently does not have a coordinated, cross-governmental approach to food safety. Right now, food safety activities are siloed across a range of agencies, and many priorities and practices are outdated and inconsistent. Better organization and coordination within and between federal food safety agencies would improve public health. In the longer term, the Administration should develop a plan with a set timeline for how to restructure food safety functions across the federal government — potentially consolidating them within a single, unified food safety agency — to better carry out a prevention-focused, integrated strategy. One part of this plan, which is the logical next step after FSMA, should be to modernize the meat and poultry laws so that they are more risk-based and science-based and protective of public health. This same type of coordinated, cross-governmental approach to food safety is also needed within each state.

- **Improving surveillance of foodborne illnesses.** Currently, foodborne illnesses are radically underreported in the United States and the quality of reporting varies dramatically by state. For example, CDC estimates for every reported case

of *Salmonella* infection, there are 29 unreported cases, and for every *E.coli* O157-H7 case there are an estimated 26 unreported cases.[329] New standards and requirements should be put in place to incentivize states to improve reporting. Surveillance for foodborne illness outbreaks should be fully integrated with other HIT systems, which will help improve tracking and identification of the scope of problems as well as sources of outbreaks. As public health moves toward genome sequencing of foodborne pathogens, federal and state policymakers should ensure adequate workforce and infrastructure investment for the transition to modern detection systems. FDA and CDC should also have a plan for requiring clinics to send cultures and/or specimens from rapid culture-independent response tests showing positive results to public health labs to allow for subtype pathogen testing.[330]

- **Adopting FDA's Food Code recommendations — a uniform system of food safety provisions for food service, retail food stores, or food vending operations in local, state and federal jurisdictions.** Data consistently identify five major risk factors that contribute to foodborne illness: 1) improper holding temperatures; 2) inadequate cooking, such as undercooking raw shell eggs; 3) contaminated equipment; 4) food from unsafe sources; and 5) poor personal hygiene.[331] FDA describes the benefits associated with the 2013 Food Code's complete and widespread adoption to include:[332]

  - Reduction of the risk of foodborne illnesses within food establishments, thus protecting consumers and industry from potentially devastating health consequences and financial losses.

  - Uniform standards for retail food safety that reduce complexity and better ensure compliance.

  - The elimination of redundant processes for establishing food safety criteria.

  - The establishment of a more standardized approach to inspections and audits of food establishments.

- **Assuring clean water for all Americans, especially after disasters.** All states should include water preparedness and sewage removal in their preparedness plans, including building relationships between health departments and local environmental and water agencies that oversee water security and safety. CDC should include national guidance and metrics for planning for a range of water-related crises. Measures should be taken to protect a safe water supply for all Americans, including addressing the ongoing problem of lead and other toxins in the drinking water in some communities, and taking measures, such as those in the Environmental Protection Agency (EPA)'s Clean Water Rule, to reduce the potential for waterborne illnesses and increase protection against potential acts of drinking and agricultural water-related biological and chemical terrorism.

- **Strengthening environmental health and integrating into preparedness and response.** Environmental health professionals work at local level to ensure safe water, food and environments before and after disasters, and mitigate hazards such as mold, mosquitos, and contaminated food and water. State and local public health should ensure environmental health is incorporated into emergency operations planning and incident command.

Ready or Not?
Protecting the Public's Health from Diseases, Disasters and Bioterrorism

APPENDIX A: State Public Health Budget Methodology

TFAH conducted an analysis of state spending on public health for the last budget cycle, fiscal year 2016-2017. Several states only report their budgets in biennium cycles; in those cases, an average year from the budget that includes FY 2016-2017 was used (for North Dakota, Oregon and Washington that was the 2015-2017 biennium budget and for Wyoming that was the 2017-2018 budget). The percent change in budget for these four states was calculated from the last biennium budget.

This analysis was conducted September-October of 2017 using publicly available budget documents through state government web sites. Based on what was made publicly available, budget documents used included either executive budget document that listed actual expenditures, estimated expenditures, or final appropriations; appropriations bills enacted by the state's legislature; or documents from legislative analysis offices.

"Public health" is defined to broadly include all health spending with the exception of Medicaid, CHIP, or comparable health coverage programs for low-income residents. Federal funds, mental health funds, addiction or substance abuse-related funds, WIC funds, services related to developmental disabilities or severely disabled persons, and state-sponsored pharmaceutical programs also were not included as best as possible in order to make the state-by-state comparison more accurate since many states receive federal money for these particular programs. For most states, all state funding, regardless of general revenue

or other state funds (e.g. dedicated revenue, fee revenue, etc.), was used.

Because each state allocates and reports its budget in a unique way, comparisons across states are difficult. This methodology may include programs that, in some cases, the state may consider a public health function, but the methodology used was selected to maximize the ability to be consistent across states. As a result, there may be programs or items states may wish to be considered "public health" that may not be included in order to maintain the comparative value of the data.

Finally, to improve the comparability of the budget data between FY 2015-2016 and FY 2016-2017 (or between biennium), TFAH adjusted the FY 2016-2017 numbers for inflation (using a 0.976 conversion factor based on the U.S. Dept. of Labor Bureau of Labor Statistics; Consumer Price Index Inflation Calculator at http://www.bls.gov/cpi/).

After compiling the results from this online review of state budget documents, TFAH coordinated with the Association of State and Territorial Health Officials (ASTHO) to confirm the findings with each state health official. ASTHO sent out emails on October 21, 2017 and state health officials were asked to confirm or correct the data with TFAH staff by November 10, 2017. TFAH and ASTHO followed up via email with those state health officials who did not respond by the November 10, 2017 deadline. New Mexico did not respond by December 6, 2017 when the report went to print and the most recent publicly available data was used.

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