Ready or Not

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

2016

Trust *for* America's Health

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Acknowledgements

Trust for America's Health is a non-profit, non-partisan organization dedicated to saving lives by protecting the health of every community and working to make disease prevention a national priority.

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Ready or Not? Protecting the Public's Health from Diseases, Disasters and Bioterrorism

Health emergencies disrupt the lives of millions of Americans and cost the country billions of dollars each year.

While emergencies are inevitable, the country is often caught "off guard" when a new threat arises, whether it is a disease outbreak like Zika or Ebola, a natural disaster or a bioterrorist threat.

The current system is not built for "readiness" — to be able to consistently respond in an effective and efficient way when new crises occur. Health security is chronically underfunded. So when emergencies happens, they divert time, attention and resources away from other ongoing needs and priorities.

- Investments are often made in response to new emergencies — once they have already become serious problems — instead of maintaining ongoing core preparedness and response capabilities;

  - The country often relies on a series of emergency supplemental funding packages, which require new debate and analyses for each new problem instead of having a standing Health Emergency Fund that can immediately provide a surge of funding to effectively and quickly respond to crises. While new funding is being deliberated, existing funds may be diverted from other ongoing priorities to address immediate needs. This leads to situations where a significant amount of emergency supplemental funds are needed to "pay back" the diverted money, but they are often insufficient to fill the gaps that are left or make up for the damage done by diverting from other priorities — such as the escalating hepatitis C crisis, measles and whooping cough outbreaks, healthcare-associated infections and maintaining food safety systems;

- The funding provided is often too little, too late — and is not sufficient to backfill longstanding gaps in preparedness and response for ongoing and emerging threats;

  - Failure to invest in cross-cutting capabilities leads to insufficient health security, such as not updating surveillance and diagnostic systems to keep pace with modern technology; maintaining a sustained, modern public health workforce; or sufficiently investing in the research and development of new medical countermeasures;

Healthcare Emergency Preparedness Funds Have Been Cut in Half Since 2004

$515 million

$255 million

| FY 2004 | FY 2016 |
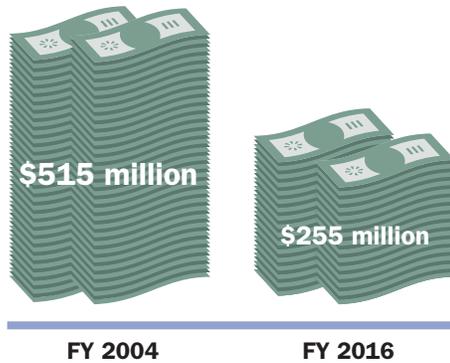
- Once an emergency subsides, complacency leads to funds being cut that are needed to maintain baseline public health capabilities;

- 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 around one-third (from $940 million in fiscal year (FY) 2002 to $660 million in FY 2016, including cuts restored by the Zika supplemental funding) and hospital emergency preparedness funds have been cut in half ($515 million in FY 2004 to $255 million in FY 2016);[1]

- 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;[2, 3]

- 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;

- Lack of clear, consistent preparedness and response capabilities mean that abilities range dramatically from community to community across the country; and

- Disjointed, uncoordinated and inconsistent planning across the public health, healthcare and other emergency first responders and across federal, state and local agencies and programs leads to inefficient and unprepared responses, rather than maintaining ongoing planning, testing and readiness coordination.

HEALTH SECURITY MATTERS[4, 5]

- In the course of one year, CDC's Emergency Management Program has conducted 585 global activities, including 65 Emergency Operations Center activations for outbreaks in 28 countries, including in the United States, and 135 exercises.

- CDC's Emergency Operations Center has been 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 past 2 years alone. There have been more than 16 known terror plots in New York City alone since 9/11.

- Every year, an average of one brand new contagious disease emerges — for the past 30 years. 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.[6]

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 that have never been sufficiently addressed and the backsliding of some advances, as budgets needed to support capabilities have been cut.

A modern and stable biodefense requires refocusing public health departments, healthcare and resources to more effectively use workforce, 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 are core basic capabilities that could be maintained to better protect the public from the range of possible concerns. In the past 15 years:

- **Some major areas of accomplishment include:** Emergency operations planning and coordination; public health laboratories; more advanced development and manufacturing for vaccines and other medical countermeasures; development of the Strategic National Stockpile, a federal repository of medical countermeasures, as well as an improved system to develop medical countermeasures more quickly; pharmaceutical and medical equipment distribution and administration; surveillance and epidemiologic investigation; information sharing and communications; 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; and improving systems for deployment of emergency medical and public health personnel.

- **Some major ongoing gaps include:** Coordinated, interoperable, near real-time biosurveillance; a stable medical countermeasure strategy and funding to continue research, development and purchase of vaccines, antiviral medications, diagnostics and antibiotics; chemical and radiation laboratory services; limited improvements in 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; 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.

A modern and stable biodefense requires refocusing public health departments, healthcare and resources to more effectively use workforce, emerging technology and strategies to achieve better outcomes and results.

In the 2016 *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. They are based on a range of concerns — reflecting a broad definition of all-hazards preparedness — of being able 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 the performance of specific state or local health departments, since they reflect a much broader context including resources, policy environments, healthcare systems and their availability and health status of communities — including many factors that are 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 actions for major emerging threats. The current process of insufficient funding means there are long-standing gaps in the baseline system. Emergency supplementals are delayed and not able 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.

- Improving **federal leadership before, during and after disasters** — including at the White House level, such as by designating a dedicated high-level adviser to the President and National Security Advisor on health security to provide leadership, coordination and expertise for a government-wide approach to 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, modernizing to near real-time, interoperable 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; and communicate and effectively educate the public on how to reduce risk and better protect themselves, their families and their neighborhoods.

There should be special emphasis on recruitment of Disease Intervention Specialists (DIS), who help determine the source of a problem and how it may be spread (such as contact tracing) and other services that are critical during outbreaks.

- Reconsidering **health system preparedness for new threats and mass outbreaks.** Develop stronger coalitions and partnerships among providers, hospitals, 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.

- 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.

- Preventing the negative health consequences of **climate change and weather-related threats.**

- Prioritizing efforts to address one of the most serious threats to human health by expanding efforts to stop **superbugs and antibiotic resistance.**

- Improving rates of **vaccinations for children and adults** — which are one of the most effective public health tools against many infectious diseases.

- 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.

"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."[7]

– *A National Blueprint for Biodefense: Leadership and Major Reform Needed to Optimize Efforts,* 2015.

"The country does not think about health security the way we do to be ready to respond to other threats. We need to think of it more in terms of maintaining an ongoing and steady defense, but having the surge capacity to be ready to respond when and if there is a threat. Many health problems created by Mother Nature can be our worst and most unpredictable adversaries."

– **Rear Admiral Steven C. Redd, M.D.,** Director of Preparedness Programs, Centers for Disease Control and Prevention.

"Our nation is experiencing an increasing number of emergencies that impact health, from natural disasters to emerging infectious diseases in addition to the ongoing threat of chemical and biological weapons and explosives. Creating and maintaining the necessary level of readiness for all threats requires sustained funding at all levels of government, continual collaboration with the private health care industry and recognition that there is no end point to preparedness."

– **Dr. Nicole Lurie, M.D., MSPH,** U.S. Department of Health and Human Services, Assistant Secretary for Preparedness and Response.

Indirect Costs of the Flu
$87 billion

\+

Direct Costs of the Flu
$10.4 billion

=

Total Costs of the Flu
$97.4 billion

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, resulting in severe birth defects, including microcephaly. 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 most of South and Central America, as well as the Pacific Islands. As of November 28, 2016, Florida and Texas are the only U.S. states with confirmed locally acquired cases (182), and there are ongoing outbreaks in Puerto Rico, American Samoa and the U.S. Virgin Islands. There is currently no vaccine or medicine for Zika.[8]

- **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 1,800 individuals, spreading from the Middle East to South Korea through international travel, causing a significant outbreak.[9, 10] MERS is fatal in more than 30 percent of cases.[11] As of July 2016, there have only been two MERS-CoV cases in the United States, 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.[12]

- **Superbugs:** More than two million Americans contract 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.[13] Globally, by 2050, superbugs could claim 10 million lives a year and could cost a cumulative $100 trillion of economic output.[14]

- **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.[15]

- **Influenza (the Flu):** Between 5 percent and 20 percent of Americans get the flu each year. Flu-associated deaths ranged from a low of 12,000 (during 2011 to 2012) to a high of 56,000 (during 2012 to 2013). The flu contributes to more than $10 billion in direct medical expenses and more than $87 billion in total costs (direct and indirect) each year.[16, 17]

- **Pandemic Flu:** In addition to the seasonal flu, historically there have been three to four flu pandemics each century. Pandemics occur when a new influenza virus emerges against which people have little-to-no immunity and the virus spreads internationally with sustained human-to-human transmission (an "A" virus that is antigenically and genetically distinct from already circulating seasonal flu "A" viruses, which most people have little-to-no immunity to fight against). 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 outbreak will be.[18] Once a novel influenza strain mutates and becomes easily transmissible among humans, it can cause a worldwide pandemic in a relatively short time.[19] A severe pandemic in 1918 resulted in 30 percent of the population becoming ill and more than 2.5 percent (625,000 Americans) of those who became ill died. The most recent pandemic (H1N1 in 2009) while considered relatively mild, infected around 20 percent of Americans (approximately 60 million individuals), and it resulted in approximately 274,000 hospitalizations and more than 12,000 deaths.[20]

Chikungunya: A mosquito-borne virus that, while rarely fatal, causes fever and joint pain that can be excruciating.[21] 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 in the Caribbean Islands. As of May 2016, more than 1.7 million cases have been reported to the Pan American Health Organization (PAHO) in 45 countries, and in November 2016, there have been around 120 cases reported from 34 states in the United States.[22, 23] As of November 29, 2016, a total of 141 chikungunya virus disease cases with illness onset in 2016 have been reported from 36 states.

Dengue Fever: A mosquito-borne illness that causes flu-like symptoms and severe joint, muscle and bone pain. There is a dengue vaccine licensed in 10 countries, but it is not currently available in the United States. Around 400 million people are infected each year, leading to around 50 million to 100 million illnesses and 22,000 deaths, mostly among children. It is endemic in Puerto Rico and in many popular tourist destinations in Latin America, Southeast Asia and the Pacific islands.[24] In the United States, small dengue outbreaks occurred in Texas in 2005, in Florida in 2013 and most recently in Hawaii in 2015.[25, 26, 27]

Chagas Disease: Caused by the parasite *Trypanosoma cruzi*, 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.

Many U.S. healthcare professionals are not familiar with the disease which leads to under-diagnosis.[28]

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.[29] More than 1,600 cases of West Nile virus disease have been reported to CDC. Of these, 747 (52 percent) were classified as neuroinvasive disease (such as meningitis or encephalitis) and 681 (49 percent) were classified as non-neuroinvasive disease.[30] Older adults are at higher risk for developing WNV neuroinvasive disease.

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.[31] Antimalaria drugs can provide effective treatment, but resistance is emerging and spreading globally. Globally, in 2015, there were 214 million cases and 438,000 deaths, mostly among African children.[32] The United States experiences approximately 1,500 cases to 2,000 cases of the disease per year, with most individuals exposed outside the country.[33] 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 dusty soils of the U.S. Southwest, mainly Arizona and California.[34] Most people never experience any symptoms, but some patients develop flu-like symptoms, 5 percent to 10 percent develop long-term lung problems and one percent may develop meningitis or die.[35] 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 and fewer than 100 Americans die from Valley fever annually.[36, 37]

Acute Flaccid Myelitis Outbreak: A recent uptick in children developing severe neurological symptoms has spotlighted a rare and alarming condition called acute flaccid myelitis (AFM).[38] 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. The largest 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 2015, there were 50 cases, and as of September 2016, 89 people in 33 states have been diagnosed with AFM. Spinal fluid samples have been unable to point to one pathogen causing the paralysis.

BIOTERRORISM THREATS

CDC classifies biological agents that could be used for an intentional bio-attack into three categories:[39, 40]

- Category A, or "High-Priority Agents," are considered the most dangerous because they can be easily spread from person to person and/or have a high death rate. Examples include: Anthrax, botulism, plague, smallpox, tularemia and viral hemorrhagic fevers (e.g., Ebola, Marburg).

- Category B, or "Second-highest Priority Agents," are moderately easily spread, have a low mortality rate and include food safety threats (e.g., *Salmonella* and *E. coli*), ricin toxin, Typhus fever and viral encephalitis, among others.

- Category C, or "Third-highest Priority Agents," include emerging pathogens that could be engineered for mass dissemination in the future because of availability; ease of production and dissemination; and potential for high morbidity and mortality rates and major health impact. Hantavirus, Chikungunya and MERS-CoV are examples of a Category C agent.

Fourteen out of 17 chemical, biological, radiological and nuclear (CRBN) agents meet the **Material Threat Determination (MTD)** — recognized as a threat that could be sufficient to affect national security — by the Secretary of the Department of Homeland Security (DHS), including:[41]

1. *Bacillus anthracis* (anthrax)
2. *Burkholderia mallei* (glanders)
3. *Burkholderia pseudomallei* (melioidosis)
4. *Clostridium botulinum* (botulism toxin)
5. Ebola virus (hemorrhagic fever)

6. *Francisella tularensis* (tularemia)
7. Junin virus (hemorrhagic fever)
8. Marburg virus (hemorrhagic fever)
9. Multidrug-resistant *Bacillus anthracis* (MDR anthrax)
10. *Rickettsia prowazekii* (typhus)
11. *Variola major* (smallpox)
12. *Yersinia pestis* (plague)
13. Radiological agents
14. Nuclear agents

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.[42] 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 buildings 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 over-whelmed receiving samples of items to test all around the country — testing more than 70,000 samples following the identification of the anthrax attacks.[43] Public health officials from CDC, New Jersey and Washington, D.C. and other agencies were among the primary inves-tigators determining the sources of the anthrax, helping to ensure it was con-tained and developing containment and response strategies.

Anthrax is a potentially lethal infection, particularly when it manifests as inha-lation anthrax. Historically, numerous nations have experimented with anthrax as a biological weapon, including the U.S. offensive biological weapons pro-gram that was disbanded in 1969.[44] The worst documented outbreak of inhalation anthrax in humans occurred in Russia in 1979, when anthrax spores were accidentally released from a military bio-logical weapons facility near the town of Sverdlovsk, killing at least 66 people.[45]

- **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 pos-sible bioterror threats. The last natu-rally occurring case of smallpox was reported in 1977.[46] Currently, there is no evidence of naturally occurring smallpox transmission anywhere in the world. Although a worldwide immuni-zation program eradicated smallpox disease decades ago, small quantities of smallpox virus officially still exist in research laboratories in Atlanta, Geor-gia and in Novosibirsk, Russia.

SECTION 1

State-by-State
*Health Security
Indicators*

STATE-BY-STATE HEALTH SECURITY INDICATORS

DECEMBER 2016

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 10 in Massachusetts to a low of three 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 2014 – FY 2015 to FY 2015 – FY 2016..	(2) National Health Security Preparedness Index: State met or exceeded the overall national average score (6.7) of the National Health Security Preparedness Index™, as of 2016.	(3) Public Health Accreditation: State had at least one accredited public health department.	(4) Flu Vaccination Rate: State vaccinated at least half of their population (ages 6 months and older) for the seasonal flu from Fall 2015 to Spring 2016.	(5) Climate Change Readiness: State received a grade of A, B or C in *States at Risk: America's Preparedness Report Card.*	
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	**26 States**	**30 States + D.C.***	**43 States + D.C.**	**10 States**	**32 States + D.C.***	

Note: Washington, D.C. data not available; they were awarded a point for the indicator."

	(6) Food Safety: State increased the speed of DNA fingerprinting using pulsed-field gel electrophoresis (PFGE) testing for all reported cases of *E. coli* O157.	(7) Reducing Healthcare-Associated Infections (HAIs): State implemented all four recommended activities to build capacity for HAI prevention.	(8) Public Health Laboratories: State public health laboratory provided biosafety training and/or provided information about biosafety training courses for sentinel clinical labs (from July 1, 2015 to June 30, 2016).	(9) Public Health Laboratories: State public health laboratories reported having a biosafety professional on staff (from July 1, 2015 to June 30, 2016).	(10) Emergency Healthcare Access: State has a formal access program or a program in progress for getting private sector healthcare staff and supplies into restricted areas during a disaster.	Total Score
Alabama	✓		✓	✓		5
Alaska	✓		✓			3
Arizona	✓		✓	✓		6
Arkansas	✓	✓	✓	✓		6
California	✓	✓	✓	✓		8
Colorado	✓	✓	✓	✓		7
Connecticut	✓	✓	✓	✓		8
Delaware	✓		✓	✓		7
D.C.	✓	✓		✓		6
Florida	✓		✓	✓	✓	7
Georgia	✓		✓	✓		6
Hawaii	✓	✓	✓	✓		6
Idaho	✓			✓		3
Illinois	✓	✓	✓	✓		6
Indiana	✓	✓	✓	✓		7
Iowa	✓	✓	✓	✓		8
Kansas	✓	✓	✓	✓		6
Kentucky	✓	✓	✓	✓		6
Louisiana		✓	✓	✓	✓	6
Maine	✓	✓	✓			6
Maryland	✓	✓		✓		7
Massachusetts	✓	✓	✓	✓	✓	10
Michigan	✓	✓	✓	✓		7
Minnesota	✓		✓	✓		6
Mississippi	✓	✓	✓	✓	✓	6
Missouri	✓		✓	✓		5
Montana	✓	✓	✓	✓		6
Nebraska	✓		✓	✓		6
Nevada	✓		✓			4
New Hampshire	✓	✓	✓	✓		7
New Jersey	✓	✓	✓	✓	✓	8
New Mexico	✓	✓	✓	✓		7
New York	✓	✓	✓	✓		7
North Carolina	✓	✓	✓	✓	✓	9
North Dakota	✓	✓	✓	✓		7
Ohio	✓	✓		✓	✓	6
Oklahoma	✓		✓	✓		5
Oregon		✓	✓	✓		7
Pennsylvania	✓	✓				6
Rhode Island				✓	✓	7
South Carolina	✓	✓	✓	✓	✓	7
South Dakota		✓	✓	✓		5
Tennessee	✓	✓	✓	✓		8
Texas	✓	✓	✓	✓		6
Utah	✓	✓	✓	✓		7
Vermont			✓	✓		6
Virginia	✓	✓	✓	✓		8
Washington	✓	✓	✓	✓	✓	9
West Virginia	✓	✓		✓		5
Wisconsin	✓	✓	✓	✓		7
Wyoming	✓		✓	✓		4
	45 States + D.C.*	35 States + D.C.	44 States	47 States + D.C.	10 States	

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

Scores	Color
3	
4	
5	
6	
7	
8	
9	
10	

SCORES BY STATE

10 (1 state)	9 (2 states)	8 (6 states)	7 (15 states)	6 (17 states & D.C.)	5 (5 states)	4 (2 states)	3 (2 states)
Massachusetts	North Carolina Washington	California Connecticut Iowa New Jersey Tennessee Virginia	Colorado Delaware Florida Indiana Maryland Michigan New Hampshire New York North Dakota Oregon Rhode Island South Carolina Utah Wisconsin	Arizona Arkansas D.C. Georgia Hawaii Illinois Kansas Kentucky Louisiana Maine Minnesota Mississippi Montana Nebraska Ohio Pennsylvania Texas Vermont	Alabama Missouri Oklahoma South Dakota West Virginia	Nevada Wyoming	Alaska Idaho

INDICATOR SUMMARY

Indicator	Finding
1. Public Health Funding Commitment	26 states increased or maintained funding for public health from Fiscal Year (FY) 2014 – FY 2015 to FY 2015 – FY 2016. *Source: Publicly available state budget information; distributed to state officials for updates and verification*
2. National Health Security Preparedness Index	30 states and Washington, D.C.* met or exceeded the overall national average score (6.7) of the National Health Security Preparedness Index™ (NHSPI™) (as of 2016). *Source: NHSPI*
3. Public Health Accreditation	43 states and Washington, D.C. have at least one accredited public health department. *Source: Public Health Accreditation Board*
4. Vaccinations	10 states vaccinated at least half of their population (ages 6 months and older) against the seasonal flu during the 2015-2016 flu season (from July 2015 to May 2016). *Source: CDC*
5. Climate Change Readiness	32 states and Washington, D.C.* received a grade of C or above in *States at Risk: America's Preparedness Report Card*, a national assessment of state-level preparedness for climate change-related threats. *Source: Climate Center and ICF*
6. Food Safety	45 states and Washington, D.C.* increased the speed of DNA fingerprinting using pulsed-field gel electrophoresis (PFGE) testing for all reported cases of Shiga toxin-producing Escherichia coli (E. coli) O157. *Source: CDC*
7. Healthcare-Associated Infection Control	35 states and Washington, D.C. have implemented four recommended activities to build capacity for Healthcare-Associated Infection (HAI) prevention. *Source: CDC*
8. Public Health Laboratories	44 state laboratories 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, 2016). *Source: Association of Public Health Laboratories annual survey*
9. Public Health Laboratories	47 state laboratories and Washington, D.C.'s laboratory have a biosafety professional. *Source: Association of Public Health Laboratories annual survey*
10. Emergency Healthcare Access	10 states have a formal access program or a program in progress for getting private sector healthcare staff and supplies into restricted areas during a disaster. *Source: Healthcare Ready*

Note: Washington, D.C. data not available; they were awarded a point for the indicator

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 during health emergencies.

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

KEY FINDING: 26 states increased or maintained funding for public health from FY 2014 – FY 2015 to FY 2015 – FY 2016.

26 states increased or maintained public health funding from FY 2014 – FY 2015 to FY 2015 – FY 2016. (1 point.)		24 states and Washington, D.C. cut public health funding from FY 2014 – FY 2015 to FY 2015 – FY 2016. (0 points.)	
Alabama (1.4%)	New Jersey (3.4%)	Alaska (-9.1%)	Maryland (-8.7%)
Arizona (0.4%)	North Dakota (13.6%)	Colorado (-8.1%)	Minnesota (-2.6%)
Arkansas (7.9%)	Ohio (2.0%)	Connecticut (-4.2%)*	Missouri (-1.3%)
California (4.2%)	Oregon (73.1%)	Delaware (-2.0%)	New Hampshire (-20.7%)*
Georgia (2.6%)	Pennsylvania (0.1%)	D.C. (-1.6%)	New Mexico (-4.4%)*
Hawaii (1.4%)	Rhode Island (0.9%)	Florida (-8.2%)	New York (-7.3%)
Indiana (6.3%)	South Carolina (17.4%)	Idaho (-4.8%)	**North Carolina (-2.3%)^**
Massachusetts (1.9%)	South Dakota (0.0%)	Illinois (-16.7%)	Oklahoma (-3.3%)*
Michigan (0.0%)	Tennessee (1.3%)	Iowa (-1.4%)	Texas (-2.9%)*
Mississippi (3.5%)	Vermont (13.9%)	**Kansas (-3.7%)^**	Utah (-1.3%)
Montana (9.5%)	Virginia (2.4%)	Kentucky (-7.0%)	**West Virginia (-2.5%)**
Nebraska (11.0%)	Washington (8.3%)	**Louisiana (-3.1%)**	Wisconsin (-0.7%)
Nevada (4.4%)	Wyoming (2.7%)	**Maine (-1.7%)**	

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

Notes: Bolded states did not respond to a request to review their state budget information, sent October 20, 2016 in coordination with ASTHO. States were able to provide confirmations or updates to information through December 14, 2016 to be reflected in the report.

*Budget decreased for second year in a row.

^Budget decreased for third 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.

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 2014 - FY 2015 and FY 2015 - FY 2016, 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.

Based on this analysis (adjusted for inflation), 26 states increased or maintained their public health budgets, while 24 states and Washington, D.C. made cuts. Five states (Connecticut, New Hampshire, New Mexico, Oklahoma and Texas) cut their budget for two or more years in a row, and two states had cuts for three or more years in a row (Kansas and North Carolina). The median spending in FY 2016 was $37.20 per capita, up from $33.71 in FY 2008.

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. The overall infrastructure of public health programs supports the ability to carry out all of their responsibilities, which includes infectious disease prevention, immunization services 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 (PHEP) cooperative agreements and the Hospital Preparedness Program (HPP), see Appendix B.

STATE PUBLIC HEALTH BUDGETS		
	FY 2015 - FY 2016	FY 2015- FY 2016 Per Capita
Alabama	$286,634,894	$59.95
Alaska	$87,298,217	$120.14
Arizona	$60,762,590	$9.04
Arkansas	$156,951,808	$53.56
California	$2,201,846,616	$57.16
Colorado	$239,660,934	$44.64
Connecticut	$106,756,130	$30.18
Delaware	$40,641,266	$43.66
D.C.	$90,552,600	$136.90
Florida	$369,559,682	$18.53
Georgia	$197,288,342	$19.63
Hawaii	$256,746,571	$182.26
Idaho	$147,298,109	$90.45
Illinois	$273,955,538	$21.65
Indiana	$86,868,535	$13.34
Iowa	$250,888,243	$81.62
Kansas	$34,758,479	$12.13
Kentucky	$137,699,922	$31.62
Louisiana	$89,632,324	$19.50
Maine	$28,370,095	$21.69
Maryland	$217,051,704	$36.72
Massachusetts	$342,230,567	$51.19
Michigan	$166,799,513	$17.08
Minnesota	$301,749,504	$55.86
Mississippi	$37,331,149	$12.68
Missouri	$35,214,294	$5.88
Montana	$24,834,043	$24.43
Nebraska	$90,437,475	$48.47
Nevada	$12,031,513	$4.23
New Hampshire	$16,613,281	$12.69
New Jersey	$236,248,560	$26.80
New Mexico	$94,992,998	$46.30
New York	$1,738,033,394	$89.23
North Carolina	$139,115,184	$14.08
North Dakota	$71,166,521	$95.55
Ohio	$162,903,149	$14.26
Oklahoma	$163,753,344	$42.55
Oregon	$111,493,271	$28.12
Pennsylvania	$185,414,136	$14.72
Rhode Island	$56,064,811	$53.94
South Carolina	$117,998,151	$24.49
South Dakota	$30,364,445	$35.95
Tennessee	$302,486,126	$46.57
Texas	$733,493,099	$27.14
Utah	$92,180,136	$31.27
Vermont	$32,087,244	$52.09
Virginia	$298,672,158	$36.21
Washington	$292,304,651	$41.43
West Virginia	$398,350,858	$219.52
Wisconsin	$86,335,078	$15.20
Wyoming	$32,539,129	$56.42
National	**$11,764,460,380**	**$37.20**

Note: Adjusted for inflation.

INDICATOR 2: NATIONAL HEALTH SECURITY PREPAREDNESS INDEX™

KEY FINDING: 30 states and Washington, D.C.* met or exceeded the overall national average score (6.7) of the National Health Security Preparedness Index™ (NHSPI™).[47]

30 states and Washington, D.C.* met or exceeded the overall national average score (6.7) in the National Health Security Preparedness Index.™ (1 point.)		20 states were below the overall national average score (6.7) in the National Health Security Preparedness Index.™ (0 points.)	
California (6.8)	New Hampshire (7.3)	Alabama (5.9)	Mississippi (5.8)
Colorado (6.7)	New Jersey (6.8)	Alaska (6.0)	Montana (5.7)
Connecticut (7.0)	New Mexico (6.8)	Arizona (5.8)	Nevada (5.9)
D. C. (N/A)*	New York (7.5)	Arkansas (6.2)	North Dakota (6.5)
Delaware (6.7)	North Carolina (7.0)	Georgia (6.2)	Ohio (6.5)
Florida (6.7)	Oregon (7.0)	Hawaii (6.1)	Oklahoma (6.5)
Illinois (7.1)	Pennsylvania (6.9)	Indiana (6.4)	South Carolina (6.5)
Iowa (6.8)	Rhode Island (7.2)	Idaho (6.1)	South Dakota (6.1)
Kansas (6.7)	Tennessee (6.7)	Louisiana (5.6)	West Virginia (6.3)
Kentucky (6.9)	Texas (6.7)	Michigan (6.5)	Wyoming (6.4)
Maine (7.0)	Utah (7.0)		
Maryland (7.6)	Vermont (7.3)		
Massachusetts (6.8)	Virginia (7.3)		
Minnesota (7.4)	Washington (6.8)		
Missouri (6.8)	Wisconsin (6.9)		
Nebraska (7.1)			

Note: *Washington, D.C. was not included in the NHSPI (since information was not available, D.C. was awarded a point for the indicator).

Source: National Health Security Preparedness Index

This indicator examines whether a state met the national average for the National Health Security Preparedness Index™ (NHSPI), 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 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.

The overall national average was a 6.7 out of a possible 10 in 2015. This is a 1.8 percent improvement from 2014 across all NHSPI domains, and a 3.6 percent improvement from 2013. State scores ranged from a low of 5.6 in Louisiana to a high of 7.6 in Maryland. Generally, Northeastern states scored highest, while those in the Deep South and Mountain West scored lowest.

The scores from the Index includes 134 individual measures, aggregated into six domains and 19 sub-domains. The six domains encompass:[48]

- **Health Security Surveillance: National score 7.5 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 5.4 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 — enable communities to effectively work together during crises and recover faster in the aftermath.
  - Sub-domains 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 of volunteers during an emergency; and 4) social cohesion — the degree of connection and sense of "belongingness" among residents. This domain has improved 8.4 percent since 2013.

- **Incident and Information Management: National score 8.4 out of 10.** The ability to mobilize and manage resources during a health incident.

  - Sub-domains 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.

- **Healthcare Delivery: National score 5.1 out of 10.** The state of healthcare 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

Preparedness by Domain

Domain	Score
Health Security Surveillance	7.5
Community Planning & Engagement	5.4
Incident & Information Management	8.4
Healthcare Delivery	5.1
Countermeasure Management	7
Environmental & Occupational Health	6.4

Source: nhspi.org

Preparedness by State

KEY

ABOVE NATIONAL AVERAGE   MEETS NATIONAL AVERAGE   BELOW NATIONAL AVERAGE
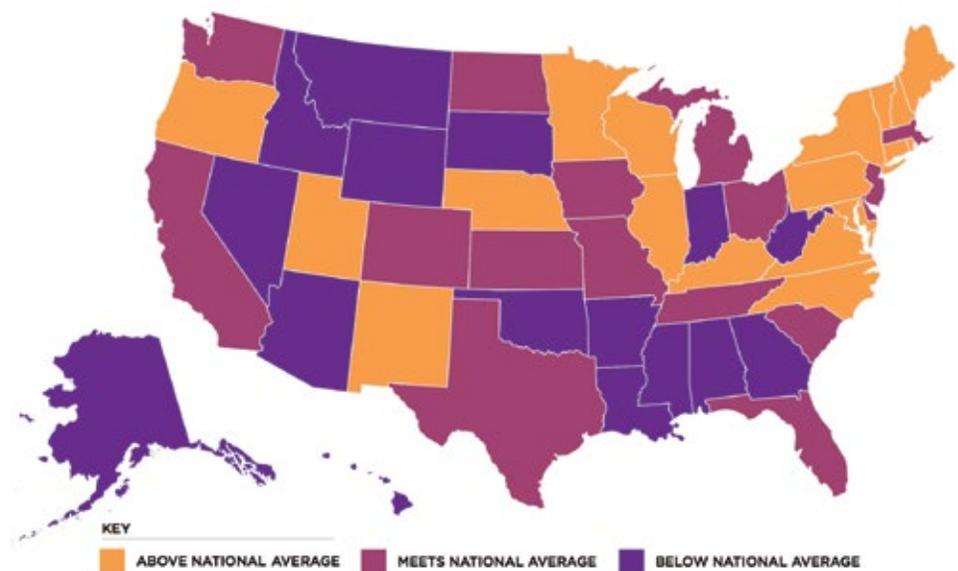
effectiveness of countermeasure utilization, including community preparedness for usage and follow through of usage; and 3) non-pharmaceutical intervention to contain disease spread or exposure using community mitigation strategies.

- **Environmental and Occupational Health: National score 6.4 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. The score for this domain decreased by 4.5 percent between 2013 and 2015, reflecting challenges in rapidly detecting and responding to environmental risks, as exemplified by events like the water contamination crises in Michigan and West Virginia.

INDICATOR 3: PUBLIC HEALTH DEPARTMENT ACCREDITATION

KEY FINDING: 43 states and Washington, D.C. have at least one accredited public health department.[49]

43 states and Washington D.C. have at least one accredited public health department. (1 point.)			7 states have no accredited public health departments. (0 points.)
Alabama	Kentucky	North Dakota	Alaska
Arizona	Louisiana	Ohio*	Hawaii
Arkansas*	Maine*	Oklahoma*	Mississippi
California*	Maryland	Oregon*	New Hampshire
Colorado*	Massachusetts	Pennsylvania	South Carolina
Connecticut	Michigan	Rhode Island*	South Dakota
D.C.*	Minnesota*	Tennessee	Wyoming
Delaware*	Missouri*	Texas	
Florida*	Montana*	Utah	
Georgia	Nebraska*	Vermont*	
Idaho	Nevada	Virginia	
Illinois*	New Jersey	Washington*	
Indiana	New Mexico*	West Virginia	
Iowa	New York*	Wisconsin	
Kansas	North Carolina		

*Source: Public Health Accreditation Board. * Accredited states.*

This indicator examines whether states have at least one public health department that is accredited by the Public Health Accreditation Board (PHAB).[50] 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.[51]

PHAB has accredited 162 health departments and one integrated local public health department system — together covering around 56 percent of the U.S. population. Forty-three states and D.C. have at least one accredited health department.[52] Another 173 health departments are in process.[53] Most recently, the Cherokee Nation became the first tribal public health department to achieve 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;

- 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."[54, 55]

10 states vaccinated at least half of their population (ages 6 months and older) against the seasonal flu from July 2015 to May 2016. (1 point.)	40 states and Washington, D.C. did not vaccinate half of their population (ages 6 months and older) against the seasonal flu from July 2015 to May 2016. (0 points.)		
Connecticut (52.6%)	Alabama (43.9%)	Louisiana (44.0%)	Oklahoma (45.8%)
Delaware (50.5%)	Alaska (37.9%)	Maine (49.0%)	Oregon (42.0%)
Hawaii (50.2%)	Arizona (41.5%)	Michigan (42.2%)	Pennsylvania (48.2%)
Iowa (51.8%)	Arkansas (45.4%)	Minnesota (49.7%)	South Carolina (46.9%)
Maryland (51.7%)	California (43.7%)	Mississippi (42.1%)	Tennessee (46.3%)
Massachusetts (50.4%)	Colorado (49.1%)	Missouri (47.4%)	Texas (47.9%)
New Hampshire (50.9%)	D.C. (47.6%)	Montana (43.8%)	Utah (43.5%)
North Carolina (50.9%)	Florida (39.5%)	Nebraska (49.1%)	Vermont (49.2%)
Rhode Island (56.1%)	Georgia (41.2%)	Nevada (36.8%)	Virginia (49.5%)
South Dakota (56.6%)	Idaho (39.2%)	New Jersey (45.4%)	Washington (47.9%)
	Illinois (42.9%)	New Mexico (47.4%)	West Virginia (49.6%)
	Indiana (43.2%)	New York (49.1%)	Wisconsin (42.7%)
	Kansas (44.4%)	North Dakota (48.8%)	Wyoming (38.1%)
	Kentucky (44.2%)	Ohio (43.8%)	

Source: CDC, Flu Vaccination Coverage, United States, 2015-2016 Influenza Season

KEY FINDING: 10 states vaccinated at least half of their population (ages 6 months and older) against the seasonal flu from July 2015 through May 2016.

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 the last three flu seasons (2013 to 2014, 2014 to 2015 and 2015 to 2016). CDC estimates that 144.5 million people were vaccinated this past flu season in the United States.[56]

This measure provides important context for a state's preparedness for pandemics. 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 2015-2016 season. The U.S. Department of Health and Human Services (HHS)

Source: CDC

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.[57] This indicator uses 50 percent as a marker of showing progress toward achieving this goal.

FLU SEASONS ARE UNPREDICTABLE AND VARY IN SEVERITY

BUT STATISTICS UNDERSCORE THE SERIOUSNESS OF THE DISEASE

It has been estimated that **each year in the United States,** flu results in:

BUSINESS CHALLENGES

Each year, on average, **5 percent to 20 percent** of the U.S. population gets the flu, tens of thousands are hospitalized and thousands die from flu-related illness. This costs an estimated $10.4 billion a year in direct medical expenses and an additional $16.3 billion in lost earnings annually. Employers can play an important role in preventing flu, helping to protect employees' health and reducing losses in productivity and revenue.

Molinari NA, et al. Vaccine 25 (2007)

31.4 MILLION outpatient visits

Molinari NA, et al. Vaccine 25 (2007)

About **200,000 HOSPITALIZATIONS**

Zhou H et al. CID (2012)

More than **$87 BILLION** in total economic burden

Molinari NA, et al. Vaccine 25 (2007)

Between **3,000 & 49,000 DEATHS**

*Annual motor vehicle deaths: 33,783, for comparison

50k
40k
30k
20k
10k

CDC: MMWR 59 2010 (30-YEAR RANGE)

Source: CDC

The highest flu vaccination coverage was in South Dakota at 56.6 percent and the lowest was in Nevada at 36.8 percent.[58, 59] Ten states vaccinated 50 percent or more of their population and 45 states and Washington, D.C. vaccinated 40 percent or higher. Nationally, 45.6 percent of Americans ages 6 months and older were vaccinated.

- Flu vaccination coverage levels were significantly higher for children (59.3 percent) compared to adults (41.7 percent).

- The lowest vaccination coverage was among adults ages 18 to 49 at just 32.7 percent.

- 63.4 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, pregnant women, people with certain chronic health conditions and people 65 years and older. For example, about 90 percent of all flu-related deaths occur in persons 65 and older.[60] If all seniors received the flu shot, flu cases among this vulnerable population could drop an estimated 15 percent to 25 percent.[61, 62]

Each year, millions of Americans get the flu — ranging from around 9 million 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 to 2012 flu season) to a high of 56,000 (2013 to 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).[63, 64, 65]

Between 2004 and 2016, 1,176 children between 6 months and 18 years old died from flu complications; 43 percent of these children were otherwise completely healthy.[66]

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. One study projected that an increase of vaccinations by 5 percent would prevent more than 500,000 illnesses and nearly 6,000 hospitalizations.[67] 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.[68]

According to a CDC survey of healthcare personnel, about one-fifth (21 percent) of healthcare workers were not vaccinated against the flu during the 2015 to 2016 season.[69] Healthy People 2020 has set a goal of 90 percent of healthcare workers vaccinated each flu season.[70] Among healthcare workers, vaccination coverage was highest among healthcare personnel working in hospitals (91.2 percent) and lowest among those working in long-term care settings (69.2 percent); however, coverage in long-term care settings increased by 5.3 percentage points compared with the previous season. Flu vaccination coverage levels were higher among healthcare professionals whose employers required vaccination (96.5 percent). In settings with no employer requirement for vaccination, coverage was higher where vaccination was offered on-site at no cost for one day (82.1 percent) or multiple days (82.8

percent) and lowest among personnel working in settings where vaccination was neither required, promoted, nor offered on-site (44.9 percent).[71]

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.[72] For the 2015-2016 season, CDC estimates the seasonal flu prevented 5.1 million illnesses, 71,000 hospitalizations and about 3,000 deaths.[73]

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 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 as part of comprehensive healthcare — 36 programs now cover vaccines in accordance with ACIP recommendations, including 8 of the 10 largest programs (not Florida or Texas). Seventeen of these programs (17/36) also prohibit copayments.[74] Medicare Part B covers annual flu vaccinations for beneficiaries with no co-pay.

INDICATOR 5: CLIMATE CHANGE READINESS

Key Finding: 32 states and Washington, D.C.* received a grade of A, B or C in States at Risk: America's Preparedness Report Card, a national assessment of state-level preparedness for climate change-related threats.

32 states and Washington, D.C.* received a grade of A, B or C on climate change preparedness. (1 point.)		18 states received a grade of D or below on climate change preparedness. (0 points.)	
Alaska (B+)	New Mexico (B-)	Alabama (D-)	Missouri (F)
Arizona (C-)	New York (A)	Arkansas (F)	Montana (D-)
California (A)	North Carolina (B+)	Hawaii (D-)	Nebraska (D+)
Colorado (B)	North Dakota (C+)	Idaho (D+)	Nevada (F)
Connecticut (A-)	Oklahoma (C+)	Illinois (D)	New Jersey (D+)
D.C. (N/A)*	Oregon (B-)	Kansas (D+)	Ohio (D-)
Delaware (B+)	Pennsylvania (A)	Kentucky (D)	South Dakota (D-)
Florida (C-)	Rhode Island (B)	Maine (D)	Texas (F)
Georgia (C-)	South Carolina (C-)	Mississippi (F)	Wyoming (D)
Indiana (C-)	Tennessee (C)		
Iowa (C+)	Utah (C+)		
Louisiana (C)	Vermont (C+)		
Maryland (B+)	Virginia (B)		
Massachusetts (A)	Washington (B+)		
Michigan (B)	West Virginia (C)		
Minnesota (B-)	Wisconsin (B-)		
New Hampshire (C)			

*Note: *Washington, D.C. data were not available; they were awarded a point for the indicator.*
Source: Climate Central and ICF.

Extreme weather events are becoming more and more common in the United States — which has major implications for health. 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, hurricanes and other severe weather and extreme heat events.[75, 76] Pounding rains cause devastating floods, extended droughts threaten agriculture and massive wildfires threaten homes and businesses. Every year it seems there are new historic weather-related disasters — displacing families and putting human health at risk.

Climate change 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

Climate Change Readiness Grades by State
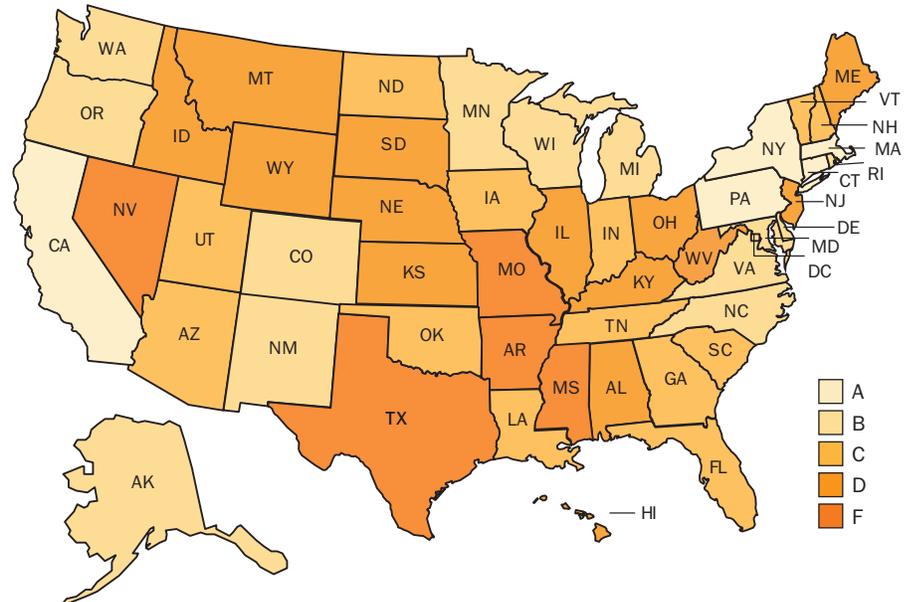
and waterborne diseases, may increase in incidence and spread as changes in temperature and weather patterns allow pathogens to expand into different geographic regions. For instance:

- 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.[77]

- Climate change may have an effect on the timing of migration of wild birds. Wild birds are a concern for public health because they can be infected by a number of microbes that can be transmitted to humans. In addition, birds migrating across national and intercontinental borders can become long-range carriers of any bacteria, virus or parasite they harbor. Birds were the source of the rapid spread of West Nile virus after it was first identified in 1999. By 2012, the virus had been reported in humans, mosquitoes and birds in 48 states.[78]

- Changing weather patterns put people in different regions at increased risk for different types of diseases.[79, 80]

- 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.[81] 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 2016, the White House Council on Climate Preparedness and Resilience released a report, *Opportunities to Enhance the Nation's Resilience to Climate Change.* Among the highlights include integrating climate resilience into federal agency activities; supporting community efforts to enhance climate resilience; ensuring the impacts of climate change be considered in the implementation of national security policy; integrating resilience into health and social service delivery to ensure continuity of care and services; and continuing to promote sustainable and climate resilient healthcare facilities.[82]

This indicator examines how prepared states are for the climate change-driven, weather-related threats they face. States scoring B or above received a point. Of the 50 states, 5 states scored A; 13 scored B; 14 scored C; 13 scored D; and 5 scored F.

States at Risk: America's Preparedness Report Card, prepared by Climate Central* and ICF,** is the first national analysis of state-level preparedness for climate change-related threats ever developed.[83] The five weather-related threats examined are extreme heat (48 states), drought (36 states), wildfires (24 states), inland flooding (32 states) and coastal flooding (24 states). Each state is 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.

The report card assesses the changing characteristics of the five climate-related threats for the baseline period (around year 2000) through the year 2050, using the latest fine-scale climate and hydrology projections based on the high emission scenario for multiple global climate models.[84]

The report card's goal is to help states improve their level of preparedness by recognizing their vulnerabilities and building and implementing action plans. States are evaluated against a core set of actions that they must take to be prepared in each threat area in five critical sectors — Health, Communities, Transportation, Energy and Water.

The core set of actions review the following questions:

1) Is the state taking action to address its current risks from the climate threat?

2) Has the state undertaken activities to understand its future changes in vulnerabilities and risks from each climate threat?

3) Has the state planned for adaptation to the future changes in risks from each climate threat?

4) Is the state implementing specific actions to address future changes in risks to each climate threat?

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 Southeast and Gulf Coast is projected to cross thresholds dangerous 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 80. 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 extreme 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 wildlands 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 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.

*Climate Central is an independent organization of leading scientists and journalists that surveys and conducts scientific research on climate change and informs the public of key findings. Its scientists publish and its journalists report on climate science, energy, sea level rise, wildfires, drought and related topics.[85]

**ICF is an organization that is internationally recognized for its leadership in carbon accounting, greenhouse gas mitigation, climate and extreme weather vulnerability assessment and adaptation planning. It supported the first greenhouse gas inventory, the first mandatory greenhouse gas reporting program, the first federal agency climate adaptation program and the first federal agency infrastructure resilience framework in the United States.[86]

45 states and Washington, D.C.* met the national performance target of testing 90 percent of reported *E. coli* O157 cases within four days (in 2014). (1 point.)		5 states did not meet the national performance target of testing 90 percent of reported E. coli O157 cases within four days (in 2014). (0 points.)
Alabama (100%)	Mississippi (100%)	Louisiana (71.4%)
Alaska (100%)	Missouri (100%)	Rhode Island (0.0%)
Arizona (100%)	Montana (100%)	Oregon (61.6%)
Arkansas (100%)	Nebraska (97.1%)	South Dakota (85.0%)
California (95.7%)	Nevada (100%)	Vermont (83.3%)
Colorado (100%)	New Hampshire (100%)	
Connecticut (100%)	New Jersey (96.7%)	
D.C. (N/A)*	New Mexico (100%)	
Delaware (100%)	New York (100%)	
Florida (100%)	North Carolina (90.9%)	
Georgia 100%)	North Dakota (100%)	
Hawaii (100%)	Ohio (100%)	
Idaho (90.0%)	Oklahoma (100%)	
Illinois (92.4%)	Pennsylvania (97.7%)	
Indiana (91.8%)	South Carolina (100%)	
Iowa (93.8%)	Tennessee (98.8%)	
Kansas (97.2%)	Texas (96%)	
Kentucky (97.4%)	Utah (100%)	
Maine (92.3%)	Virginia (100%)	
Maryland (100%)	Washington (97.9%)	
Massachusetts (95.1%)	West Virginia (100%)	
Michigan (100%)	Wisconsin (98.7%)	
Minnesota (99.3%)	Wyoming (100%)	

Note: Washington, D.C. data were not available; they were awarded a point for the indicator. Information was not reported.

Source: CDC, Prevention Status Report, 2015

INDICATORS 6: FOOD SAFETY

KEY FINDING: 45 states and Washington, D.C.* increased the speed of DNA fingerprinting using pulsed-field gel electrophoresis (PFGE) testing for all reported cases of Shiga toxin-producing *Escherichia coli (E. coli)* O157.

Every year, an estimated one in six Americans suffer from foodborne illnesses.[87] Of those, around one million will suffer from long-term chronic complications, such as kidney failure and brain and nerve damage.[88, 89] Foodborne illnesses are responsible for around 128,000 hospital visits and kill approximately 3,000 individuals each year.[90] Illnesses would be reduced if prevention-based measures were fully implemented to improve the U.S. food safety system. These indicators are also important proxies for outbreak prevention and containment policies.

Escherichia coli O157 is one of the most common foodborne illnesses in the United States. Many strains of this diverse group of bacteria live harmlessly in the guts of humans and animals. However, some pathotypes of *E. coli* — known as Shiga toxin-producing *E. coli* (STEC) — can cause acute gastro-intestinal illness that may lead to systemic disease. People can be sickened by consuming contaminated leafy greens, raw dairy products and undercooked meat.[91]

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 per year.[92]

More multistate outbreaks are being found

Why? Better methods to detect and investigate, and wider food distribution.

Number of outbreaks

- 1995-1999: **34**
- 2000-2004: **51**
- 2005-2009: **79**
- 2010-2014: **120**
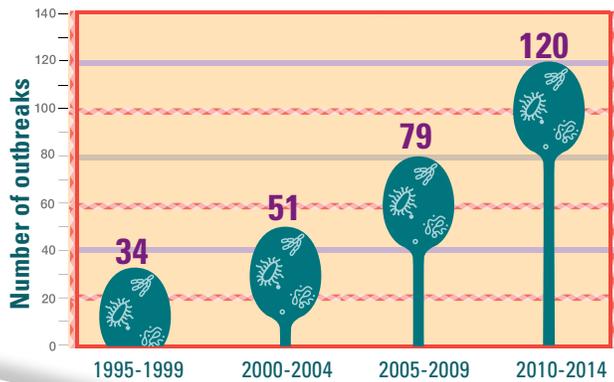
SOURCE: CDC National Outbreak Reporting System, 1995-2014.

Multistate outbreaks: less common, but more serious

Why? The deadly germs *Salmonella, E. coli* and *Listeria* cause **91%** of multistate outbreaks.

Only 3% of all US foodborne outbreaks are multistate, but they cause more than their share of outbreak sicknesses, hospitalizations and deaths:

- **11%** of sicknesses
- **34%** of hospitalizations
- **56%** of deaths
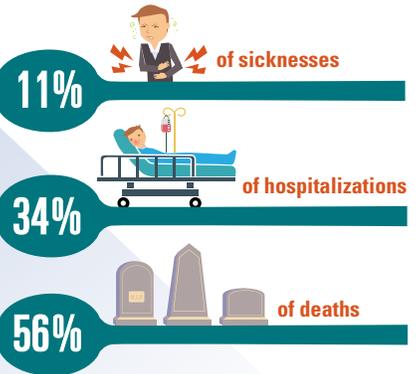
SOURCE: CDC Vital Signs MMWR, November 2015.

This estimate includes medical costs (doctor visits and hospitalizations) and productivity loss due to premature death and time lost from work.[93]

One practice that can help states reduce the rapid spread of foodborne illness is increasing the speed of pulsed-field gel electrophoresis (PFGE) testing (DNA fingerprinting) of reported *E. coli* O157 cases. According to the CDC, "Speed of PFGE testing is defined as the annual proportion of *E. coli* O157 PFGE patterns reported to CDC…within four working days of receiving the isolate in the state public health PFGE lab."[94] Detecting outbreaks quickly not only prevents new cases of illness, but also can help the food industry identify gaps and minimize adverse economic impact. Food safety surveillance faces the additional challenge of culture-independent diagnostics, which provide a quick diagnosis, but do not provide a bacterial isolate that is needed for DNA fingerprinting to enable public health officials to identify an outbreak.

Indicator 6's ratings reflect the extent to which each state tested *E. coli* O157 cases within four days as determined by the PulseNet database.[95] Forty-five states met CDC's national performance target of testing 90 percent of reported *E. coli* O157 cases within four days. Four states tested between 60 percent and 89.9 percent of reported cases and one state tested fewer than 60 percent.[96] Quickly detecting *E. coli* O157 contamination serves as a marker for the ability of states to protect their populations and the nation from foodborne illness.

35 states and Washington, D.C. have implemented all four activities to build capacity for HAI prevention. (1 point.)		15 states have implemented three or fewer activities to build capacity for HAI prevention. (0 points.)
Arkansas	New Hampshire	Alabama
California	New Jersey	Alaska
Colorado	New Mexico	Arizona
Connecticut	New York	Delaware
D.C.	North Carolina	Florida
Hawaii	North Dakota	Georgia
Illinois	Ohio	Idaho
Indiana	Oregon	Minnesota
Iowa	Pennsylvania	Missouri
Kansas	South Carolina	Oklahoma
Kentucky	South Dakota	Nebraska
Louisiana	Tennessee	Nevada
Maine	Texas	Rhode Island
Maryland	Utah	Vermont
Massachusetts	Virginia	Wyoming
Michigan	Washington	
Mississippi	West Virginia	
Montana	Wisconsin	

Source: CDC Prevention Status Report, 2016

INDICATOR 7: REDUCING HEALTHCARE-ASSOCIATED INFECTIONS (HAIs)

KEY FINDING: 35 states and Washington, D.C. have implemented four recommended activities to build capacity for HAI prevention.

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.[97] 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.

HAIs cost the country $28.4 billion to $33.8 billion in preventable healthcare expenditures each year.[98] A 2013 meta-analysis found that central line-associated blood stream infections were the most costly HAIs at $45,814 per case.[99] According to CDC, if 20 percent of these infections were prevented, healthcare facilities could save nearly $6 billion to $7 billion, and reducing infections by 70 percent could result in $25 billion to nearly $32 billion in savings.[100]

A person's risk for an HAI, which includes a range of antibiotic-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.[101] In 2011, there were an estimated 722,000 HAIs and 75,000 patients with HAIs died during their hospitalizations in the United States.[102, 103] Of the infections, 157,500 were from pneumonia; 157,500 from surgical site infections; 123,100 from gastrointestinal illness; 93,300 from urinary tract infections; 71,900 from primary bloodstream infections; and 118,500 from other types of infections.[104] Clostridium difficile, which caused 12.1 percent of HAIs, was the most commonly reported pathogen.

This indicator examines whether state health departments have implemented all four activities to build capacity for HAI prevention according to data from a CDC 2015 survey of state HAI coordinators. These four activities are: 1) building and maintaining

Protect every patient every time.

Actions to prevent antibiotic-resistant infections in healthcare.

Prevent infections from catheters and after surgery.

- ✓ Use catheters only when needed.
- ✓ Follow recommendations for safer surgery and catheter insertion and care.
- ✓ Remove catheters from patient as soon as they are no longer needed.

Prevent bacteria from spreading.

- ✓ Improve hand hygiene.
- ✓ Use gloves, gowns, and dedicated equipment for patients who have resistant bacteria.
- ✓ Know about antibiotic-resistant HAI outbreaks in your hospital and region (e.g. promote coordinated action for prevention).

Improve antibiotic use.

- ✓ Get cultures and start antibiotics promptly, especially in the case of sepsis.
- ✓ Use cultures to reassess the need for antibiotics and stop antibiotic treatment as soon as they are no longer needed.
- ✓ When antibiotics are necessary, use the appropriate antibiotic in the proper dosage, frequency, and duration.

NATIONAL ACUTE CARE HOSPITALS

Healthcare-associated infections (HAI) are infections patients can get while receiving medical treatment in a healthcare facility. Working toward the elimination of HAIs is a CDC priority. For more information on HAI prevention progress, visit: www.cdc.gov/hai/progress-report/index.html.

CLABSIs
CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS

- ■ **1 in 6** CLABSIs were caused by urgent or serious antibiotic-resistant threats.

SSIs
SURGICAL SITE INFECTIONS

- ■ **1 in 7** SSIs were caused by urgent or serious antibiotic-resistant threats.

CAUTIs
CATHETER-ASSOCIATED URINARY TRACT INFECTIONS

- ■ **1 in 10** CAUTIs were caused by urgent or serious antibiotic-resistant threats.

C. difficile Infections

- ■ **9 in 10** patients diagnosed with *C.difficile* are related to healthcare.

SOURCE: CDC Vital Signs, March 2016. Data used for this analysis was reported to CDC's National Healthcare Safety Network.

3

partnerships (e.g., collaborating with quality improvement organizations or hospital associations); 2) supporting HAI-related outbreak response by building infrastructure to identify and respond to reports of outbreaks in healthcare settings; 3) conducting or supporting HAI training; and 4) validating HAI data (i.e., analyzing data for quality and completeness and/ or reviewing medical records to check data accuracy).

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.[105, 106] In addition, in 2008, Medicare provided an incentive to reduce infections by adopting a "no pay" rule for infections acquired during a hospital stay, requiring the hospitals themselves to cover any costs incurred by these infections.[107] According to a 2012 survey, 80 percent of infection-control professionals believe the rules have resulted in a greater focus on reducing HAIs. The ACA also requires in-patient hospitals to report certain infections to the National Healthcare Safety Network (NHSN) in order to receive their full payment updates, and the information is available on the CMS' Hospital Compare website.[108] The NHSN is the largest healthcare-associated infection reporting system in the United States, serving more than 20,000 healthcare facilities of all types that track HAIs.[109]

Many states are seeing decreases in HAIs. 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.[110] There

were an estimated 30,800 fewer invasive Methicillin-resistant Staphylococcus aureus (MRSA) infections in the United States from 2005 to 2011, with hospital-onset MRSA decreasing by more than 60 percent.[111] Hospital-onset MRSA decreased 13 percent between 2011 and 2014.[112]

In addition, CDC updated the annual National and State Healthcare-Associated Infections: Progress Report. It found from between 2013 and 2014, 11 states reduced rates for one of the sentinel infections — central line-associated blood stream infections (CLABSI), including: Arizona, Florida, Indiana, North Carolina, New York, Pennsylvania, South Carolina, Texas, Utah, Virginia and Wisconsin.[113] In addition, 13 states had rates that were statistically significantly better than the national rate: Colorado, Hawaii, Illinois, Michigan, North Carolina, Ohio, Oklahoma, Pennsylvania, South Dakota, Texas, Virginia, West Virginia and Wisconsin.

A central line is a tube that is typically inserted in a patient's large vein, usually in the neck, chest, arm or groin, to give important medical treatment. When not put in correctly or kept clean, central lines can become a freeway for germs to enter the body and cause deadly infections in the blood. These infections are usually serious, often resulting in the prolongation of hospital stay and increased cost and risk of mortality.[114] Nationally, the number of CLABSI infections has decreased overall — by 50 percent — from 2008 to 2014, when the standard infection ratio benchmark was established (0.54) to be able track progress over time.[115, 116] The indicator reflects whether healthcare systems and providers are aware of infection problems and have taken appropriate steps to prevent them.[117]

STATE HAI PROGRESS — ACUTE CARE HOSPITALS

LEGEND:
- 2014 state SIR is significantly lower (better) than comparison group in column header
- 2014 state SIR is significantly higher (worse) than comparison group in column header
- Change in 2014 state SIR compared to group in column header is not statistically significant
- 2014 state SIR cannot be calculated
- Yes ✓

CLABSIs: CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS

STATE	# Hospitals Reporting to NHSN*	State Reporting Mandate	State HD† has Access to Data	Data Checked for Quality‡	Additional In-Depth Data Review§	vs. 2013 State SIR	vs. 2014 Nat'l SIR	vs. 2008 Nat'l Baseline
		2014 Reporting and Validation				2014 State CLABSI SIR		
Alabama	70	✓	✓	✓	✓	↑	↑	↓
Alaska	11			✓		↑	↑	↓
Arizona	60		✓			↓	↑	↓
Arkansas	47	✓	✓	✓	✓	↑	↑	↓
California	358	✓	✓	✓	✓	↓	↑	↓
Colorado	53	✓	✓	✓	✓	↓	↓	↓
Connecticut	31	✓	✓	✓		↓	↓	↓
D.C.	8	✓	✓	✓		↓	↑	↓
Delaware	8	✓	✓	✓		↓	↑	↓
Florida	194			✓		↓	↑	↓
Georgia	108	✓	✓			↓	↑	↓
Hawaii	16	✓	✓	✓		↓	↓	↓
Idaho	15			✓		↑	↑	↓
Illinois	150	✓	✓			↓	↓	↓
Indiana	101	✓	✓			↓	↑	↓
Iowa	61		✓	✓	✓	↓	↑	↓
Kansas	48		✓	✓		↑	↑	↓
Kentucky	70		✓			↓	↑	↓
Louisiana	80	✓	✓	✓		↓	↑	↓
Maine	21	✓	✓	✓		↑	↑	↓
Maryland	48	✓	✓	✓		↑	↑	↓
Massachusetts	69	✓	✓	✓		↓	↑	↓
Michigan	98		✓	✓		↓	↓	↓
Minnesota	48		✓	✓		↑	↑	↓
Mississippi	49		✓		✓	↓	↑	↓
Missouri	76		✓			↓	↑	↓

*The number of hospitals that reported to NHSN and are included in the SIR calculation.
†State Health Department
‡State analyzed 2014 data for quality and completeness.
§State reviewed medical records to determine 2014 data accuracy.

THIS REPORT IS BASED ON 2014 DATA, PUBLISHED IN 2016

STATE HAI PROGRESS — ACUTE CARE HOSPITALS

LEGEND:
- 2014 state SIR is significantly lower (better) than comparison group in column header
- 2014 state SIR is significantly higher (worse) than comparison group in column header
- Change in 2014 state SIR compared to group in column header is not statistically significant
- 2014 state SIR cannot be calculated
- Yes ✓

CLABSIs: CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS

STATE	# Hospitals Reporting to NHSN*	State Reporting Mandate	State HD† has Access to Data	Data Checked for Quality‡	Additional In-Depth Data Review§	vs. 2013 State SIR	vs. 2014 Nat'l SIR	vs. 2008 Nat'l Baseline
		2014 Reporting and Validation				2014 State CLABSI SIR		
Montana	16				✓	↓	↑	↓
Nebraska	27					↑	↑	↓
Nevada	24	✓	✓			↓	↑	↓
New Hampshire	24	✓		✓		↑	↑	↓
New Jersey	72	✓	✓	✓		↓	↑	↓
New Mexico	34	✓	✓	✓		↑	↑	↓
New York	168	✓	✓	✓	✓	↓	↑	↓
North Carolina	98	✓	✓	✓		↓	↓	↓
North Dakota	8					↑	↓	↓
Ohio	137					↓	↓	↓
Oklahoma	58	✓	✓			↑	↓	↓
Oregon	50	✓	✓			↑	↓	↓
Pennsylvania	176	✓	✓	✓		↓	↓	↓
Puerto Rico	16			✓		↓	↑	↓
Rhode Island	11		✓			↓	↓	↓
South Carolina	67		✓	✓		↓	↓	↓
South Dakota	13		✓	✓	✓	↑	↓	↓
Tennessee	105	✓	✓			↓	↓	↓
Texas	289	✓	✓	✓	✓	↓	↓	↓
Utah	27	✓	✓			↓	↓	↓
Vermont	7		✓			↑	↑	↓
Virginia	83	✓	✓			↓	↓	↓
Washington	86	✓	✓	✓	✓	↓	↑	↓
West Virginia	43	✓	✓			↑	↑	↓
Wisconsin	96		✓	✓		↓	↓	↓
Wyoming	22			✓		↓	↓	↓

*The number of hospitals that reported to NHSN and are included in the SIR calculation.
†State Health Department
‡State analyzed 2014 data for quality and completeness.
§State reviewed medical records to determine 2014 data accuracy.

THIS REPORT IS BASED ON 2014 DATA, PUBLISHED IN 2016

INDICATORS 8 AND 9: PUBLIC HEALTH LABORATORIES

KEY FINDING: 44 state laboratories provided biosafety training and/or provided information about biosafety training courses for sentinel clinical labs in their jurisdiction (from July 1, 2015 to June 30, 2016.)

44 state laboratories provided biosafety training and/or information about biosafety training courses for sentinel clinical labs in their jurisdiction (from July 1, 2015 to June 30, 2016.) (1 point.)			6 state laboratories and Washington, D.C.'s laboratory did not provide biosafety training and/or information about biosafety training courses for sentinel clinical labs in their jurisdiction (from July 1, 2015 to June 30, 2016.) (0 points.)
Alabama	Kentucky	North Carolina^	D.C.
Alaska^	Louisiana	North Dakota	Idaho
Arizona	Maine	Oklahoma	Maryland
Arkansas	Massachusetts	Oregon	Ohio
California	Michigan	South Carolina	Pennsylvania
Colorado^	Minnesota	South Dakota	Rhode Island
Connecticut	Mississippi	Tennessee	West Virginia
Delaware^	Missouri^	Texas	
Florida^	Montana^	Utah	
Georgia	Nebraska^	Vermont	
Hawaii	Nevada	Virginia^	
Illinois^	New Hampshire^	Washington	
Indiana	New Jersey^	Wisconsin	
Iowa	New Mexico^	Wyoming	
Kansas	New York		

Note: ^Provided both training and information.
Source: Association of Public Health Laboratories 2016 survey

Key Finding: 47 state laboratories and Washington, D.C.'s laboratory reported having a biosafety professional (from July 1, 2015 to June 30, 2016.)

47 state laboratories and Washington, D.C.'s laboratory reported having a biosafety professional (from July 1, 2015 to June 30, 2016). (1 point.)			3 state laboratories reported not having a biosafety professional (from July 1, 2015 to June 30, 2016). (0 points.)
Alabama	Louisiana	North Dakota	Alaska
Arizona	Maine	Ohio	Nevada
Arkansas	Maryland	Oklahoma	Pennsylvania
California	Massachusetts	Oregon	
Colorado	Michigan	Rhode Island	
Connecticut	Minnesota	South Carolina	
D.C.	Mississippi	South Dakota	
Delaware	Missouri	Tennessee	
Florida	Montana	Texas	
Georgia	Nebraska	Utah	
Hawaii	Nevada	Vermont	
Idaho	New Hampshire	Virginia	
Illinois	New Jersey	Washington	
Indiana	New Mexico	West Virginia	
Iowa	New York	Wisconsin	
Kansas	North Carolina	Wyoming	
Kentucky			

Source: Association of Public Health Laboratories 2016 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:[118]

● 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;

● Reference laboratories are responsible for investigation and/or referral of
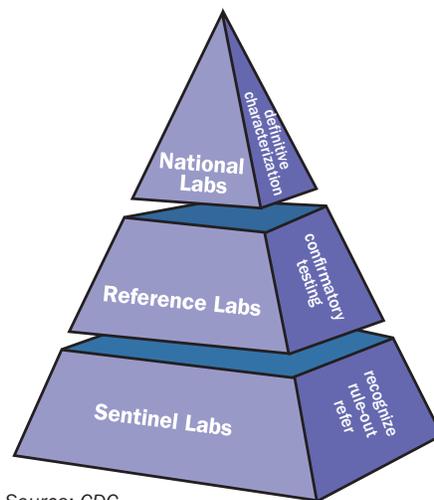
Source: CDC

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.[119] 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. Grants are used to strengthen epidemiological, laboratory and health information systems capacity at state, local and territorial levels. The ELC cooperative agreement totaled over $245 million in awards in FY 2016, boosted from 2015 levels by Zika and funding for Combating Antimicrobial Resistant Bacteria (CARB).[120]

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, 2015 to June 30, 2016, 44 state labs 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.[121]

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

4 BIOSAFETY LAB LEVELS

CDC 24/7 · CDC
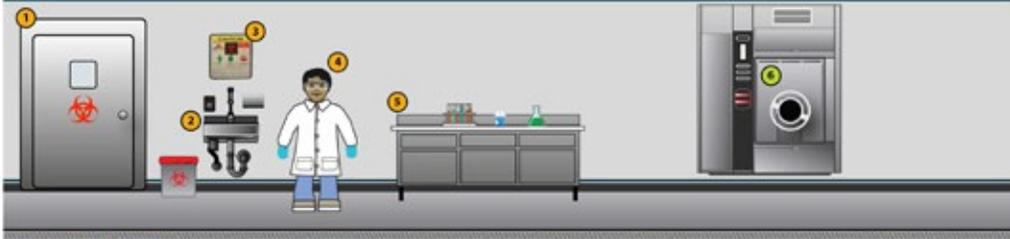
BSL1

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

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.[122] One of the primary elements of lab safety is personal protective equipment (PPE) — the protective gear 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.[123]

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.[124]

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 training helps ensure that appropriate biosafety precautions are taken. In the past several years, labs have had to respond to the rise of emerging threats, such as Zika, Chikungunga, 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, as some states are now managing in response to Zika.

LABORATORY SAFETY IMPROVEMENT

The Office of the Associate Director for Laboratory Science and Safety (OADLSS) was established in 2015 to centralize oversight and leadership of laboratory safety and quality following reported laboratory safety incidents in 2014. CDC created the executive position of the ADLSS, staffed with a senior scientist who directly reports to the CDC Director, to provide agency-wide leadership and accountability for laboratory safety and quality; and the U.S. Food and Drug Administration (FDA) hired a safety official to address gaps in FDA labs.[125, 126, 127]

The creation of OADLSS represents a major success in transforming laboratory quality and safety oversight at the agency. By centralizing all laboratory quality and safety functions in a single point of accountability, OADLSS merges the scientific and safety priorities of its diverse laboratories and established a framework for effective leadership of CDC's laboratories. One key accomplishment to enhance safety at CDC includes the creation of the Laboratory Safety Review Board, which reviews all new and amended protocols for the transfer of biological materials out of Biosafety Level 3 (BSL-3) and BSL-4 laboratories, and conducts annual reviews of existing protocols. Another key accomplishment is the creation of the Laboratory Leadership Service (LLS), a fellowship program that prepares early career laboratory scientists to become future laboratory leaders. LLS is modeled after the Epidemic Intelligence Service, and it combines competency-based public health laboratory training with practical, applied investigations.

MEANINGFUL USE

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." Through the Medicare and Medicaid Programs: Electronic Health Records Incentive Program, CMS is providing incentive payments to eligible hospitals, providers and critical access hospitals that adopt and successfully demonstrate meaningful use of certified EHR technology.[128]

One public health objective for meaningful use is electronic lab reporting (ELR), 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 (APHL) — 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."[129]

INDICATOR 10: HEALTHCARE PREPAREDNESS — ACCESS TO DISASTER SITES

Key Finding: 10 states have a formal access program or a program in progress for getting private sector healthcare staff and supplies into restricted areas during a disaster.

10 states have a formal access program or a program in progress for getting private sector healthcare staff and supplies into restricted areas during a disaster. (1 point.)	40 states and Washington, D.C. do not have a formal access program or a program in progress for getting private sector healthcare staff and supplies into restricted areas during a disaster. (0 points.)		
Florida	Alabama**	Iowa	Nevada
Louisiana	Alaska	Kansas	Oklahoma
Massachusetts	Arizona	Kentucky	Oregon
Mississippi	Arkansas	Maine	Pennsylvania**
New Jersey	California	Maryland**	South Dakota
North Carolina	Colorado	Michigan	Tennessee
Ohio	Connecticut**	Minnesota	Texas**
Rhode Island*	D.C.	Missouri	Utah
South Carolina	Delaware	Montana	Vermont
Washington*	Georgia**	North Dakota	Virginia
	Hawaii	Nebraska	West Virginia
	Idaho	New Hampshire	Wisconsin
	Illinois**	New Mexico	Wyoming
	Indiana	New York**	

*Note: *State programs in progress. **City or county programs.*
Source: Healthcare Ready

This indicator examines state access programs across the United States for getting critical private sector healthcare staff and supplies into restricted areas during and following a disaster. Healthcare Ready's research approach included:[130]

- A comprehensive review of state-level legislation, regulations for provisions and existing programs addressing entry and re-entry, transportation and delivery.

- A survey of over 120 federal and state emergency managers, public health officials and private sector representatives on their experiences and recommendations.

- Interviews with twenty-five public and private sector stakeholders, including emergency management agencies and business continuity specialists in the healthcare, retail, telecommunications and logistics industries.

- Analysis of applicable emergency declaration language addressing private sector access to restricted sites and/or healthcare operations during a disaster.

During a disaster, access and re-entry of critical healthcare personnel and supplies to the site are essential. Many states have disjointed policies for permitting private sector personnel and supplies into disaster sites. This can create delays in healthcare operations — limiting access for patients, deliveries of critical products, employee access to work sites and community and economic resiliency. In healthcare settings, staff shortages and delivery delays can cost lives.

Coordination with law enforcement and emergency responders is one key component of any disaster response. They mitigate dangerous and unsafe conditions and restrict access to protect communities and begin to establish stability in the immediate aftermath. While maintaining safety, they must validate identities and roles of individuals requesting access in order to grant entry only to those who are essential. If officers manning roadblocks are not aware of access programs in place and do not recognize the badges or credentials that parties will use to gain access, critical operations can be delayed.

While having an access program does not necessarily result in improved outcomes, it is an indicator of prioritization, attention and/or resources focused on addressing the concerns and issues around access to healthcare during and following disasters.

Three major challenges with access to disaster sites are defining critical personnel, "last mile delivery" and jurisdictional challenges. Private personnel whose roles are considered critical (doctors, nurses, etc.) will likely receive access. Unfortunately, what is deemed critical varies widely between public and private sectors. Additionally, companies that manufacture and distribute medicines and supplies often contract their "last mile" delivery to local third party companies with unmarked courier vans and drivers unaware of the cargo they are carrying. As contractors, these drivers lack company ID verifying their affiliation. This hinders law enforcement in verifying the contents to ensure only the most critical supplies gain access.

Supply chains that deliver critical medicines and supplies are often global or national and need access across multiple jurisdictions. Yet, emergency response operations are run by local emergency management agencies and law enforcement. Some companies also contract surge or third party personnel. If rules are different at checkpoints in every jurisdiction, companies must have relationships with every jurisdiction along their supply route — a nearly impossible endeavor.

There are two primary methods of facilitating access to restricted sites: formal access programs and ad hoc or just-in-time methods:

- **Formal access programs.** These identify and authorize essential personnel before an event and are administered either by the state or local jurisdiction or by a third-party organization that has an access program adopted by the jurisdiction. Vetted personnel are first registered, and then approved, managed and monitored through a database.

Eight states currently maintain state-wide programs. Of these, five are managed by the state (Florida, Ohio, New Jersey, North Carolina and South Carolina) and three have adopted programs set up and managed by a third-party access program (Louisiana, Massachusetts and Mississippi). Two states (Rhode Island and Washington) have state-wide programs in development. In addition, several cities and counties have implemented locally-developed or third-party programs in eight states: Alabama, Connecticut, Georgia, Illinois, Maryland, New York, Pennsylvania and Texas.

Third-party organizations dedicated to providing governments with customizable ready-to-use systems for defining, managing and enforcing access are gaining popularity. Two major programs include Corporate Emergency Access System (CEAS) in the Northeast and the Emergency Responder–ID Trust Network (ER-ITN) in Gulf Coast states. Both programs are sustained by fees assessed to companies.

CEAS uses pre-issued identification cards that can be managed online to verify requesting personnel's affiliation and qualifications to law enforcement controlling access. Law enforcement can scan the card with a mobile app to verify the credential and track personnel on the scene. ER-ITN provides a tiered time-phased procedure for access and re-entry. Its system assesses the entry tier for which personnel are approved and other response qualifications or certifications, which are displayed to law enforcement scanning their badge or looking them up in the system. The program uses a mobile app, vehicle access placards and letters of access for re-entry.

- **Ad hoc or just-in-time methods** authorize personnel during or immediately following an event.

One type is coordination through emergency operations centers (EOCs) and business emergency operations centers (BEOCs), which maintain a large volume of private sector points of contact in their databases and serve as hubs during crises to share information between sectors, coordinating resources and supporting local response operations. Law enforcement can contact the BEOC or EOC with questions or concerns about the validity of an access request and, conversely, private sector organizations can contact the BEOC or EOC when they experience challenges gaining access to a site.

Another common practice companies that routinely require access after a disaster use is the development of event-specific letters requesting access. These letters are printed on official letterhead and contain a brief message explaining the role of the critical personnel or nature of the supplies requiring delivery. They are issued to critical employees and shown at security checkpoints.

Emergency declarations have also been used to facilitate access during disasters, but declaration language can vary widely even within the same jurisdiction. For example, during Hurricane Sandy, bridge restrictions were lifted for emergency and medical personnel but the language was not as effective for allowing other personnel and delivery access. While ad hoc just-in-time solutions have been proven to work occasionally, formal programs are more reliable and should be the standard.

SECTION 2

National
Health
Security Issues
&
Recommendations

NATIONAL HEALTH SECURITY ISSUES AND RECOMMENDATIONS

DECEMBER 2016

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. Preparing requires maintaining a stronger steady defense that is able to more effectively manage ongoing public health needs while being ready and able to respond to emerging and emergency priorities.

Investments have helped significantly improve many areas of preparedness over the past 15 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 actually eroded gains that had been made, 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 — Surge Capacity for Major Emergencies; Healthcare Associated Infections; and Integrated Public Health and Healthcare Response;**

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

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

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

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

L. **Fixing Food Safety.**

BACKGROUND REVIEW OF MAJOR RECENT FEDERAL DIRECTIVES, STRATEGIES AND REPORTS

In recent years, the federal government — DHS, including FEMA, and HHS, including the Office of the Assistant Secretary for Preparedness and Response (ASPR) and CDC — has released a number of strategies and reports on disaster and public health preparedness to provide a concrete vision for state and local governments on recommended actions and the essential elements for success. These reports also examine current trends and progress and outline necessary improvements for the future.

PRESIDENTIAL POLICY DIRECTIVE-8 AND NATIONAL HEALTH SECURITY STRATEGY

In March 2011, President Obama issued the Presidential Policy Directive-8 (PPD-8): National Preparedness, which laid out the country's approach to preparing for acts of terrorism (including cyber attacks), disease outbreaks and natural disasters.[131] Requirements of the directive include a National Preparedness Goal; a National Preparedness System that includes a series of National Planning Frameworks and Federal Interagency Operational Plans; an annual National Preparedness Report; and a Campaign to Build and Sustain Preparedness. DHS, through FEMA, released an updated National Preparedness Goal in September 2011, which set the vision for preparedness in five mission areas — prevention, protection, mitigation, response and recovery. In November 2011, DHS/FEMA released the National Preparedness System as integrated guidance, programs and processes need to implement the National Preparedness Goal.

The National Preparedness Goal (Goal) — updated in 2015 based on lessons learned and real-world events — defines what it means for the nation to be prepared for all types of disasters and emergencies.

> "A secure and resilient Nation with the capabilities required across the whole community to prevent, protect against, mitigate, respond to and recover from the threats and hazards that pose the greatest risk."[132]

While the language of the Goal itself did not change, a new core capability, Fire Management and Suppression, was added in 2016 to provide greater visibility on firefighting capabilities and operations.
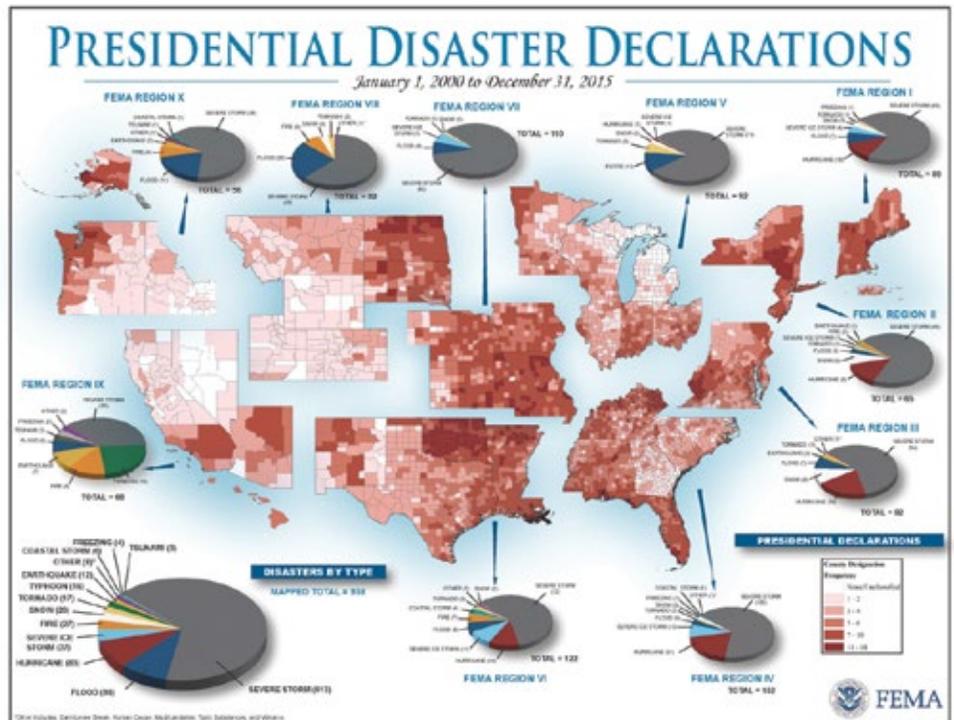
Source: FEMA

NATIONAL PREPAREDNESS SYSTEM

The National Preparedness System outlines an organized process for every person — individuals, families, communities, the private and nonprofit sectors, faith-based organizations, and all levels of governments — to achieve the National Preparedness Goal. It comprises a capabilities-based approach to preparedness planning that is applicable to all five mission areas.

It has six parts: 1) Identifying and Assessing Risk; 2) Estimating Capability Requirements; 3) Building and Sustaining Capabilities; 4) Planning to Deliver Capabilities; 5) Validating Capabilities; and 6) Reviewing and Updating.

Within the National Preparedness System, there are Federal Interagency Operational Plans (FIOPs) for each preparedness mission area that describe how the federal government aligns resources and delivers the core capabilities.

Given the whole community approach to the System, a Comprehensive Campaign to Build and Sustain National Preparedness is another essential piece of the ongoing effort of preparedness. FEMA built a website soliciting the public to post on a number of topics. This public feedback will ultimately help FEMA more effectively increase outreach efforts and encourage everyone to take actionable steps to be prepared.

> **The National Preparedness Frameworks** set the strategy and doctrine for realizing the Goal, with one framework for each mission area — prevention, protection, mitigation, response and recovery.[133] They define objectives for the core capabilities and the critical tasks necessary to meet them.

FEMA'S NATIONAL PREPAREDNESS REPORT

— first released in March 2012 and most recently in March 2016 — summarizes progress made in building, sustaining and delivering the 32 core capabilities in the Goal's five mission areas. FEMA collects and analyzes quantitative and qualitative information gathered from more than 450 data sources and 190 stakeholders, including 66 non-federal organizations.[134]

The 2016 report's findings related to public health and medical services — the fifth report in the series — demonstrates that the nation has achieved significant improvements in national preparedness since 2011. Improvements highlighted in the Report in the five mission areas include:

- **Prevention (to avoid, prevent or stop an imminent terrorist attack within the United States)**
  - Expanding the use and accuracy of terrorist and criminal biometric identification capabilities through the achievement of full operational status for the FBI's Next Generation Identification Program.
  - Increasing the number of fusion centers that meet designated standards for gathering, receiving, analyzing and sharing threat-related information.
  - Expanding training and support to enhance capabilities for chemical, biological, radiological, nuclear and explosive threats.

- **Protection (secures the homeland against acts of terrorism and manmade or natural disasters)**
  - Improving resilience to cybersecurity risks through increased availability of training and resources and increased information sharing between the federal government and the private sector.
  - Securing vulnerable nuclear and radiological materials around the world.
  - Improving abilities to detect and address chemical, biological, nuclear and radiological threats.

- **Mitigation (reduces loss of life and property by lessening the impact of disasters)**
  - Enhancing the connection between the Mitigation and Recovery mission areas by encouraging resilient building practices through post-disaster funding.
  - Expanding efforts to plan for and adapt to hazards posed by climate change.
  - Developing the Federal Flood Risk Management Standard.

- **Response (saves lives, protects property and the environment and meets basic human needs after an incident has occurred)**
  - Extending the coverage of an integrated set of public alert and warning capabilities to a larger portion of the country.
  - Creating new — and improving existing — active-shooter response planning and training resources.
  - Providing a unified approach to deliver mass care services through the National Mass Care Strategy.

- **Recovery (maintains and restores important community assets after an incident, such as housing, infrastructure, businesses and health and social services, as well as ensures consideration for natural and cultural resources)**

- Strengthening federal coordination of recovery assistance, including environmental and historic preservation reviews, in order to expedite the recovery process.

- Applying the National Disaster Recovery Framework in real-world incidents and familiarizing national stakeholders with its principles.

- Integrating research and lessons learned from real-world incidents to improve outcomes in health and social services for disaster-affected communities.

Despite increased capabilities, disasters continued to challenge the nation through 2016:

- Cyber attacks on private and public systems and multiple active-shooter incidents tested protection capabilities.

- Severe weather events like the historic winter storm in New England and Hurricane Matthew's destructive flooding in North Carolina highlight the need for mitigation strategies to reduce loss of life and property.

- A major avian or "bird" flu outbreak and the worst wildfire season since at least 1960 demonstrated the importance of quick and effective response activities.

- Torrential flooding in Louisiana, Maryland, North Carolina and West Virginia demonstrated the need for community capabilities to recover by quickly restoring critical infrastructure and essential services.

In 2015, federal agencies supported disaster survivors by assisting in:

- 43 major disaster declarations across 32 states, territories and tribes.

- 34 instances of fire management across nine states.

- Drought declarations for 1,000+ counties across 35 states and territories.

In 2015, efforts to strengthen catastrophic preparedness occurred in each of FEMA's 10 regions

Region X
- Initiated a new catastrophic planning effort to address a Cascadia subduction zone earthquake

Region VIII
- Developed an operational playbook for catastrophic earthquake response that identifies operational priorities and provides a unified concept of operations and a plan for providing resources in phases

Region I
- Increased rapid response preparedness capabilities for catastrophic events through medical countermeasures planning

Region V
- Trained and exercised catastrophic scenarios, such as a dam failure and radiological explosion, with state and local governments

Region II
- Trained more than 200 local search and rescue personnel to enhance capabilities in Puerto Rico and the U.S. Virgin Islands
- Completed New York City's catastrophic plan for improvised nuclear devices

Region III
- Completed joint-skills training with Emergency Support Function partners through monthly Readiness Days to improve preparedness for catastrophic disasters

Region IX
- Assessed emergency power requirements for Hawaii and the Commonwealth of the Northern Mariana Islands in partnership with the Army Corps of Engineers
- Participated in ARDENT SENTRY 15, a U.S. Department of Defense exercise in which Federal, state, and local emergency responders validated processes for addressing a catastrophic earthquake

Region VI
- Supported development of Houston's medical countermeasures plan and Rio Grande Rift's earthquake plan

Region VII
- Completed an enhanced Threat and Hazard Identification and Risk Assessment and preparedness assessment program to identify capability needs and areas of improvement

Region IV
- Conducted regional catastrophic planning for nuclear radiological and biological events

Source: FEMA National Preparedness Report

Several lessons learned from the 2014 Ebola outbreak are outlined in the **National Preparedness Report**. The $5.4 billion in emergency funding awarded in December 2014 supported progress in 2015 on assessing and increasing hospital capabilities and the development of diagnostics, vaccines and therapeutics for Ebola.

Ebola highlighted that not every major hospital could build and sustain the capabilities to handle Ebola identification, bio-containment and treatment. HHS worked with states to assess hospitals' preparedness and designate those with the best capabilities as Ebola Treatment Centers.

The Ebola response also highlighted the essential need for rapid development of medical countermeasures. ASPR's Public Health Emergency Medical Countermeasures Enterprise worked closely with suppliers to accelerate the development and initiate clinical trials of vaccines, therapeutics and diagnostic tests for Ebola. It is expected that candidates may soon be mature enough for inclusion in the Strategic National Stockpile.

HHS also funded 31 research projects to support post-Hurricane Sandy recovery efforts, generating best practices and tools to enhance future recovery, such as insights into mental health services provision and coordination between local health departments and non-governmental organizations.

ASPR, in partnership with CMS, completed two studies that followed treatment patterns and outcomes of 13,000 dialysis patients in New York City and New Jersey. The studies identified mitigation measures that protected patient's health, while minimizing stress on the healthcare system before, during and after the storm.[135, 136]

FOCUS ON COMMUNITY RESILIENCE

National Health Security Strategy (NHSS)

In December 2009, HHS released the National Health Security Strategy (NHSS) to help galvanize efforts to minimize the health consequences associated with significant health incidents. The strategy is built on a foundation of community resilience.[137] In May 2012, HHS released the NHSS Implementation Plan, which describes the outcomes desired in order to meet the strategic objectives of the NHSS, and identifies priority implementation activities, including fostering informed, empowered individuals and families and developing and maintaining the workforce needed for national health security.

National Health Security Review (NHSR)

The national health security goals of the inaugural NHSS 2010-2014 included: build community resilience; and strengthen and sustain health and emergency response systems. Since 2010, progress has been made in achieving both of these goals, while the greatest improvement involved integration of public health, healthcare and emergency management systems; planning at all levels of government and coordination within government and between it and the private sector; and building national health security workforce capabilities in disaster medicine and public health.[138]

CDC'S 15 PUBLIC HEALTH PREPAREDNESS CAPABILITIES[139]

In 2011, CDC identified 15 core capabilities in six domains as the basis for state and local public health preparedness to assist health departments in their strategic planning:

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, healthcare 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** are the abilities to recommend to the applicable lead agency and implement strategies for disease, injury and exposure control, such as quarantine, social distancing and hygiene.

- **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.

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 (PHEP) cooperative agreement investments.[140]

2017-2022 HEALTH CARE PREPAREDNESS AND RESPONSE CAPABILITIES[141]

The Hospital Preparedness Program (HPP) distributes grants to 62 state and territorial departments of public health to support the building of healthcare capabilities outlined in the recently released *2017-2022 Health Care Preparedness and Response Capabilities*. 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. Grant awards help state and local governments, healthcare coalitions (HCCs) and ESF #8 planners identify gaps in preparedness, determine specific priorities and develop plans for building and sustaining the capabilities. These capabilities aim to help patients receive the care they need at the right place, at the right time, and with the right resources, during emergencies; decrease deaths, injuries, and illnesses resulting from emergencies, and promote healthcare delivery system resilience in the aftermath of emergencies. The four healthcare preparedness and response capabilities include:

Capability 1: Foundation for Health Care and Medical Readiness

Goal of Capability 1: The community's healthcare organizations and other stakeholders — coordinated through a sustainable HCC — have strong relationships, identify hazards and risks and prioritize and address gaps through planning, training, exercising and managing resources.

Capability 2: Health Care and Medical Response Coordination

Goal of Capability 2: Healthcare organizations, the HCC, their jurisdiction(s) and the ESF-8 lead agency plan and collaborate to share and analyze information, manage and share resources and coordinate strategies to deliver medical care to all populations during emergencies and planned events.

Capability 3: Continuity of Health Care Service Delivery

Goal of Capability 3: Healthcare organizations, with support from the HCC and the ESF-8 lead agency, provide uninterrupted, optimal medical care to all populations in the face of damaged or disabled healthcare infrastructure. Healthcare workers are well-trained, well-educated and well-equipped to care for patients during emergencies. Simultaneous response and recovery operations result in a return to normal or, ideally, improved operations.

Capability 4: Medical Surge

Goal of Capability 4: Healthcare organizations — including hospitals, EMS and out-of-hospital providers — deliver timely and efficient care to their patients even when the demand for healthcare services exceeds available supply. The HCC, in collaboration with the ESF-8 lead agency, coordinates information and available resources for its members to maintain conventional surge response. When an emergency overwhelms the HCC's collective resources, the HCC supports the healthcare delivery system's transition to contingency and crisis surge response and promotes a timely return to conventional standards of care as soon as possible.

U.S. INTERNATIONAL HEALTH REGULATIONS (IHR) JOINT EXTERNAL EVALUATION (JEE)[142]

The first U.S. International Health Regulations (IHR) Joint External Evaluation (JEE) was conducted on May 23-27, 2016. Led by ASPR, 23 federal agencies participated in a self-assessment in the months leading up to the JEE using the evaluation tool approved by the World Health Organization (WHO). Fifteen external assessors from 11 countries visited the United States to review the self-assessment and conduct detailed interviews with more than 120 national subject matter experts. The JEE Tool is now being used by numerous other countries as a part of the Global Health Security Agenda to evaluate the performance of core public health capacities required by the IHR and to guide the development of national and regional roadmaps and strategies for supporting global health security. The United States JEE, conducted at the federal level, indicated a number of nation-wide gaps and challenges. Among the 19 technical areas of the JEE Tool, there are 48 capacity indicators that are ranked on a scale from 1 (lowest) to 5 (highest). The United States received a score of 5 in 20 indicators (41 percent), a score of 4 in 21 indicators (43 percent) and a score of 3 in 7 indicators (15 percent). Despite the fact that the United States has consistently demonstrated its ability to detect, assess and report public health emergencies — the U.S. IHR National Focal Point in ASPR has notified WHO of 95 potential public health emergencies of international concern since the IHR went into effect in 2007 — there are still numerous areas for improvement within the health security scope of the JEE.

The following table lists examples of the indicators (abridged) and the scores from the 2016 U.S. JEE.

Technical Area	Indicator (abridged)	JEE Score
Antimicrobial Resistance	Antimicrobial stewardship activities	3
Zoonotic Disease	Surveillance for zoonoses	3
Real-Time Surveillance	Interoperable, electronic real-time event reporting	3
Emergency Response Operations	High-risk patient transportation and case management	3
Risk Communication	Crisis communication with affected communities	3
Radiation Emergencies	Detection and response to radiation hazards	3
Radiation Emergencies	Policies, plans and workforce	3
Antimicrobial Resistance	Detecting emergence of antimicrobial resistance	4
Antimicrobial Resistance	Surveillance of community-acquired AMR infections	4
Antimicrobial Resistance	Surveillance for healthcare associated infections	4
Zoonotic Disease	Veterinary workforce	4
Zoonotic Disease	Responding to zoonoses	4
Food Safety	Responding to outbreaks and contamination	4
Biosafety and Biosecurity	National biosafety/biosecurity system	4
Biosafety and Biosecurity	Biosafety/biosecurity training and oversight	4
National Laboratory System	Specimen referral and transport system	4
Real-Time Surveillance	Syndromic surveillance system	4
Reporting	Reportable disease system	4
Workforce Development	Workforce development strategy	4
Preparedness	Public health risk assessments and priorities	4
Emergency Response Operations	Health emergency plans and procedures	4
Emergency Response Operations	Health emergency operations programs	4
MCM and Personnel Deployment	Deploying/receiving emergency medical teams	4
Risk Communication	Risk communication plans	4
Risk Communication	Public health communication	4
Risk Communication	Dynamic listening and rumor management	4
Points of Entry	Preparedness plans at all points of entry	4
Chemical Events	Detection and response to chemical emergencies	4
National Legislation, Policy, Financing	Federal legislation supports implementation of IHR	5
National Legislation, Policy, Financing	National policies and procedures	5
IHR Coordination, Communication and Advocacy	National systems support multisectoral coordination	5
Immunization	Adequate vaccine coverage for measles	5
Immunization	National vaccine access and delivery	5
National Laboratory System	Confirmatory testing for priority diseases	5
National Laboratory System	Point of care and laboratory based diagnostics	5
National Laboratory System	Laboratory testing quality system	5
Real-Time Surveillance	Indicator and event based surveillance systems	5
Real-Time Surveillance	Analysis of surveillance data	5
Reporting	System for efficient reporting to WHO, FAO and OIE	5
Workforce Development	Human resources are available to implement IHR	5
Workforce Development	Applied epidemiology training programs	5
Preparedness	National health emergency plans	5
Emergency Response Operations	Capacity to activate emergency operations centers	5
Linking Public Health and Security Authorities	Public health and law enforcement authorities are linked	5
MCM and Personnel Deployment	Receiving/deploying public health countermeasures	5
Risk Communication	Communication among internal and external stake-holders	5
Points of Entry	Emergency response systems in place for points of entry	5
Chemical Events	Policies, plans and workforce	5

The external assessors' mission report for the U.S. IHR JEE has been posted online at https://www.ghsagenda.org/docs/default-source/jee-reports/united-states-jee-report.pdf and the U.S. IHR JEE Self-Assessment Report is published on the ASPR website as www.phe.gov.

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 in the 15 years since the anthrax and terrorist attacks of 2001 and 11 years since the landfall of Hurricane Katrina, funding has been unstable and insufficient to maintain baseline capabilities. As a result, fundamental public health services intended to protect our health and the funding of these programs often vary dramatically from state to state and among communities and territories. And disease and death rates vary significantly from city to city and region to region.

While many public health agencies are able to prepare for and respond to many small scale emergencies, such as isolated foodborne outbreaks and some types of natural disasters, the instability of maintaining a strong base level defense for more significant health crises leaves first responders without adequate tools and systems to respond and an unsteady 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 (formally 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.[144, 145]

These foundational capabilities would help support preparedness and readiness, helping provide a stronger core, more consistent foundation for public health activities in states and localities. The foundational capabilities approach would complement and helps provide a backbone to build and expand the capabilities that are supported by PHEP, HPP, FEMA and other homeland security grants and 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.[146, 147]

In addition, 20 state, 141 local, one integrated and one tribal health department have been accredited through the voluntary national accreditation program (as of November 2016) — a measurement of health department performance against a set of nationally recognized, practice focused and evidence-based standards.[148] 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.[149]

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 — 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.

RECOMMENDATION:

- **Prioritizing and fully funding a foundational capabilities approach for public health departments at all levels of government.** More than perhaps any other role of health departments, the foundational capabilities model is key to strengthening preparedness for public health emergencies. These core functions of modern public health — such as modernized laboratory, workforce and surveillance capabilities — are the cornerstone to a community's capacity to track and contain disease outbreaks or respond to disasters. This approach 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 instance, many current grants for epidemiological, laboratory and surveillance support are administered separately and for specific diseases. A foundational capabilities model includes the ability and flexibility for communities to build upon foundational capabilities to meet their specific needs and concerns, contingent on additional available resources. Jurisdictions that could demonstrate their ability to meet the 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 their 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.[150] 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.[151]

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.[152, 153] Colorado legally defined foundational "minimum quality standards," and within two years has shown significant increases in the delivery of several programs and service areas.[154]

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.[155, 156]

SOME KEY CDC HEALTH SECURITY PROGRAMS

- **CDC's Epidemic Intelligence Service (EIS):** EIS officers serve as expert "disease detectives" who conduct investigations, research and surveillance — around the United States and abroad. EIS is a two-year post-graduate training program for physicians, nurses, veterinarians, PhD-trained scientists and other health professionals.[157]

- **CDC's Division of Global Health Protection:** The Division works in over 70 countries to build global public health capacity to rapidly detect, fight and control disease outbreaks. This includes the Global Disease Detection (GDD) Program, the Field Epidemiology Training Program (FETP), National Public Health Institutes Program, Global Health Security, and Emergency Response and Recovery.[158] The GDD program works to strengthen global health security — especially supporting countries with limited capabilities — in order to rapidly detect, accurately identify and promptly contain emerging infectious diseases and intentional bioterrorist threats that occur.[159] FETP trains field epidemiologists globally to become "disease detectives" in their home countries and quickly identify causes of communicable and non-communicable outbreaks. CDC has begun providing technical support to 50 countries through the Global Health Security program to better prevent, detect and respond quickly and effectively to public health threats in accordance with the Global Health Security Agenda (GHSA).[160]

WORLD IMMUNIZATION WEEK 2016

50 Years of Global

Immunization Success

CDC

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world pneumonia day

Every breath counts. Stop pneumonia now. **November 12th.**
http://www.worldpneumoniaday.org

The facts

Pneumonia is the **#1** infectious disease killer of children under 5

99% of pneumonia deaths in children under 5 occur in low & middle income countries

USA 300

Pakistan 71,000

China 33,000

Ethiopia 35,000

Nigeria 121,000

DRC 48,000

India 174,000
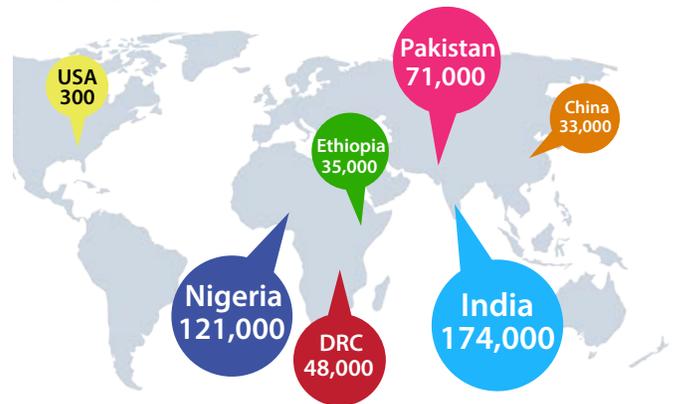
Simple, proven solutions

Exclusive breastfeeding for baby's first 6 months

Vaccination

Safe drinking water and good sanitation

Frequent hand washing with soap

Good nutrition, especially for kids aged 6 months to 2 years

Adequate indoor ventilation
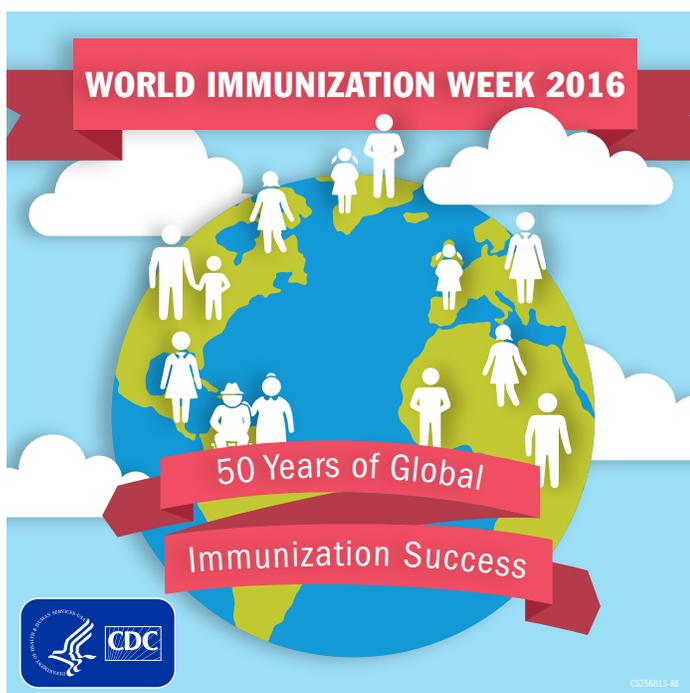
Every breath counts. Stop pneumonia now.

#fightpneumonia
www.worldpneumoniaday.org

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WHO. 2013. Pneumonia: Priority diseases and reasons for inclusion. www.who.int/medicines/areas/priority_medicines/Ch6_22Pneumo.pdf

November 2014

CDC

- **Public Health Emergency Preparedness (PHEP) 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.[161] 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.[162]

- **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.[163] Twelve-hour Push Packages of medicines and supplies are kept in secure locations around the country and are available for deployment within 12 hours of a federal decision. 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 **>$6 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

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 Division of 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 for distributing and dispensing SNS resources in an emergency.

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

CS2560%B

- **WHO 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. As a WHO Collaborating Center, CDC's Influenza Division plays a major role in year-round surveillance for early detection and identification of antigenically drifted seasonal influenza viruses as well as novel influenza A viruses that may have pandemic potential. The Influenza Division collects and analyzes influenza viruses from around the world for epidemiological, antigenic (immune response), antiviral susceptibility and genetic characterizations.

- **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.[164] 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 more timely manner.

- **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.[165] 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, as well as pharmacy and laboratory data. 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 and Expedited Emergency Funding

Every year, millions of Americans are impacted by infectious disease outbreaks and other health emergencies. Infectious diseases alone — including the regular seasonal flu — cost the country more than $120 billion each year.[166] Baseline funding for public health and healthcare preparedness and response is not sufficient to address ongoing needs, yet alone emerging new 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 $660 million in FY 2016) and hospital emergency preparedness funds have been cut in half ($515 million in FY 2004 to $255 million in FY 2016).[167]

As new crises arise, they pull funding and attention from ongoing needs. Major problems 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, too late by delays in bureaucratic processes to be used when they are immediately needed. This means the funds and attention that were diverted for use during the time of emergency take away from the ability to carry out other important functions. The supplemental funds are often then used to pay back expenses that were incurred during the emergencies but they typically do not also cover all the costs of the diverted money — or the consequences of neglecting other ongoing public health problems. Budget cuts over time — or when money is diverted during an emergency — leads to layoffs of highly trained public health experts, many of whom cannot be hired back with short-term emergency funds.

The Zika outbreak has illustrated how the erratic nature of funding for infectious disease capacity impacts our ability to respond. For instance, the country made significant

CDC'S RESPONSE TO ZIKA
WHAT WE KNOW

AND WHAT WE DON'T KNOW.

What we know

Zika can be passed from a pregnant woman to her fetus.

Infection during pregnancy can cause certain birth defects.

Zika is spread mostly by the bite of an infected *Aedes* species mosquito.

These mosquitoes are aggressive daytime biters. They can also bite at night.

The mosquitoes that can carry Zika are found in some areas of the US.

Because the mosquitoes that spread Zika virus are found throughout the tropics, outbreaks will likely continue.

There is no vaccine or medicine for Zika.

What we don't know

If there's a safe time during your pregnancy to travel to an area with Zika

If you do travel and are bitten
- How likely you are to get Zika
- How likely it is that your baby will have birth defects from the infection

CDC
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention
July 29, 2016

For more information:
www.cdc.gov/zika

investments to respond to vector-borne diseases after West Nile virus outbreaks, but then overtime, the funding and priority for those efforts were cut and eroded — resulting in a decline in that capability at many health departments.[168] When Zika emerged, the cycle had to start again, rebuilding much of the capacity that had once existed — and served ongoing purposes for protecting against West Nile and other diseases — but had been lost. This cycle puts the nation at unnecessary risk when new threats emerge and hampers the ability to tackle ongoing problems — like HIV, antibiotic-resistant infections or even the seasonal flu. Currently, without sufficient support for emergencies, funds and personnel end up being diverted from other public health priorities to respond to a new problem, like the Zika outbreak.

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 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
CDC Total*	$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
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
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

* 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)

^ 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

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
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	$1,396,828,000
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
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
BioShield Special Reserve Fund	--	--	$5,600,000,000*	--	--	--	--	--	--	--	--	--	$255,000,000	$255,000,000	$520,000,000

* 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 2016: https://www.hhs.gov/sites/default/files/budget/fy2016/fy2016-public-health-social-services-emergency-budget-justification.pdf

Source FY 2015: http://rules.house.gov/sites/republicans.rules.house.gov/files/113-1/PDF/113-HR-83sa-ES-G.pdf

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.** 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, has 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. 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 has not received resources since FY 1999.

- Such a fund would need to be maintained and replenished at a funding level sufficient to respond to an emerging public health threat. Providing contingency resources for a public health emergency fund would bridge the gap between the smaller-scale emergency response that public health conducts on a day-to-day basis and the arrival of supplementary emergency appropriations, if the crisis rises to the level of health problems like Ebola, H1N1 or Superstorm Sandy. 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 standing Public Health Emergency Fund would complement ongoing preparedness, but cannot replace ongoing funds to support baseline preparedness. This Fund would need to be paired with ongoing 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.

- 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 grantmaking 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 — as well as states — should have authorities to use flexible hiring, contracting and transaction mechanisms. Emergency funding announcements also should require plans by grantees for how and when states will distribute the money to local jurisdictions, partners and other subgrantees.

Delays in Funding for Public Health Emergencies*

- ■ Hurricane Katrina (2005)
- ■ Ebola Virus (2014-2015)
- ■ H1N1 Influenza (2009)
- ■ Hurricane Sandy (2012)
- ■ Zika Virus (2016)

| 1 Day | 42 Days | 51 Days | 53 Days | 235 Days |

* Time between Presidential request and Congressional approval

C. Supporting Global Health Security

Global health security — an effort to make the world safe from infectious disease and other health threats — is integral to the health of those nations as well as to domestic health security.

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 flareups in these nations after response systems were established. Due to worldwide connectivity, these diseases can travel around the world quickly if left unchecked. And often, these responses are 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 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.[169]

RECOMMENDATION:

- **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. commitment to GHSA, funded through the Ebola supplemental, expires in FY 2019. The United States should reemphasize its ongoing commitment to global health security and other programs through CDC's Center for Global Health, the State Department, Department of Defense, ASPR and NIH that seek to build local public health capacity and response capabilities.

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.[170] The executive order was intended to strengthen the U.S. commitment to the GHSA, including roles and responsibilities of U.S. agencies like State, HHS, 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.

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.[171] 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.
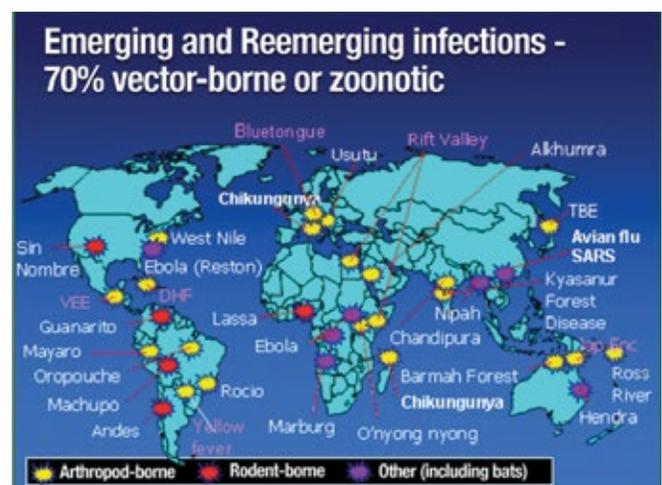
Source: One Health Initiative

D. Improving Federal Leadership Before, During and After Disasters

In addition to funding, recent disasters have illustrated gaps in federal leadership. In 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.

RECOMMENDATIONS:

- **Designating a senior White House level position to advise the President on health security.** There is an ongoing need for a White House position to provide leadership and coordination for a government-wide approach to preparedness, response and recovery efforts. While the appointment of emergency coordinators — such as the Ebola or pandemic flu response coordinators — has been important, there is an ongoing gap in the permanent structure of the White House to prepare for and respond effectively to emerging and ongoing threats. A White House-level leader could ensure ongoing preparedness planning and capabilities remain a sustained priority — even in times between emergencies — in addition to the ability to trigger and coordinate a multi-agency response, identify the lead agency and be the ultimate arbiter for contested decisions. A permanent position would also ensure a major focus on the national security risks posed by health emergencies and bring health expertise to the role, and help provide day-to-day leadership, cross-government strategic alignment, effectiveness, efficiencies and accountability. White House-level leadership in health security has also been supported by the Blue Ribbon Study Panel on Biodefense and the American Academy of Pediatrics.[172, 173]

- **Improving federal, state, local and interstate coordination during multi-agency responses.** At the federal level, in addition to White House leadership and engagement, there must be improved interagency synchronization and integration in response to health emergencies. There must be improved coordination across levels of government; agencies within government; across regions, states and jurisdictions; and across the public health, healthcare and other emergency responder sectors. In addition, there is a need to review the 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 U.S. Agency for International Development (USAID) — to ensure efforts are as efficient and effective as possible, roles and responsibilities are clear and bureaucracy is limited. 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.[174]

NATIONAL GOVERNORS ASSOCIATION: IMPROVING STATE EFFORTS TO PREPARE AND RESPOND TO PUBLIC HEALTH EMERGENCIES[175]

While overarching federal-level preparedness is essential because diseases and disasters do not follow state lines, governors and their state officials must also be prepared to act quickly and decisively when crises strike. Emergency response is resource-intensive and costly and a solid planning infrastructure can save time, money and lives.

In an *Improving State Efforts to Prepare and Respond to Public Health Emergencies* Issue Brief, the National Governors Association (NGA) provided recommendations for states to improve their efforts to prepare and respond to emergencies, focusing on four components: legal authority, coordination; communication; and capability gaps and resources.

- **Legal Authority.** NGA recommends that governors ensure that they and those involved in response — like public health officials — understand their legal authorities and expected roles and responsibilities. Often governors must take immediate action and their authorities can vary depending on the state's constitution, laws and extent of the governor's emergency powers. Public

health officials may have the authority to declare public health emergencies or issue quarantines. Governors should consult with their legal counsel to ensure their actions are within scope and familiarize themselves with the legal authorities of cabinet officials and other staff.

- **Coordination.** As with disaster response at any level, coordination among key players is essential. Governors must understand the way homeland security, emergency management and public health agencies interact with one another and coordinate with the private healthcare sector. The governor can institutionalize these relationships through task forces or routine meetings to ensure roles and responsibilities are established before a crisis. They can also foster collaboration through training exercises which can help all players understand where they fit in the overall response.

- **Communication** — both internal and external — can make or break a response. It can be difficult to identify and share relevant information across all level of governments. Incoming information can be insufficient, overwhelming, or delayed

and end up being ineffective to act upon. Governors should institutionalize internal communication practices among key players through frequent cabinet briefings or having selected public health officials nominated for security clearances so they can serve in homeland security fusion centers. States also must relay clear and consistent messaging to the public and healthcare workers during emergencies to put them at ease, minimize confusion and keep them safe. Governors must determine who should address the public and how often. States can use social media to disseminate messages quickly and also gather information for situational awareness. A Joint Information System can integrate all information pertaining to an incident and deliver a coordinated response to the public. CDC and ASPR also have many existing communication toolkits that can be leveraged by states during an emergency.

- **Capability Gaps and Available Resources.** Emergencies are resource intensive and state executives are not always aware of what resources are needed, how to obtain them and how to best use them during an emergency. Gap analyses among public health, homeland security and emergency management can determine existing resources and capabilities to leverage in an emergency and assess limitations to identify improvements to prioritize. In an era of funding cuts, paying for the costly staff, training and equipment required to maintain a sufficient level of preparedness is a constant challenge — exacerbated ever more by the urgent needs during an actual crisis. Governors must identify, leverage and coordinate available state and federal funding mechanisms at the state and local levels to allocate funds effectively and minimize duplication.

Recent Actions through Governor Authority

Executive Orders

- Indiana Governor Mike Pence signed an executive order in response to an HIV outbreak to coordinate a multiagency response and to provide additional resources and tools for addressing the outbreak.

- Florida Governor Rick Scott signed executive orders declaring a state of emergency around the Zika virus outbreak to provide for state funding and authorities for state officials to respond to the virus and request additional resources and information from the CDC to prepare for the Zika virus.

- Virginia Governor Terry McAuliffe created a multiagency, statewide task force to prepare for the Zika virus. Prior to mosquito season, the task force was responsible for ensuring coordination across state and local mosquito surveillance and control programs.

Emergency Declaration

- Iowa Governor Terry Branstad requested a major disaster event declaration from the President to allow the Federal Highway Administration to issue a waiver for weight limits to help accelerate the disposal process for birds infected with Avian Flu.

Budgetary Authority

- Alabama Governor Robert Bentley authorized more than $235,000 in emergency funding for testing and treatment services in response to a tuberculosis outbreak in 2016.

The CDC also has many existing communication toolkits that can be leveraged by states during an emergency. For instance, CDC's *Morbidity and Mortality Weekly Report (MMWR)* is a critical tool for disseminating timely public health information to state and local health departments, healthcare providers and scientists during a public health response.

A NATIONAL BLUEPRINT FOR BIODEFENSE: LEADERSHIP AND MAJOR REFORM NEEDED TO OPTIMIZE EFFORTS[176]

In October 2015, the bipartisan Blue Ribbon Study Panel on Biodefense issued a Blueprint identifying the need for increased leadership to elevate coordination and collaboration and drive innovation to improve the nation's preparedness for biological threats. Panel members included high-level former federal officials including: Senator Joseph Lieberman (co-chair), Governor Thomas Ridge (co-chair), U.S. Secretary of HHS Donna Shalala, Senator Thomas Daschle, Representative James Greenwood and U.S. Homeland Security Advisor Kenneth Wainstein. The *Blueprint for Biodefense* recommendations included: institutionalization of centralized federal biodefense leadership; development of a comprehensive national biodefense strategy and plan; modernization of biodetection and biosurveillance systems that meet the threat; incentivization of public-private partnerships to support medical countermeasure development; support for building and maintaining coordinated and functional hospital preparedness; and sufficient and sustained support for state and local preparedness capacity.

In June 2016, an independent panel of experts, led by Jonathan Fielding, MD, published its review of the HHS response to the Ebola outbreak. The report found that the U.S. government was not well prepared to respond to a crisis that had both domestic and international elements and did not effectively use existing plans during the outbreak. The recommendations included: implement the Global Health Security Agenda; improve coordination between HHS and other government partners, including clarifying roles and responsibilities; ensure effective communications with the public; and provide sustained funding for emergency preparedness, as well as contingency funding for initial response activities.

AMERICAN ACADEMY OF PEDIATRICS' *BLUEPRINT FOR CHILDREN*

In 2016, the American Academy of Pediatrics released a *Blueprint for Children: How the next president can build a foundation for a healthy future*.[178] Among the report's health security recommendations:

- **Provide Leadership** — The next president must be able to effectively coordinate the response to an infectious disease outbreak across all federal agencies.

- **Ensure that hospitals are prepared for public health emergencies** — Conduct a top-to-bottom review of the HPP and CDC's emergency program to ensure they address the needs of children. Grantees showing poorer performance should be granted technical assistance; pediatric medical home providers must be included in all healthcare coalitions.

- **Keep children safe during disasters and other emergencies** — To assist with pediatric preparedness, the next administration should continue to activate and utilize the subject expertise of (CDC's) Children's Preparedness Unit. It should also consider making the unit permanent, to expand its role beyond responding to a public health emergency, and improve its ability to support state and local public health preparedness before emergencies occur.

- **Close the gaps in medical countermeasures for children** — National stockpiles of medical countermeasures (vaccines, pharmaceuticals and medical devices (such as personal protective equipment for children (e.g. face masks and ventilators)) lack pediatric formulations, dosing and safety information. Federal agencies need to collaborate with industry, academia and Biomedical Advanced Research and Development Authority (BARDA) to develop pediatric medical countermeasures.

- **Congressional Actions** — Reauthorize HPP and add capability measures for state and local pediatric healthcare providers. Congress should also reauthorize the National Advisory Committee on children and Disasters within HHS.

- **Funding Priorities** — Restore lost funding to HPP, restoring emergency capabilities. There's a need for emergency "bridge" funding that doesn't force agencies to reallocate money from other important health functions.

NATIONAL PEDIATRIC READINESS PROJECT (PEDS READY)[179]

Historically, assessments of emergency departments' (EDs) readiness have not been comprehensive and have shown relatively poor pediatric readiness.[180] The National Pediatric Readiness Project is a "multi-phase quality improvement initiative to ensure that all U.S. EDs have the essential guidelines and resources in place to provide effective emergency care to children."[181] It is a collaboration between the federal Emergency Medical Services for Children program, the American Academy of Pediatrics (AAP), the American College of Emergency Physicians and the Emergency Nurses Association.

Comprised of a 55-question web-based assessment sent to ED nurse managers, the project has three primary purposes:[182]

1) To establish a composite baseline of the nation's capacity to provide care to children in the ED;

2) To create a foundation for EDs to engage in an ongoing quality improvement (QI) process that includes implementing the Guidelines for the Care of Children in the Emergency Department;[183] and

3) To establish a benchmark that measures an ED's improvement overtime.

The Peds Ready online assessment was launched in 2013 and 82.7 percent of America's hospitals participated, representing 4,149 EDs and 24 million annual pediatric ED visits. The assessment was re-launched in November 2015 — allowing a new opportunity for more hospitals to participate and for 2013 participants to assess their progress. States vary widely in their participation. Only 3 States and Washington, D.C. (Connecticut, Maryland and West Virginia) have 100 percent of their EDs participating in the assessment. Conversely, eighteen states have fewer than 5 percent of their EDs participating. About half of ED respondents reported missing certain policies, procedures and protocols. Specifically, only 47 percent of EDs reported having a disaster plan that addresses the specific needs of children.[184]

In 2015, in its feedback on the newly proposed Healthy People 2020 preparedness topic under consideration, American Academy of Pediatrics, the American College of Emergency Physicians and the Emergency Nurse Association strongly recommended a new objective — to increase the number of EDs that have completed the National Pediatric Readiness Project reassessment, with a target of 100 percent participation.[185]

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 on many levels are often disjointed and out-of-date. Public health departments tend to 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. Health departments are often burdened with redundant, siloed disease reporting systems.

There are around 300 different health surveillance systems or networks supported by the federal government, according to a review in 2011.[186] Most of the systems are not interoperable and serve an array of different purposes. 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 outbreaks — stemming from a rise in heroin 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.

- **Medical Countermeasures Development.** The government is often the only real customer for certain medical countermeasure products, such as anthrax and smallpox vaccines. As a result, 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, expected or unexpected, by building the science, policy and production capacity in advance of an outbreak.

- Congress created Project BioShield (in 2004) and authorized the Biomedical Advanced Research and Development Authority (BARDA) 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.[187] 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 190 new candidate projects and 21 new medical countermeasures for purchase under Project BioShield.[188] Six have achieved FDA approval and a number have pediatric dosing recommendations. After the initial investment was depleted, Congress began funding BioShield by an annual appropriation for purchase of products, appropriating $520 million in FY 2016. The FDA also launched the Medical Countermeasures Initiative (MCMi) in 2010 to coordinate medical countermeasure development, preparedness and response.[189]

- Ebola supplemental funding also helped BARDA to develop 12 potential Ebola vaccine and therapeutic candidates.[190] Thus far in 2016, some promising areas under development with HHS investments include: assisting Zika vaccine advancements, a new anthrax vaccine and diagnostic, new broad spectrum antibiotics and pathogen reduction technologies for blood products.[191] 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 2015, 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.[192]

- **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 the technology, as well as training for how to use the technology and to 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 "leap frog" 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.

  - Health information technology is transforming the way healthcare is delivered, and public health must adapt just as quickly to take advantage of these advancements. These transformations mean public health must also 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 essential to ensure systems are built to protect privacy and incorporate strong cyber-security measures.

  - There is growing capability to connect health trend information with risk factor data sources — to look at the impact of different factors on health and better identify outbreaks or the potential causes of health problems in particular neighborhoods or regions. Any new system should be able to identify health trends at a neighborhood or zip code level to be able to help quickly identify locally concentrated health problems or outbreaks and to effectively identify trends and contributing factors to many health inequities, which cannot be discerned through county or state level data. For instance, mapping projects have helped identify at-risk populations during the seasonal flu, including people who have life-maintaining medical and assistive equipment.

  - Achieving a modern biosurveillance system would help faster, more effective identification and tracking of outbreaks and other health problems, while making surveillance less burdensome on state and local public health departments and healthcare providers. It will require upgrading hardware and software; maintaining these technologies around the country; standardizing efficient reporting standards; 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 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.

  - To help overcome fragmentation in health information systems, reduce the burden in reporting and better analyze existing data, CDC, ASTHO and other groups explored the creation of a Public Health Community Platform based on shared infrastructure and services. The goal is to provide a forum for common data exchange, analysis and visualization through an interoperable system where common data can be exchanged, analyzed and visualized.[193] With RWJF leadership, public health departments (including CDC) have partnered with the healthcare industry and developers of electronic medical records to begin a phase one implementation scalable demonstration in a few states to notify state health departments automatically when cases of reportable diseases are detected in the healthcare system. This first electronic case reporting service (on a community public health platform) in a few states sets the way forward for a host of needed services to exchange data between healthcare and public health for prompter action.

  - 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.[194, 195, 196] However, most of these plans do not include funding estimates for the coming years. Currently, there 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. An investment in modernization would save money in the longer term by reducing duplicative and work-intensive legacy systems and preventing avoidable outbreaks.

• 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 "it managed more effectively, federal investment in HIT (whether through the [Office of National Coordinator for Health Information Technology (ONC)] or through CMS, which is now actively encouraging states to develop all-payer data systems) and public-health surveillance … could achieve better outcomes without necessarily requiring new resources."[197] 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

• 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 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 Surveillance Strategy to help facilitate work to consolidate systems, eliminate unnecessary redundancies in reporting and reduce the reporting burden on state and local health departments.[198] Once such initiative is the NNDSS Modernization Initiative (NMI), which would move all case notification reporting to a standard format (HL7) for over 100 nationally notifiable diseases. 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. Several of these new message mapping guides (data standards) are expected to begin production rollout in December 2016 and continue throughout 2017.

SHARING DATA TO IMPROVE CLINICAL CARE AND PUBLIC HEALTH: THE DIGITAL BRIDGE INITIATIVE[199]

RWJF, Public Health Informatics Institute and Deloitte Consulting 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.

In 2017, the Digital Bridge will help coordinate eCR implementation in at least five 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 medical countermeasure strategy in the United States that continues to support research and development of vaccines, antivirals and other countermeasures requires continued support for incentives for biopharmaceutical companies to invest in the research and development of medical countermeasures, particularly due to the limited funding for purchase under Project BioShield. Unpredictable short term emergency and annual funding, discourage innovation by being inconsistent with industry planning standards and creating uncertainty if the government will be an assured partner for the long-term.

  - In addition, ongoing funding should be considered to restock and upgrade the Strategic National Stockpile so medical countermeasures are available and not expired in the event they are needed. Also, there must be better established systems to support public-private partnerships for distributing and administering vaccines and medicines, including insurer support for medical countermeasure payment when appropriate and possible. And, without a robust public health infrastructure to ensure the Strategic National Stockpile and other medical countermeasure products reach the individual patient, research and development on its own is not enough to ensure products are used effectively.

ALTERNATIVE MODELS TO SPUR RESEARCH & 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 stimulate, finance and coordinate vaccine development against priority threats, particularly when market incentives alone are unlikely to result in development. The partnership, which is in the start-up phase, is between the Government of Norway, Government of India, Wellcome Trust, Bill and Melinda Gates Foundation and World Economic Forum.[200]

- As part of the National Action Plan on Combating Antibiotic Resistant Bacteria (CARB), HHS partnered with academic and philanthropic entities to form the Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator, or CARB-X. The partnership seeks to refill the pipeline of products against bacterial threats, including therapeutics, vaccines, diagnostics and devices through funding for research and development and technical assistance for companies with promising solutions to antibiotic resistance.[201] BARDA has committed up to $250 million over five years and other entities have promised funding. CARB-X is a partnership between BARDA, NIAID, the AMR Centre, Wellcome Trust, California Life Sciences Institute, MassBio, The Broad Institute, Boston University and RTI International.[202]

HHS Preparedness Enterprise
To ensure a funded, coordinated, effective response

Source: Bavarian Nordic

HHS Medical Countermeasure Development Pathway
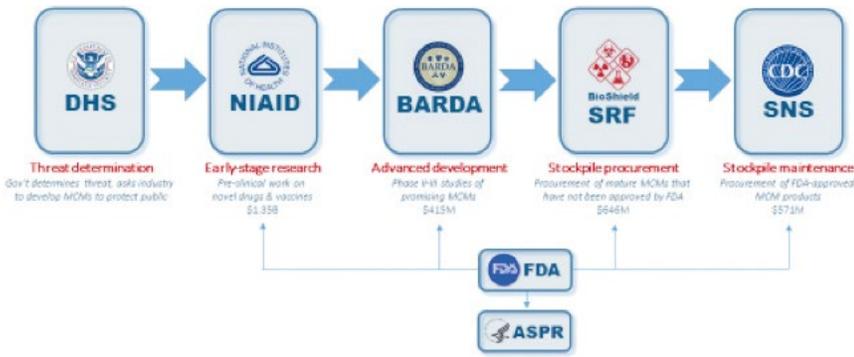
Source: Alliance for Biosecurity

- **Upgrading to modern molecular technologies.** Advances in diagnostic technologies allow scientists to identify the causes of outbreaks and connections between different cases much faster. This helps identify how widespread an outbreak may be and how to treat it. In public health, the revolution in DNA sequencing technologies over the past decade is having a dramatic impact on the detection of, and response to, infectious disease outbreaks. However, historically the public health system has not had built-in mechanisms to support and incorporate developments in science and technology. 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 invests in public health.

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. Three 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. Roll out of NGS to all 87 PulseNet labs (which includes all 50 states and Washington, D.C.) is currently underway.

To explain the technology in general terms, 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."[203]

AMD technologies are now being applied in many areas, such as food safety, influenza prevention and tuberculosis control. While CDC has this technology, it is starting to scale broader use to targeted public health labs to be able to test for certain pathogens. With assistance from CDC, state health laboratories are now acquiring the technology and applying it to detect outbreaks and improve health. 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 and detected earlier, it has also increased the need for epidemiologic "boots on the ground" to investigate possible 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.

EXAMPLES OF CDC INVESTIGATIONS USING ADVANCED MOLECULAR DETECTION (AMD)

AMD Helps Trace Connections in HIV and HCV Outbreak[204, 205]

In January 2015, there were 11 confirmed cases of HIV in one county in rural southeastern Indiana — by May there were 135 HIV-infected people connected to this community, which had a large number of injection drug users. In addition to traditional epidemiological approaches, CDC scientists helped Indiana by using AMD methods — combining demographic data gathered from labs and genetic sequences of each individual's HIV strain — to find the links between the infected and how the virus was spreading. This enabled researchers to quickly, in near real-time, identify where the most transmissions were occurring, thereby allowing public health workers to target prevention efforts and researchers to use additional AMD tools to predict how fast the outbreak could grow. Going one step further, CDC scientists also used a novel state of the art technology, known as the Global Hepatitis Outbreak and Surveillance Technology (GHOST), to determine hepatitis C virus (HCV) transmission patterns and links, which helped public health officials strategically assign additional resources to reduce further HCV and HIV infections. Genetic data from 392 HCV cases tested concluded that while the HIV outbreak was new, the large number of co-circulating HCV strains indicate that HCV had been introduced into the community multiple times over a period of several years. Tracking HCV identifies communities at risk for introduction of HIV. The major anticipated impact of GHOST as a new surveillance tool, is enabling state laboratories to independently conduct sustainable, cost-effective and real-time molecular surveillance of hepatitis C in support of implementing timely public health interventions.

Identifying Enterovirus D68 in Children with Respiratory Illness[206]

In summer 2014, hospitals in Missouri and Illinois were experiencing increased admissions of children with severe respiratory illness — some children were so ill they needed intensive care and ventilators to breathe. The hospitals quickly tested specimens from the

children and found enterovirus. After being notified, CDC confirmed the finding and identified enterovirus D68 (EV-D68) in most specimens. Soon thereafter, CDC began to test specimens from across the country, discovering EV-D68 in almost every state. Along with some state public health labs, CDC used AMD methods to gain more information on the virus. As a result, in little over three months, CDC and the state labs had identified 1,116 people across 47 states who had suffered respiratory illness that was caused by EV-D68. With the AMD program's resources, CDC was able to quickly map the entire genomic sequence of the virus along with six other viruses representing the three known strains. The program also helped develop a rapid lab test. This work improved the capacity of public health laboratories to perform molecular typing tests that more rapidly identify and detect enteroviruses and thus enhance outbreak investigations and response.

Whole Genome Sequencing Pinpoints Source of Listeriosis Outbreak[207, 208]

In the fall of 2014, seven people died and 34 were hospitalized during a multi-state listeriosis outbreak. Since the outbreak was spread over several states, researchers needed to quickly identify which cases were related. Using the traditional laboratory technique, scientists found the DNA of the germs, identifying two different strains. In addition, scientists began using WGS and other AMD methods, allowing them to investigate one cluster a week earlier than if they had used only traditional methods. Researchers soon found one individual infected with both strains, leading them to conclude

that there was a common source of the outbreak. Through patient interviews, it became evident that most had eaten caramel apples before becoming ill, tracing the apples back to a single supplier.

With AMD methods and whole genome sequencing, quickly identified that source of the outbreaks were contaminated Granny Smith and Gala apples and likely prevented many additional illnesses.
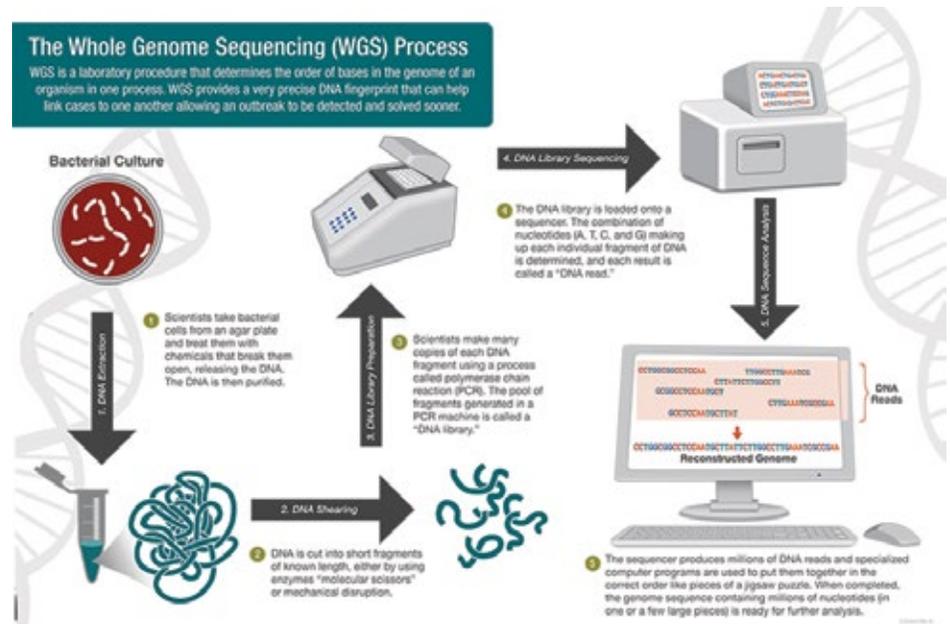

Source: Centers for Disease Control and Prevention

Whole genome sequencing prevents *Listeria* illness
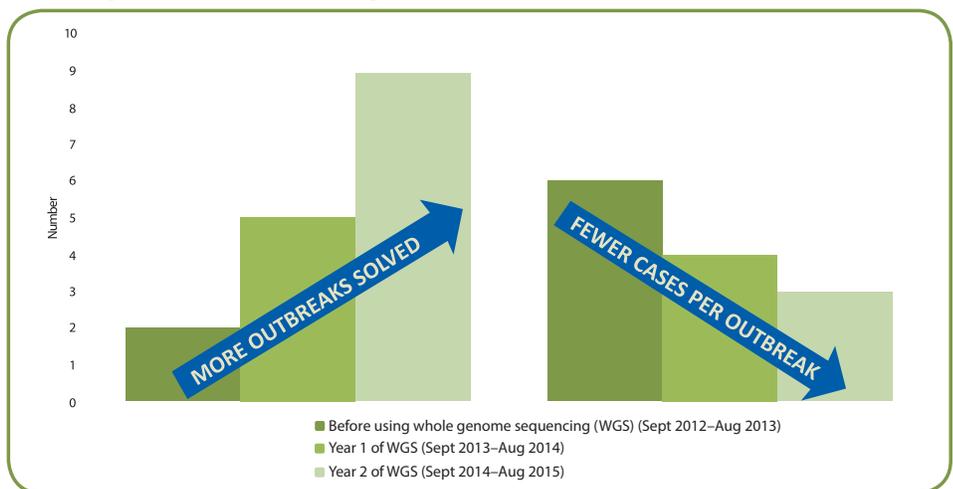
Source: Centers for Disease Control and Prevention

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

Many leading experts — including initiatives led by the Association of State and Territorial Health Officials (ASTHO), the National Association of County and City Health Officials (NACCHO), the Association of Public Health Laboratories (APHL), 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 public health workforce is experiencing major challenges. 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.

The size of the workforce has been cut over the past 35 years — and there needs to be greater training to match the skills of the workforce to the most pressing, current public health needs.[209, 210]

- 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 per 100,000 population to 158 per 100,000 population;

- 38 percent of state and local public health professionals plan to leave governmental public health 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.

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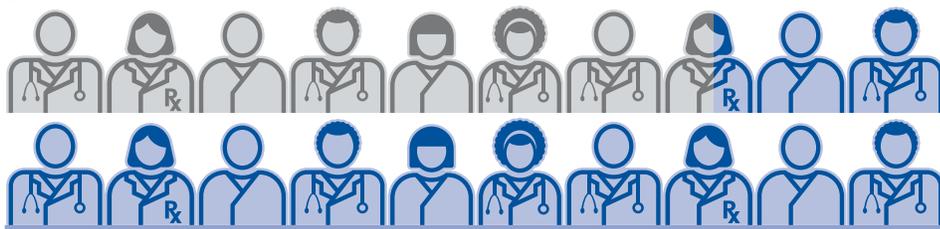
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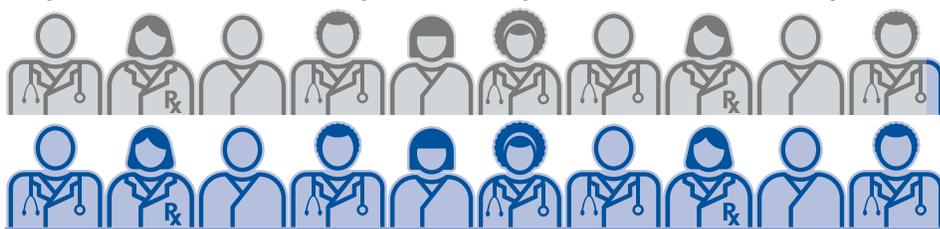
Some key issues raised in the Public Health Workforce Interests and Needs Survey (PH WINS) conducted by ASTHO and the de Beaumont Foundation to highlight the need for cross-cutting skills include that:[211]

- 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.[212, 213, 214] Ongoing training, including drills and scenario exercises, help better prepare public health and healthcare professionals to respond efficiently and effectively during crises.

RECOMMENDATION:

- **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 and that can 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.[215] As technological and informatics needs of health departments increase, it will be especially challenging to sustain a public health workforce when 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 updated on a regular basis based on training needs assessments and changing agency and community needs.[216] 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.[217] 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 highly skilled technology specialists and data scientists with experience outside the traditional health sciences.

G. Rebooting and Developing a New Strategy for Hospital and Healthcare Readiness; Improving Healthcare Infection Control Practices

HPP, administered by ASPR, was created after September 11, 2001, to help build capabilities in health system preparedness for major emergencies.[218, 219] 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 2016. 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.[220] Currently, there are nearly 500 HCCs nationwide, with more than 28,000 members, including hospitals, long-term care facilities, outpatient facilities, emergency medical services, local health departments and others.[221] 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.[222]

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 administration within 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;

  - ASPR should assess how funds are spent at the state level and confirm adequate funding is reaching coalitions. HPP awardees (the state and local health departments) should distribute sufficient resources to healthcare coalitions and not retain HPP funds for public health or administrative purposes;

  - As it updates performance measures to align with the new capabilities, ASPR should make certain the measures come with transparency, accountability and quality improvement. HPP must also 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.[223] While all coalitions should avail themselves of these resources, ASPR should continue to conduct targeted outreach to new and less effective coalitions;

  - Coalitions should ensure they are formulated to reflect how healthcare is really delivered in their region, leveraging existing affiliations and assets among facilities and providers; and

  - As the program — and the field of healthcare preparedness — matures, ASPR should continue to strengthen the focus of HPP on the readiness of the healthcare delivery system as distinct from public health preparedness.

- **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. 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.

  - One potential lever is the recently finalized CMS emergency preparedness requirements for Medicare and Medicaid participating providers and suppliers.[224] Facilities that may have never prepared for disaster could now have an incentive to participate in healthcare coalitions and to ensure their staff is well-trained for a crisis. 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 healthcare preparedness and response capabilities, such as the resources dedicated to the CMS rule on ASPR TRACIE and a recent joint webinar with the Medical Learning Network. CMS could also pilot bonus incentive payments for performance outcomes around preparedness.

  - Another important preparedness asset could be value-based healthcare models, such as Accountable Care Organizations (ACOs).[225] 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.[226]

  - A number of additional levers can be further explored for engaging the health system — such as tax incentives, the 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.

RECOMMENDATIONS:

- 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 urge states to clarify laws and policies regarding healthcare disaster readiness.

- Potential support mechanisms from broader community institutions, such as universities, economic and community development agencies and other prominent partners that benefit from stability and vitality of their neighborhoods can also serve as levers.[227] 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.[228] 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 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 start-up funding in order to be maintained.[229] 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 (HHS) Ebola Response also recommends HHS maintain a national network of identified treatment centers for urgent public health threats, including standardized requirements and protocols.[230] 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, health systems and public health agencies.

  - For instance, during the 2009 H1N1 pandemic flu response, the distribution and administration of the vaccine and the dispensing of the antiviral Tamiflu (oseltamivir) and Relenza (zanamivir) medications were through combinations of public and private distribution, insurer and provider systems. The private sector — such as large or community-based pharmacies — was better be able to distribute medical countermeasures in some communities in the midst of a crisis than overstretched public health agencies, but collaboration is key to ensuring equity of distribution and reach into underserved communities.

  - Since 2012, ASTHO, CDC and BARDA have been assessing best practices for coordinating pandemic vaccination preparedness activities between public health programs and pharmacies. Successful strategies, tactics and operational components, identified through stakeholder interviews and workshops, were incorporated into a template memorandum of understanding (MOU). ASTHO, in conjunction with CDC, will fund and support up to two state health agencies to implement a template MOU for pandemic planning and response. The MOU is intended to improve coordination between state-level public health programs and pharmacies by outline the roles and responsibilities each plays in planning for and responding to flu pandemics. The best practices from these states will be incorporated into a toolkit.

  - Resilience of the healthcare delivery system during and after a disaster is also contingent on the ability of healthcare personnel and supplies to reach affected regions. States should develop formal access and re-entry programs so critical healthcare personnel and supplies can reach restricted areas during disasters.

  - Both public and private sector health organizations are also exploring the use of nurse triage lines to reduce the strain on the healthcare system during a pandemic or other event. Public health, healthcare and insurers should collaborate on these models before

the next event to ensure questions of credentialing, payment and risk communications are addressed.

- **Healthcare Infection Prevention and Control.** Despite years of progress, healthcare facilities still do not routinely carry out standard infection control procedures on every patient so that when new serious outbreaks occur they are able to safely diagnose and treat patients, and ensure that other patients and the healthcare workers themselves are protected from exposure. For instance, the lack of adherence to best practices led to initial mistakes in not admitting the first initial presenting Ebola patient in the United States. And, one out of every 25 people who are hospitalized each year contracts a healthcare-associated infection (HAI), leading to around 75,000 deaths a year.[231]

  - 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; 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. Private healthcare also needs to be seen as part of a coordinated response. 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.

NEW EMERGENCY PREPAREDNESS REGULATIONS FOR MEDICARE AND MEDICAID PROVIDERS AND SUPPLIERS

In September 2016, CMS finalized a rule 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.[232]

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.

Protecting Health and Saving Lives in Epidemics and Disasters: New Approaches in a New Health Landscape

By Eric Toner, M.D., UPMC Center for Health Security

Although the healthcare system is undoubtedly better prepared for disasters than before the launches of the Hospital Preparedness and Public Health Emergency Preparedness Programs in 2002, the experience of Hurricane Sandy suggests that important gaps exists in the resilience of our health sectors for large-scale disasters.

These disasters, as well as smaller ones, are becoming ever more frequent. At the same time, over the last decade there have been major ongoing changes in healthcare, especially the consolidation of hospitals, physician practices and outpatient facilities into large integrated healthcare networks. This started well before the Affordable Care Act (ACA) and is likely to continue regardless of the fate of the ACA. As the health landscape has been evolving, our understanding of the intersection of health and disasters has also been evolving. Therefore, now may be an opportune time to re-think some aspects of the approach to healthcare preparedness. With the support of the Robert Wood Johnson Foundation, over the last year the UPMC Center for Health Security has explored this question in scores of interviews and meetings with thought leaders and subject matter experts. We share some preliminary insight here.

Different types of disasters stress the healthcare system in different ways

Not all disasters are alike. A hurricane differs in important ways from, for example, a terrorist mass shooting, and both of these are different from an epidemic. Although there are important commonalities, such as a similar incident command structure, the geographic scope, time to prepare and duration and cadence of the response will be quite different. The nature of the illnesses will also be quite different. In natural disasters like hurricanes, most of the patients who present after the event are not direct causalities of the event but people with chronic health conditions who have been displaced from their normal sources of care. Examples include loss of access to medication and services for people with chronic medical, behavioral health and substance abuse conditions. The most vulnerable in our society, who are the most likely to have these conditions, are also inherently the least able to be resilient due to lack of resources and supports. Therefore, quite often these patients end up in hospital emergency departments seeking care that the ED is not well-prepared to deliver. For example, think of an elderly, low-income person with diabetes on chronic hemodialysis who relies on public transportation. When her dialysis center closes or the medication runs out, she is likely to call 911 and end up in a hospital emergency department which has little capacity for outpatient dialysis. This surge of patients stresses the hospital and degrades care for both the patients who need to be in the hospital and those who would be better served elsewhere.

The health sector preparedness base must be broadened

For events that have long-duration impacts and large geographic footprints, the stress on the hospitals could be lessened if the rest of the health sector was more resilient — if clinics, home health providers and all the other entities that support the health of the population were better prepared to resist the stress of a disaster and quickly bounce back. The entire health sector is tightly interrelated and co-dependent so a lack of resilience in any one part places an added burden on the resilience of the health sector as a whole. If every health facility and service were prepared to quickly bounce back from a disaster, patients would be better served and hospitals (that are needed for the acutely ill or injured) would be less burdened. Disaster health resilience requires a much broader health sector involvement than from just hospitals and public health.

Big events require broadly resilient communities

Furthermore, Hurricane Sandy demonstrated, as did Hurricane Katrina nearly a decade earlier, that many other segments of society that are needed for disaster-resilient communities are not adequately prepared, including among many others, utilities, transportation, supply chains and fuel. To be able to preserve health and save lives after a disaster, many sectors of society other than just the health sector need to be resilient. Thus, in the same way that broad cultural changes are needed to improve peoples' health overall, broad cultural changes are needed to promote disaster health resilience.

But for years the focus of preparedness programs has been on hospitals, public health and emergency management.

Andrei Orlov / Shutterstock.com

While this was an obvious place to start, it is now clear that the preparedness foundation must the broadened. In line with the strategy of the Hospital Preparedness Program, new partners must be recruited to join healthcare coalitions. But beyond that, community-based organizations that work on many other important health issues should also be encouraged and incentivized to include aspects of health resilience to disasters in their missions.

Creative grass-root solutions are needed

Finding ways to create public-private-philanthropic partnerships that promote greater resilience to the health consequences of disasters will require creativity and a good deal of flexibility. In this project we have seen encouraging examples of novel approaches to disaster health resilience in (1) Boston, where they have a Chief Resilience Officer with a background in public health emergency preparedness; in (2) Cedar Rapids, where multiple community-based organizations work together to improve resilience to flooding; and in (3) Los Angeles, where the health department has developed metrics and applied a rigorous quality improvement methodological approach to improving resilience. Every community and every community-based organization is different. There are likely to be many different novel ways to improve resilience at the grass roots level. Letting a thousand flowers bloom may be a needed approach during a time of major shifts in healthcare, healthcare policy and increasingly frequent disasters.

H. 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.

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 and those who are lower-income and/or have limited-English proficiency — are often the most affected and least prepared and protected during emergencies.[233]

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.[234]   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.

Frontpage / Shutterstock.com

RECOMMENDATIONS:

- **Prioritizing the need to improve the ability of communities to be resilient — to be able to cope and recover from emergencies.**[235, 236] Public, private and nongovernmental stakeholders must work together to develop innovative approaches to build resilience, including leveraging the assets within the community.

- **Leveraging 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 respond to the needs of at-risk populations.**

- **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.

- **Providing clear, accurate, straightforward guidance to the public in multiple languages 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 — integrating both mental health first aid and long term mental health treatment into disaster response and recovery strategies.**

- **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, it 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), U.S. Environmental Protection Agency (EPA) and private grants to ensure resilience and planning efforts consider the health equity needs of the most vulnerable residents. For example, New York City held a competition with HUD disaster recovery funds to make the city more capable of withstanding future storm surges and sea level rises.[237, 238] The winning designs would not only protect against flooding but would provide health and environmental benefits to the community with green, social and recreational spaces.[239] These kinds of cross-sector collaborations are a model for creating resilience for people and communities.

- **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.[240] Paid sick days help reduce the spread of contagious illnesses and diseases among workers and their families. 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. 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. This increases the chance of infectious diseases spreading through contact with food, co-workers and the general public — and it could threaten the productivity and safety of America's businesses.

SAVE THE CHILDREN: GET READYGET SAFE

Save the Children launched the Get ReadyGet Safe initiative to help U.S. communities and families to prepare to protect and care for children in times of crisis. They help generate child-focused emergency plans, provide emergency training and ensure emergency resources are in place before crisis strikes.[241]

In addition, in their 2015 report, *Still at Risk: U.S. Children 10 Years After Hurricane Katrina,* they found that only 17 of the 81 recommendations in the 2010 report by the National Commission on Children and Disasters have been fully implemented; 44 are in progress; and 20 have not been addressed at all. In addition, only 32 states have met minimum recommended emergency planning standards at schools and childcare.[242]

2015 – Our Annual Disaster Report Card

This year, we find 32 states now require minimum emergency planning standards at schools and child care. But a decade after Hurricane Katrina, 18 states and D.C. still fall short.

2008
Only four states met four minimum emergency planning standards for child care and schools later recommended by the National Commission on Children and Disasters.

4 CRITERIA MET

CRITERIA NOT MET
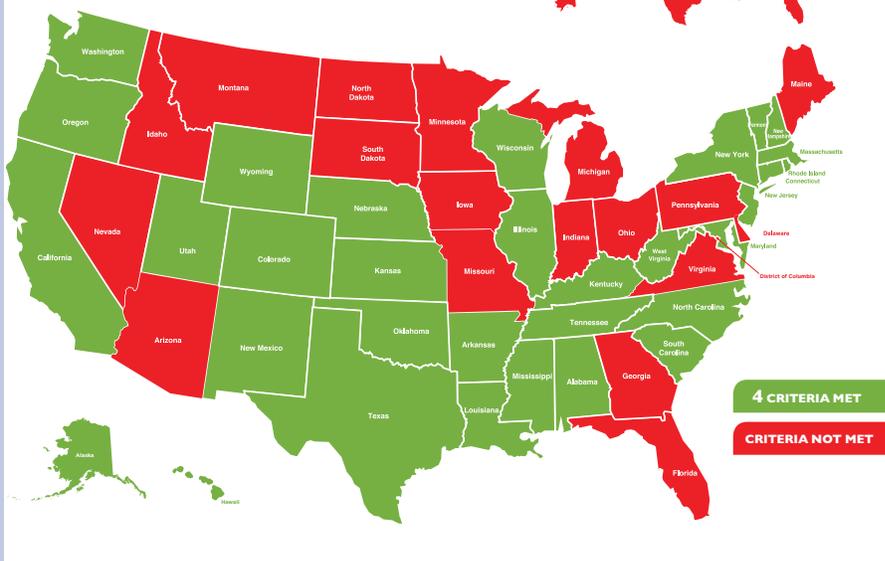
Source: Save the Children, **Still at Risk: U.S. Children 10 Years After Hurricane Katrina**

I. Readying for Climate Change and Weather-Related Threats

Climate change and extreme weather events have serious health consequences in the United States.[244] Health departments have an important role to play in helping communities understand and prepare for the adverse effects of climate change, given their role in building healthy communities.

Impact of Climate Change on Human Health

Injuries, fatalities, mental health impacts

Asthma, cardiovascular disease

Heat-related illness and death, cardiovascular failure

Malaria, dengue, encephalitis, hantavirus, Rift Valley fever, Lyme disease, chikungunya, West Nile virus

Respiratory allergies, asthma

Forced migration, civil conflict, mental health impacts

Malnutrition, diarrheal disease

Cholera, cryptosporidiosis, campylobacter, leptospirosis, harmful algal blooms

Severe Weather

Air Pollution

Extreme Heat

Changes in Vector Ecology

Environmental Degradation

Increasing Allergens

Water and Food Supply Impacts

Water Quality Impacts

RISING TEMPERATURES

MORE EXTREME WEATHER

INCREASING CO₂ LEVELS

RISING SEA LEVELS

SOURCE: CDC Climate and Health Program[243]

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.

RECOMMENDATIONS:

- **Preventing and preparing for the adverse impact of climate change on infectious disease outbreaks, including Zika.** Every state should have a comprehensive climate change adaptation plan that includes a public health assessment and response, including developing sustainable state and local mosquito control programs. 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 expand CDC's Climate Ready States and Cities Initiative nationwide and 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.[245] 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.[246]

- **Increasing 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. For each additional $1 million in funds, CDC would be able to fund approximately three additional states or cities under their Climate Ready States and Cities Initiative.[247] A larger, long-term investment will be critical to building nationwide resilience.

- **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 to $8 of economic benefits for every $1 spent on compliance.[248] Four major rules of the CAA alone would yield more than $82 billion in Medicare, Medicaid and other healthcare savings for America through 2021.[249]

- **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.[250]

- **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.

J. STOPPING SUPERBUGS AND ANTIBIOTIC RESISTANCE

Inappropriate use of antibiotics has contributed to one of the biggest threats to public health: antibiotic resistant pathogens or "superbugs."[251] Superbugs are turning infections that were once easily treated — like *E. coli* and *Salmonella* — into deadly diseases. More than 2 million people in the United States are annually infected by superbugs and at least 23,000 die.[252] Superbugs cause $20 billion in annual direct costs and an additional $35 billion in productivity losses.[253]

CDC has warned that superbugs are expected to continue to grow dramatically — and 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. Six of those urgent or serious antibiotic-resistant threats, plus *C.difficile*, can cause healthcare-associated infections.[254]

- Experts have found that nearly one-third of the 154 million annual antibiotic prescriptions written in doctor's offices and emergency departments are unnecessary. Many are prescribed for viral respiratory illnesses that inherently will not respond to antibiotics.[255]

- In addition, more than 80 percent of antibiotics sold in the United States are used in agriculture (including ionophores not used in human medicine).[256] Pathogens can develop antibiotic resistance when food animals — such as poultry, cattle or swine — are exposed to antibiotics.[257] 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.[258]
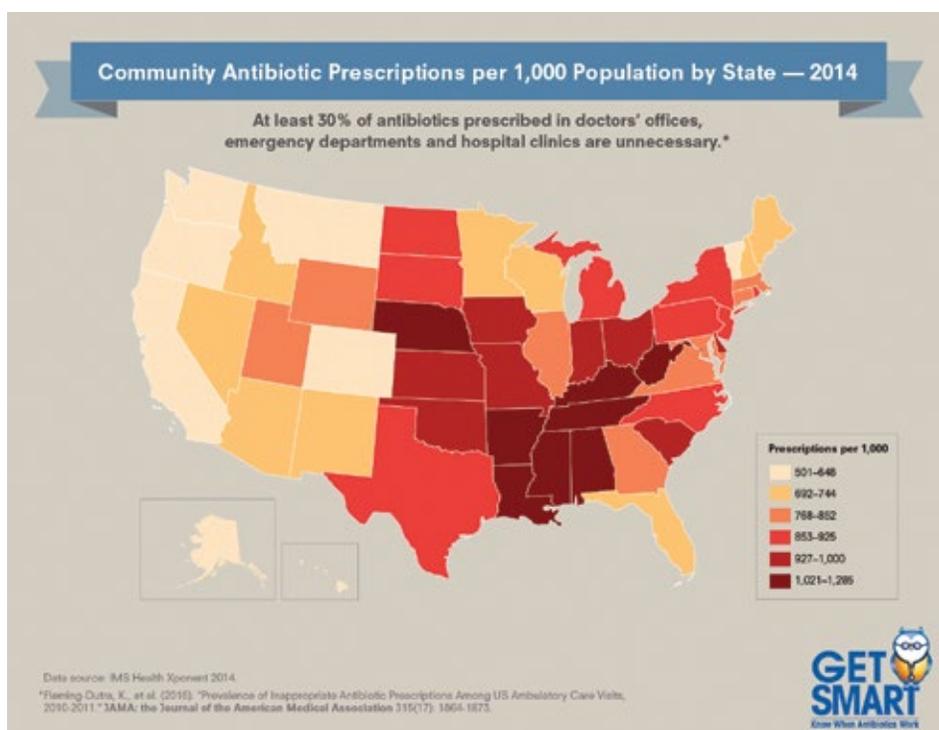
Source: CDC

Another factor contributing to the rise is that there are few market incentives for pharmaceutical companies to invest in new antibiotic research and development. As of March 2016, only 37 new antibiotics were in development, 13 of which had reached phase 3 testing.[259] Historically, only 60 percent of phase 3 drugs will be approved by the FDA.[260]

RECOMMENDATIONS:

- **Fully funding and implementing the 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*.

- **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.[261]

- **Reducing overuse of antibiotics in agriculture.** The FDA should fully implement and strengthen guidance to industry regarding the nontherapeutic use of antibiotics in food animals. Important measures include 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.

- **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 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), next generation surveillance in PulseNet laboratories and whole genome sequencing to rapidly uncover foodborne drug-resistant bacteria, 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.

- **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 and use of antibiotics and reducing the rates of viral respiratory infections, such as the flu, that are often mistakenly treated with antibiotics.[262] Federal, state and local health officials, in partnership with medical providers and community organizations, should conduct assertive campaigns about the importance of vaccines. Targeted outreach should be made to high-risk groups and to racial and ethnic minority populations where the misperceptions about vaccines are particularly high.[263]

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

Vaccines are the safest and most effective way to manage many infectious diseases in the United States. 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.[264] A recent 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.[265]

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.[266]

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.[267, 268, 269]

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.

There are several effective strategies identified by the Community Preventive Services Task Force to improve vaccinations, such as use of Immunization Information Systems (IIS).[270, 271]

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

RECOMMENDATIONS:

- **Minimizing vaccine exemptions.** Health and education sectors should work together to ensure children receive required vaccinations to help protect themselves, their classmates and educators from diseases. States should enact and enable universal childhood vaccinations 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.[272]

- **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.[273, 274] The NVAC Adult Immunization Practice Standards should be adopted by all healthcare providers and systems to ensure all providers, assess immunization needs of their adult patients; strongly recommend needed immunizations to adults; 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. To increase confidence and demand for vaccines, an NVAC committee has also recommended an index to measure and track vaccine confidence, consistent communications assessment and feedback for vaccine confidence and a repository of tools for providers to communicate with parents.[275] Training is also needed for providers to ensure they are able to effectively educate patients and make a strong recommendation for vaccines across the life cycle.

- **Making adult vaccinations routine — including regular recommendations and referrals.** Private providers and health systems should have standing orders for vaccinations so every provider of care for adults can assess the need, recommend and either provide directly or refer to another provider for vaccination. Vaccine locator systems should be expanded to build an effective vaccine referral system so providers can ensure the vaccine is administered, just as for mammograms or other preventive services. Electronic health records (EHRs) should provide reminder recalls to patients and providers through text messages or other communications. A routine adult vaccination schedule should be established, where healthcare providers are expected to purchase, educate, advise about and administer immunizations to patients.

- **Reducing barriers to alternative delivery sites.** Vaccination services, particularly for adults, should be offered by pharmacists and other community immunization providers, at the workplace and by providers who care for pregnant women — and should be covered by public and private insurance.

- **Increasing provider education.** Professional medical societies and medical and nursing schools should support ongoing education and expanded curricula on vaccines and vaccine-preventable diseases and expand standard practice for providers to discuss and track vaccination histories for all patients — including adults — and offer vaccinations to adults during other doctor and hospital visits.

- **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 may make this process simpler by encouraging integration of registry data into EHRs and enabling immunization registries (immunization information system (IIS)) data exchange between states. Resources should be available to build capacity of 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. Lifespan registries would also help better track patients' medical history to ensure they have received all needed vaccinations throughout their lives — to help improve and track vaccination rates for both children and adults.

- **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.[276, 277]

- **Ensuring first dollar coverage and access to all recommended vaccines under Medicaid, Medicare and private insurance.** 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 to getting immunized. Medicare also does not consistently provide first dollar coverage for vaccines, and the different policies dictate what is covered under Part B and Part D, leaving many seniors with gaps in coverage. Beneficiaries can get flu, pneumococcal, TDAP (for at-risk individuals) and HBV (for at-risk individuals) vaccine covered under Medicare Part B, but an out-of-pocket payment may be required, depending on the immunization and provider. The rest of the recommended vaccines are covered under Medicare Part D, the prescription drug benefit, but the patient must get immunized by an in-network pharmacist or find a healthcare provider who accepts Part D and carries the needed vaccine and not all beneficiaries have Part D coverage. Those who do will likely face a co-payment that can vary by plan and vaccine, presenting a significant barrier for seniors. 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.

- **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 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). Section 317 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.

- **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.[278] The Societies also support requiring comprehensive educational efforts to inform HCP about the benefits of immunization and risks of not maintaining immunizations.

- **Supporting the development and use of maternal immunizations.** Consistent with the recommendation of NVAC, the federal government should quickly implement the new law to include maternal immunizations in the vaccine injury compensation program (VICP) in order to address a barrier to developing and delivering vaccines for pregnant women to protect newborns.

EXAMPLES OF VACCINE PREVENTABLE DISEASES

Anthrax, Cervical Cancer, Sequelae of Hepatitis B Infection (including Liver Cancer), Diphtheria, Haemophilus influenza type b (Hib), Hepatitis A, Hepatitis B, Human Papillomavirus, 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. Fixing Food Safety

Nearly all foodborne illnesses could be avoided with a stronger U.S. food safety system. There are around 48 million cases of illness each year, with 1 million resulting in long-term complications, nearly 128,000 leading to hospital visits and 3,000 resulting in death.[281, 282]

The annual estimated economic cost of foodborne illnesses is $15.6 billion in medical costs and lost productivity.[283] Major outbreaks can also contribute 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.[284] 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 previous 15 years.[285] For example, a 2015 outbreak due to contaminated cucumbers led to more than 907 cases, 204 hospitalizations and six deaths from *Salmonella* Poona infections in at least 40 states.[286]

According to CDC, produce is related to the highest percentage of illnesses (46 percent), but meat and poultry cause the most deaths (29 percent).[287] Norovirus is the leading cause of illness from contaminated food in the United States.[288, 289] Foodborne norovirus outbreaks result most commonly from the handling of ready-to-eat foods by infected individuals, but can also occur due to use of fecally contaminated water during production and processing.[290] *Cyclospora cayetanensi*, a microscopic parasite, has caused large outbreaks of diarrheal illness linked to fecally contaminated imported produce items.

According to research conducted by University of Florida Emerging Pathogens Institute, the top 10 riskiest combinations of food and pathogens include *Campylobacter* in poultry, *Toxoplasma* in pork, Listeria in deli meats and dairy products and *Salmonella* in foods such as produce, eggs and poultry.[291] These top 10 pathogen-food combinations are responsible for more than $8 billion in annual economic loss. Of all these pathogens, *Salmonella* is the leading cause of hospitalizations and death in the United States.[292]

In 2015, FDA finalized several major rules implementing portions of the 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.[293] The FY 2016 appropriations bills included an additional $104.5 million in new budget authority for implementing FDA food safety rules.[294]

WATER SAFETY AND SECURITY

Waterborne illnesses also pose serious threats to America's health each year. While water-related illnesses are underreported, there are at least around 30 outbreaks — resulting in around 1,000 serious drinking water-related illnesses and 1,300 recreational-related water illnesses.[295, 296]

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 Flint, Michigan, a change in the water supply 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.[297]

- 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.[298, 299]

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.[300] 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.

- **Improving enforcement and inspection capacity.** FDA should work with states to ensure they are ready to enforce FSMA regulations, develop an operational strategy and ensure compliance across states.

- **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. A 2014 initiative within FDA to realign its policy and enforcement arms should be completed. 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.[301] New standards and requirements should be put in place to incentivize states to improve reporting and penalize states for underreporting. 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 "whole 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 from rapid response tests showing problems to public health labs to allow for subtype pathogen testing.[302]

- **Supporting paid sick days.** Paid sick days help to ensure workers can comply with science-based guidance on controlling the spread of an outbreak, which is a particular risk in food service. According to CDC, handling of food by an infected person is a contributing factor in up to two-thirds of restaurant related foodborne outbreaks.[303] A 2015 survey found that about half of food workers, including agricultural and restaurant workers go to work sick, often because they can't afford to lose pay.[304] As of November 2016, seven states, 30 cities and two counties have passed paid sick leave laws. Policymakers should extend paid sick leave to private sector workers to help prevent and control infectious disease outbreaks.[305, 306]

- **Adopting FDA's Food Code** — 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.[307] FDA describes the benefits associated with the 2013 Food Code's complete and widespread adoption to include:[308]

  - 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:** 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'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.

Appendix A: State Public Health Budget Methodology

TFAH conducted an analysis of state spending on public health for the last budget cycle, fiscal year 2015-2016. For those states that only report their budgets in biennium cycles, the 2015-2017 period (or the 2014-2016 and 2015-2016 for Virginia and Wyoming respectively) was used, and the percent change was calculated from the last biennium, 2013-2015 (or 2012-2014 and 2014-2015 for Virginia and Wyoming respectively).

This analysis was conducted from September to October of 2016 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 in order to make the state-by-state comparison more accurate since many states receive federal money for these particular programs. In a few cases, state budget documents did not allow these programs, or other similar human services, to be disaggregated; these exceptions are noted. For most states, all state funding, regardless of general revenue or other state funds (e.g. dedicated revenue, fee revenue, etc.), was used. In some cases, only general revenue funds were used in order to separate out federal funds; these exceptions are also noted.

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 2014-2015 and FY 2015-2016 (or between biennium), TFAH adjusted the FY 2015-2016 numbers for inflation (using a 0.984 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, 2016 and state health officials were asked to confirm or correct the data with TFAH staff by November 9, 2016. ASTHO followed up via email with those state health officials who did not respond by the November 9, 2016 deadline. Twelve states did not respond by December 7, 2016 when the report went to print. The most recent publicly available data was used for the states that did not respond.

Appendix B: PUBLIC HEALTH EMERGENCY PREPAREDNESS (PHP) AND HOSPITAL PREPAREDNESS PROGRAM (HPP) GRANTS TO STATES

	ALL-HAZARDS PREPAREDNESS FUNDING BY SOURCE AND FISCAL YEAR						
	Fiscal Year 2002			Fiscal Year 2016			Percent Change, Between FY 2002 and FY 2016
	CDC-PHEP Fuding, FY 2002	ASPR-HPP Funding, FY 2002	Total	CDC- PHEP Funding, FY 2016	ASPR-HPP Funding, FY 2016	Total	
Alabama	$14,900,443	$1,972,833	$16,873,276	$8,282,477	$3,213,182	$11,495,659	-31.9%
Alaska	$6,395,720	$492,877	$6,888,597	$4,008,961	$946,524	$4,955,485	-28.1%
Arizona	$16,422,170	$2,237,637	$18,659,807	$10,911,739	$3,802,604	$14,714,343	-21.1%
Arkansas	$10,951,709	$1,285,691	$12,237,400	$6,249,569	$2,021,657	$8,271,226	-32.4%
California	$60,816,245	$9,962,905	$70,779,150	$38,570,815	$23,405,491	$61,976,306	-12.4%
Colorado	$14,575,766	$1,916,334	$16,492,100	$9,094,118	$3,019,385	$12,113,503	-26.5%
Connecticut	$12,581,705	$1,569,336	$14,151,041	$7,233,738	$2,351,714	$9,585,452	-32.3%
Delaware	$11,273,558	$721,619	$11,995,177	$6,247,100	$948,679	$7,195,779	-40.0%
D.C.	$6,744,505	$553,571	$7,298,076	$4,243,150	$1,057,820	$5,300,970	-27.4%
Florida	$40,581,081	$6,441,669	$47,022,750	$26,833,350	$11,834,415	$38,667,765	-17.8%
Georgia	$23,225,251	$3,421,481	$26,646,732	$14,662,128	$6,009,692	$20,671,820	-22.4%
Hawaii	$7,697,208	$719,356	$8,416,564	$4,694,308	$1,253,321	$5,947,629	-29.3%
Idaho	$7,880,688	$751,285	$8,631,973	$4,694,308	$1,252,520	$5,946,828	-31.1%
Illinois	$26,201,381	$3,939,374	$30,140,755	$15,294,823	$8,882,060	$24,176,883	-19.8%
Indiana	$18,536,799	$2,605,616	$21,142,415	$10,526,446	$3,973,603	$14,500,049	-31.4%
Iowa	$11,514,786	$1,383,675	$12,898,461	$6,385,337	$2,126,090	$8,511,427	-34.0%
Kansas	$10,985,143	$1,291,509	$12,276,652	$6,355,765	$2,052,547	$8,408,312	-31.5%
Kentucky	$13,998,067	$1,815,805	$15,813,872	$7,896,874	$2,798,229	$10,695,103	-32.4%
Louisiana	$14,949,145	$1,981,308	$16,930,453	$8,286,241	$2,899,154	$11,185,395	-33.9%
Maine	$7,838,322	$743,913	$8,582,235	$4,528,810	$1,080,551	$5,609,361	-34.6%
Maryland	$16,791,405	$2,301,890	$19,093,295	$10,411,078	$4,911,525	$15,322,603	-19.7%
Massachusetts	$19,134,801	$2,709,678	$21,844,479	$12,181,742	$4,372,887	$16,554,629	-24.2%
Michigan	$27,125,655	$4,100,212	$31,225,867	$15,361,777	$6,172,668	$21,534,445	-31.0%
Minnesota	$15,952,086	$2,155,835	$18,107,921	$10,518,587	$3,546,523	$14,065,110	-22.3%
Mississippi	$11,332,975	$1,352,037	$12,685,012	$6,312,338	$2,166,456	$8,478,794	-33.2%
Missouri	$17,456,448	$2,417,618	$19,874,066	$10,067,187	$3,621,262	$13,688,449	-31.1%
Montana	$7,008,529	$599,516	$7,608,045	$4,203,760	$927,401	$5,131,161	-32.6%
Nebraska	$8,809,733	$912,954	$9,722,687	$5,119,326	$1,362,493	$6,481,819	-33.3%
Nevada	$9,448,659	$1,024,136	$10,472,795	$6,372,777	$1,929,769	$8,302,546	-20.7%
New Hampshire	$7,751,193	$728,751	$8,479,944	$4,624,949	$1,101,804	$5,726,753	-32.5%
New Jersey	$23,732,611	$3,509,769	$27,242,380	$14,289,117	$5,459,638	$19,748,755	-27.5%
New Mexico	$9,049,686	$954,709	$10,004,395	$6,475,408	$1,537,475	$8,012,883	-19.9%
New York	$29,418,122	$4,499,138	$33,917,260	$18,239,925	$9,757,860	$27,997,785	-17.5%
North Carolina	$22,919,940	$3,368,351	$26,288,291	$13,677,089	$5,908,241	$19,585,330	-25.5%
North Dakota	$6,429,710	$498,792	$6,928,502	$4,008,961	$886,426	$4,895,387	-29.3%
Ohio	$30,275,150	$4,648,274	$34,923,424	$16,356,243	$7,210,035	$23,566,278	-32.5%
Oklahoma	$12,682,086	$1,586,804	$14,268,890	$7,302,035	$2,612,637	$9,914,672	-30.5%
Oregon	$12,616,956	$1,575,470	$14,192,426	$7,510,978	$2,580,105	$10,091,083	-28.9%
Pennsylvania	$32,340,936	$5,007,754	$37,348,690	$17,808,098	$8,193,982	$26,002,080	-30.4%
Rhode Island	$7,333,840	$656,125	$7,989,965	$4,347,166	$945,077	$5,292,243	-33.8%
South Carolina	$13,931,820	$1,804,277	$15,736,097	$9,225,872	$3,120,729	$12,346,601	-21.5%
South Dakota	$6,680,486	$542,431	$7,222,917	$4,028,356	$854,218	$4,882,574	-32.4%
Tennessee	$17,665,877	$2,454,062	$20,119,939	$10,395,677	$4,062,164	$14,457,841	-28.1%
Texas	$51,421,771	$8,328,119	$59,749,890	$34,065,482	$16,294,177	$50,359,659	-15.7%
Utah	$9,971,636	$1,115,143	$11,086,779	$6,276,248	$2,288,020	$8,564,268	-22.8%
Vermont	$6,355,413	$485,864	$6,841,277	$4,008,961	$782,301	$4,791,262	-30.0%
Virginia	$20,758,682	$2,992,259	$23,750,941	$13,899,895	$6,117,444	$20,017,339	-15.7%
Washington	$18,121,901	$2,533,418	$20,655,319	$11,184,642	$4,292,040	$15,476,682	-25.1%
West Virginia	$9,025,861	$950,564	$9,976,425	$5,085,641	$1,411,417	$6,497,058	-34.9%
Wisconsin	$16,940,986	$2,327,920	$19,268,906	$10,844,792	$3,638,592	$14,483,384	-24.8%
Wyoming	$6,099,294	$441,296	$6,540,590	$4,008,961	$843,452	$4,852,413	-25.8%
State Totals by FY*	$842,653,940	$114,390,960	$957,044,900	$513,213,125	$203,838,056	$717,051,181**	-25.1%

*Note: The totals do not include funds for the three directly funded major U.S. metropolitan areas: Chicago, Los Angeles and New York; U.S. Territories, such as Puerto Rico and Guam and Freely Associated States of the Pacific, such as Marshall Islands.

**Note: FY2016 includes $44 million that was reallocated from PHEP for the Zika response, then reimbursed by the Zika emergency supplemental.

Source: CDC, Office of Public Health Preparedness and Response

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