CQ PRESS

CQ RESEARCHER

In-depth reports on today's issues

Published by CQ Press, an Imprint of SAGE Publications, Inc. www.cqresearcher.com

Pandemic Threat

Is the world prepared for the next outbreak?

Public health officials say the world is overdue for a pandemic that could kill 30 million people within a year. The possible causes include the expanding and mobile global population, mutating viruses that can outfox vaccine makers, the threat of bioterrorism and accelerating climate change that breeds new diseases. Meanwhile, in the wake of recent outbreaks of the Zika virus in Brazil, Ebola in Africa and a new strain of bird flu in China, many experts say the World Health Organization (WHO) and other agencies charged with protecting against dangerous pathogens are under-resourced and underfunded. But some experts are more optimistic, saying the global health community has taken important steps to prevent and respond to pandemics. For example, the United States has invested in crisis preparation, and WHO set up a global surveillance network and pandemic emergency fund, these experts note. But gaps in funding and leadership remain, and many warn that vaccines exist for just a fraction of the 300 known infectious viruses.

A chicken is vaccinated against avian flu in Chaltyr, a village in Russia's Rostov region, on Feb. 9. The U.S. Agency for International Development is monitoring disease outbreaks in 20 countries for their potential to become the next pandemic. Most infectious diseases that afflicted humans this century originated in animals.

INSIDE THIS REPORT

CQ Researcher • June 2, 2017 • www.cqresearcher.com
Volume 27, Number 20 • Pages 457-480

SAGE Publishing | CQ PRESS
Los Angeles | London | New Delhi
Singapore | Washington DC | Melbourne

RECIPIENT OF SOCIETY OF PROFESSIONAL JOURNALISTS AWARD FOR EXCELLENCE ◆ AMERICAN BAR ASSOCIATION SILVER GAVEL AWARD

Pandemic Threat

Cover: Getty Images/TASS/Valery Matytsin

CQ RESEARCHER
CQ PRESS

June 2, 2017
Volume 27, Number 20

Executive Editor: Thomas J. Billitteri
tjb@sagepub.com

Assistant Managing Editors: Kenneth Fireman, kenneth.fireman@sagepub.com, Kathy Koch, kathy.koch@sagepub.com, Scott Rohrer, scott.rohrer@sagepub.com

Associate Managing Editor: Val Ellicott

Senior Contributing Editor: Thomas J. Colin
tom.colin@sagepub.com

Contributing Writers: Marcia Clemmitt, Sarah Glazer, Reed Karaim, Barbara Mantel, Chuck McCutcheon, Tom Price

Senior Project Editor: Olu B. Davis

Editorial Assistant: Anika Reed

Fact Checkers: Eva P. Dasher, Michelle Harris, Betsy Towner Levine, Robin Palmer

SAGE Publishing | CQ PRESS

Los Angeles | London | New Delhi
Singapore | Washington DC | Melbourne

An Imprint of SAGE Publications, Inc.

Senior Vice President, Global Learning Resources: Karen Phillips

Executive Director, Online Library and Reference Publishing: Todd Baldwin

CQ Researcher (ISSN 1056-2036) is printed on acid-free paper. Published weekly, except: (March wk. 4) (May wk. 4) (July wks. 1, 2) (Aug. wks. 2, 3) (Nov. wk. 4) and (Dec. wks. 3, 4). Published by SAGE Publications, Inc., 2455 Teller Rd., Thousand Oaks, CA 91320. Annual full-service subscriptions start at $1,131. For pricing, call 1-800-818-7243. To purchase a *CQ Researcher* report in print or electronic format (PDF), visit www.cqpress.com or call 866-427-7737. Single reports start at $15. Bulk purchase discounts and electronic-rights licensing are also available. Periodicals postage paid at Thousand Oaks, California, and at additional mailing offices. POSTMASTER: Send address changes to *CQ Researcher*, 2600 Virginia Ave., N.W., Suite 600, Washington, DC 20037.

Pandemic Threat

By Bara Vaida

The Issues

The killer is small, hidden and elusive. Known by the mundane name of H7N9, the influenza virus has taken hold in China, lurking inside the guts of chickens and other fowl.* It is sickening a growing number of humans, including street-market poultry workers. [1]

The virus causes severe pneumonia in most victims and kills one-third of them, according to public health officials. And it is wily, like other flu viruses. H7N9 mixes with other viruses, swapping genes and circulating among birds. Every 10 to 50 years, influenza viruses mutate so drastically that large numbers of healthy people are vulnerable to contracting the flu. [2]

If H7N9 gains the ability to move more easily between humans, public health experts warn, it could cause a pandemic — a lethal, fast-moving and global infectious disease outbreak. A century ago, an influenza virus caused the 1918 Spanish flu pandemic that killed an estimated 20-50 million people worldwide. [3] Some experts say H7N9 could be equally deadly.

"I think this virus poses the greatest threat to humanity than any other in the past 100 years," said Guan Yi, director of the State Key Laboratory of Emerging Infectious Diseases and the Center of Influenza Research at the University of Hong Kong. [4]

Equally alarming, public health officials say, vaccines exist for just a fraction of the 300 or so known infectious viruses. [5]

Getty Images/Barcroft Media

A man in Sichuan province, China, is treated on Feb. 3 after he was infected by the H7N9 virus, or avian flu. Public health experts warn the virus has the potential to become a lethal, fast-moving pandemic on the scale of the 1918 Spanish flu that killed an estimated 50 million people worldwide.

Microsoft co-founder Bill Gates, a billionaire philanthropist who is working to eradicate infectious diseases, warns that the global health community must do more to prepare for a pandemic. "Epidemiologists say a fast-moving airborne pathogen could kill more than 30 million people in less than a year," he told an international security conference in Munich in February. "And they say there is a reasonable probability the world will experience such an outbreak in the next 10 to 15 years." [6]

The global health community was slow to respond to two recent disease outbreaks — Ebola in West Africa in 2014 and Zika in Brazil and elsewhere in 2015 and 2016. If officials had responded sooner, the death toll likely would have been lower, experts say. Now they are questioning whether the world will be ready if H7N9 or another infectious disease becomes a pandemic. They attributed the world's poor response to the Ebola and Zika crises to several factors: bureaucratic infighting and insufficient resources at the World Health Organization (WHO); weak public health systems in poor countries; gaps in international and local cooperation; scarcity of vaccines for fast-spreading diseases; and inattention by some in power. [7]

Some experts, however, say health agencies and governments are getting ahead of the pandemic threat.

"I'm optimistic that we are prepared for a pandemic," says Dr. Steven Gordon, chair of the Department of Infectious Disease at the Cleveland Clinic in Ohio. "We have learned so much from past outbreaks [that fell short of a pandemic]. There has been lots of preparation, there have been tremendous advances in the development of vaccines, and the U.S. has [established] lots of surveillance and information-sharing measures."

WHO, the arm of the United Nations charged with coordinating responses to world health emergencies, has a global surveillance network watching for potential pandemics and an emergency fund if a one should arise. [8]

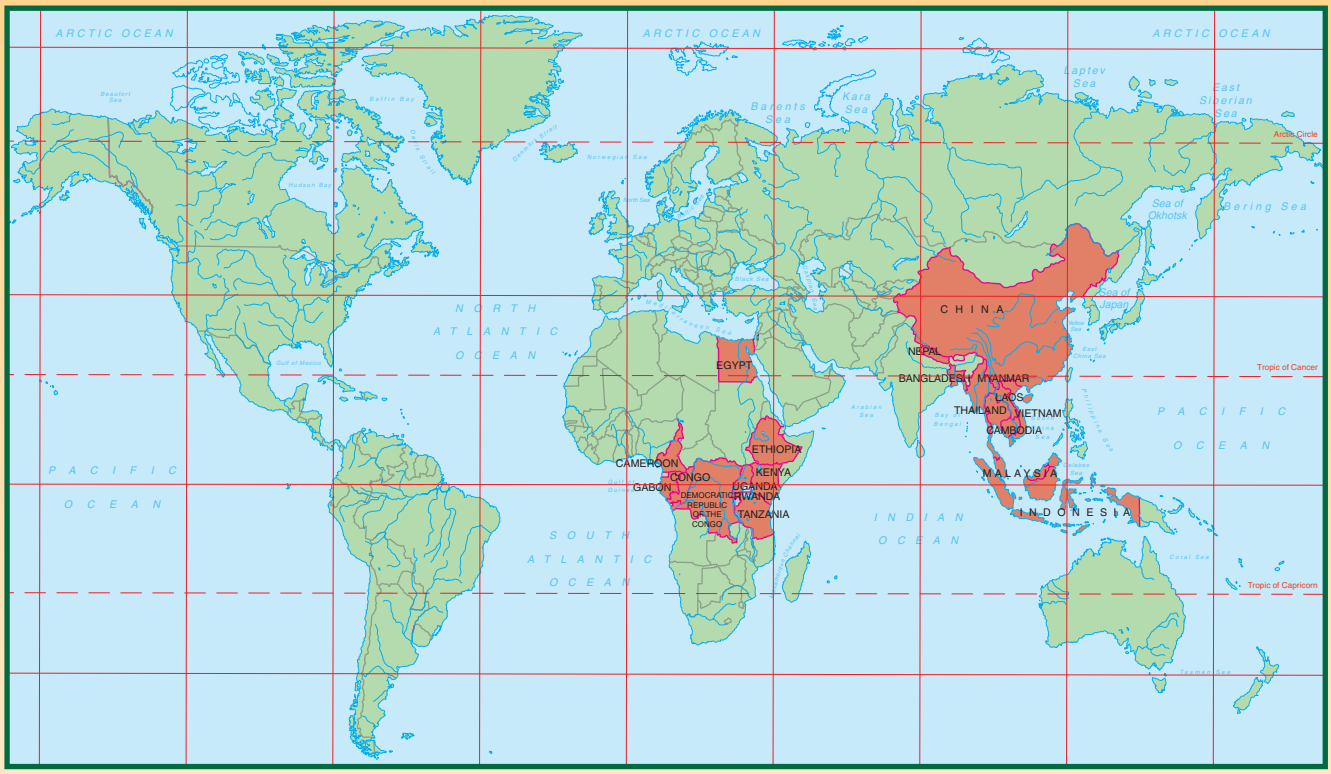
In recent years the United States has made substantial investments of time and money to prepare for a pandemic, and it has shared its expertise worldwide. In 2014, Washington expanded the Global Health Security Agenda, which is helping poor and middle-income countries build stronger public health systems capable of fighting a pandemic. In addition, a

* Researchers name influenza viruses by their particular strains, with the "H" and "N" designating the kind of proteins covering the flu virus.

Predicting the Next Pandemic

The U.S. Agency for International Development (USAID) is monitoring disease outbreaks in 20 countries for their potential to become the next pandemic. Nearly 75 percent of infectious diseases that have afflicted humans this century originated in animals. Disease outbreaks have included severe acute respiratory syndrome (SARS), H7N9 avian influenza and the 2009 pandemic known as swine flu.

USAID Monitors Disease Outbreaks in 20 African, Asian Nations



Sources: "Emerging Pandemic Threats Program," U.S. Agency for International Development, Jan. 11, 2016, https://tinyurl.com/ktbf35c; "The Road To EPT-2," U.S. Agency for International Development, undated, p. 5, https://tinyurl.com/k65okjy; and "Emerging Pandemic Threats 2 Program (EPT- 2)," U.S. Agency for International Development, Aug. 1, 2016, https://tinyurl.com/k9rntro

public-private consortium of governments, nonprofits and pharmaceutical companies is aiming to raise $2 billion to create vaccines for infectious diseases. [9]

Further, technological advances have enabled scientists to hasten development of new vaccines, including one for Zika that entered the testing phase within a year of the outbreak in Brazil.

But even the most optimistic observers say crucial gaps remain, ranging from financial to organizational. WHO faces a difficult leadership transition, and President Trump is proposing deep cuts in foreign aid and domestic programs that could halt or diminish U.S. preparedness, they say. [10]

Further, key leadership posts in U.S. health agencies remain unfilled by the Trump administration. Most poor governments still don't have a functioning public health system, and nationalistic movements in Europe and the United States are threatening the international cooperation necessary to make global health systems work. [11]

"We aren't prepared [for a pandemic]," says Michael Osterholm, director of the Center for Infectious Disease Research and Policy (CIDRAP) at the University of Minnesota.

Today's planet is a perfect incubator for pandemics, scientists say, due to an expanding global population of 7.3 billion, industrialized farming, destruction of wildlife habitats, easy access to foreign travel that can speed the spread of viruses, unstable governments and climate-change-induced proliferation of disease-carrying mosquitos.

Between January 2016 and May 23, 2017, dozens of disease outbreaks occurred

in 55 countries, according to WHO, and a new outbreak of Ebola struck the Democratic Republic of the Congo. The last pandemic was in 2009, when the swine flu, originating in Mexico, killed up to 575,000 people worldwide. [12]

Localized disease outbreaks, which affect fewer people than pandemics, are costly. In 2003, an outbreak of severe acute respiratory syndrome (SARS) cost the global economy $54 billion in lost trade and transportation and health care costs. A flu pandemic, on the other hand, could cost the global economy $4 trillion, according to the World Bank. [13]

Gates advises the world community to treat the pandemic threat as an urgent matter of national security and not just a health issue. "What we need to do is prepare for epidemics the way the military prepares for war," he said. "This includes germ games and other preparedness exercises so we can better understand how diseases will spread, how people will respond in a panic, and how to deal with things like overloaded highways and communications systems." [14]

The threat, public health experts say, is even greater than in 1918 because of the ease of international travel today. A person in China with a flu virus can get on a plane, cough and sneeze on fellow passengers and be in the United States in 13 hours.

Public health officials also worry about the growing antibiotic resistance of microbes. Since the 1940s, when antibiotics came into wide use to treat people and animals, many strains of bacteria, fungi and parasites have evolved into antibiotic-resistant "superbugs."

Currently, 2 million Americans contract antibiotic-resistant bacteria annually, and 23,000 die as a result. In one dramatic example that garnered national headlines, a woman died in Nevada in 2016 because the microbe she contracted was resistant to antibiotics. [15]

If superbugs become more common, it could be the end of much of modern medicine, experts say. Without certainty that antibiotics would work to control infection, any surgery, joint replacement, or cancer chemotherapy would become so dangerous that most hospitals would refuse to perform them, according to Dr. Ali Khan, former director of the Office of Public Health Preparedness and Response at the Centers for Disease Control and Prevention (CDC).

"If this trend continues, eventually we'll reach a new post-antibiotic age in which we slip back a century or more in terms of health care programs" because doctors won't be able to perform surgery, Khan said. [16]

Experts also worry that terrorists could use pathogens as weapons. (*See sidebar, p. 470.*) When someone in 2001 sent weaponized spores of the anthrax bacterium through the mail — the FBI said it was a rogue scientist, but the culprit remains unknown — the United States spent billions to create anti-bioterrorism programs, including a detection system to flag airborne toxins in major U.S. cities. But funding has fallen, and the aging bioterrorist detection system has "outlived its usefulness," according to former Homeland Security Secretary Tom Ridge. [17]

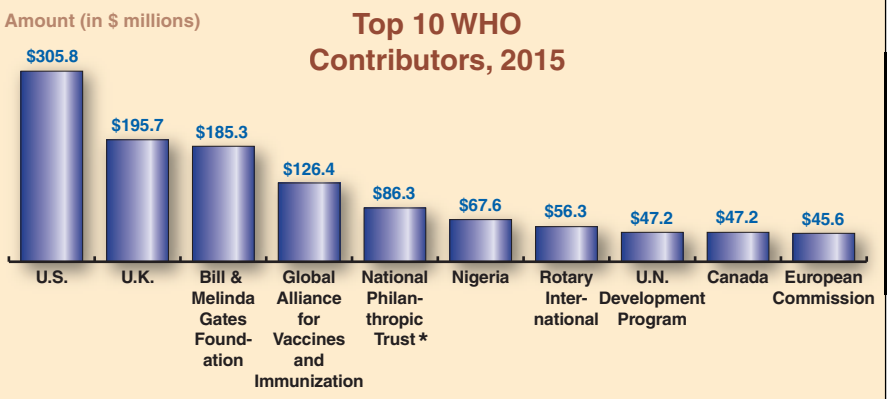
Meanwhile, technological advances have enabled scientists worldwide to create deadly viruses and bacteria to study how they evolve and to develop potential treatments. Security experts worry that a rogue scientist could launch a bioterrorism attack or share the expertise with terrorists. [18]

"All the know-how needed to create a bioterrorism tool is publicly available," says Tara O'Toole, executive vice president at In-Q-Tel, a nonprofit venture capital firm that invests in security companies. "A bioterrorism attack would be like a flu epidemic on steroids."

As scientists and health agencies prepare for the next pandemic, here are some of the questions being debated:

U.S. Is Biggest Donor to WHO

The World Health Organization (WHO) relies on donors for 70 percent of its budget. The two largest contributors are the United States and the United Kingdom. WHO's $4.7 billion budget has been flat for decades and is far smaller than the $7 billion budget for the U.S. Centers for Disease Control and Prevention.



** A public charity in Pennsylvania.*

Sources: "Voluntary contributions by fund and by contributor, 2015," World Health Organization, May 13, 2016, https://tinyurl.com/mekl5a3; Donald G. McNeil Jr., "The Campaign to Lead the World Health Organization," The New York Times*, April 3, 2017, http://tinyurl.com/kylbmmu*

Are the World Health Organization and other groups prepared to stop the next pandemic?

Three years after the Ebola outbreak, WHO, the United States and other wealthy nations have made progress toward improving global responses to pandemics, many experts say.

The United States, in partnership with WHO, funded the expansion of the Global Health Security Agenda to work with poor and middle-income countries, particularly in Africa, on preventing, detecting and responding to outbreaks before they become pandemics. [19]

Before the Ebola crisis, all 194 member countries of WHO were supposed to adhere to the organization's international health regulations that specify how to report outbreaks and prevent their proliferation. However, most poor and middle-income countries, such as Liberia and Sierra Leone, were not complying with the regulations. They feared reporting on a disease would harm their economies and lacked the resources to bolster their public health systems, according to a report in the journal *Globalization and Health*. [20]

Ebola galvanized the G-7 countries — Canada, France, Germany, Italy, Japan, the United Kingdom and the United States — to make sure poorer nations had the resources needed to adopt the WHO regulations. [21]

The health agenda has served as a roadmap to help nations prevent or mitigate infectious diseases, detect and report outbreaks when they occur and employ a global network that can respond effectively to an outbreak. The United States also has partnered with the African Union Commission, the administrative branch of the African Union, to create the African Centers for Disease Control and Prevention, which is modeled after the U.S. CDC. [22]

And the U.S. Agency for International Development (USAID) expanded its Emerging Pandemic Threats program, in coordination with WHO, to boost surveillance of potential emerging infections in 20 African and Asian countries. Because about 60 to 75 percent of emerging and re-emerging diseases originate in animals, USAID is training local health workers to detect and respond to pathogens that may be jumping from animals to people. [23]

"Outbreaks are like fires," said Eddy Rubin, chief science officer at Metabiota, a San Francisco startup that developed software to predict and prevent outbreaks. "If you're able to understand where there is a greater likelihood of their occurring and detect them early on, you can shift the impact." [24]

Cameroon has developed an emergency operations center able to respond within 24 hours to an avian flu outbreak. Last year the West African country quickly killed 67,000 birds that could have spread the virus to humans. A year before that, Cameroon took two months to respond to a cholera outbreak. [25]

"I feel quite heartened by what is going on," says John Lange, senior fellow of global health diplomacy at the U.N. Foundation and former U.S. ambassador to Botswana in southern Africa. "The world has woken up to the need to improve capabilities to prepare for infectious disease outbreaks. I think the global community is prepared to fight a pandemic."

Still, global health experts say far more needs to be done.

The Commission on a Global Health Risk Framework for the Future — an international panel that gathered the input of 250 global health experts — declared in 2016 that the world needs to invest at least $3.4 billion annually to strengthen national health systems and spend another $1 billion to speed development of new drugs and to stockpile vaccines. WHO and the World Bank should invest up to $155 million in pandemic preparedness funding, it said. [26]

But WHO is underfunded, say global health experts. Its budget of about $2.2 billion is much smaller than the CDC's budget which was over $7 billion in fiscal 2016. [27]

In addition, WHO's operational structure stymies its ability to respond quickly to outbreaks, health experts say. The organization must contend with the competing priorities of the 194 countries who make up its governing body and the priorities of six regional offices. WHO infighting over the economic impact of declaring an emergency was blamed in part for the organization's failure to respond quickly to Ebola, according to a report in *The Lancet* medical journal in November 2015. [28] It also was slow to respond to the Zika outbreak, experts say.

"While WHO should serve as a global front-line defense against pandemics and bioterror attacks, at the moment, it does not look like it's up to the job," wrote Annie Sparrow, assistant professor of global health at Mount Sinai Hospital in New York City. [29]

On May 23, WHO members elected Dr. Tedros Adhanom Ghebreyesus to be director-general, replacing Margaret Chan of China, who has run the organization since 2007. Many experts say Tedros' leadership will be critical to WHO's ability to respond to a pandemic. [30]

In addition, few vaccines are available for the dozens of viruses posing the greatest global health risks. Yet, pharmaceutical companies in recent decades have devoted less than 1 percent of their research and development budgets to vaccines for emerging diseases, judging the profit margin to be too small. [31]

To counteract that trend, an effort to bolster vaccine research was begun in January by the Bill & Melinda Gates Foundation, the European Commission, six vaccine makers and others. Called the Coalition for Epidemic Preparedness Innovations (CEPI), the group is pledging to develop a vaccine for at least three of the 11 viruses identified by WHO as the most contagious and dangerous: Lassa fever, the Nipah virus and Middle East Respiratory Syndrome (MERS).*

CEPI also is supporting the development of technologies to speed up vaccine development. [32]

"The work that CEPI is doing is really important and could be a game changer," says Dr. Rebecca Katz, co-director of the Center for Global Health Science and Security at Georgetown University. "If we had vaccines for these emerging diseases, then we'd have something in our toolkit to confront these threats."

Is the United States spending enough on pandemic preparedness?

The federal government is spending about $13 billion in fiscal 2017 on programs to improve medical and health infrastructure in the United States, address bioterrorism and prevent pandemic influenza. [33]

While that figure may seem large, it is a tiny fraction of the $3.6 trillion federal budget and is spread among at least 10 federal departments, including Commerce, Health and Human Services and Homeland Security. Related programs are in the Environmental Protection Agency, USAID and the National Science Foundation. [34]

The United States is the largest contributor to WHO, providing about $341 million in 2016. [35]

The effectiveness of U.S. anti-bioterrorism programs is hampered by poor interagency coordination, according to the Center for Health Security at Johns Hopkins University in Baltimore. "Currently, there is no systematic accounting by the federal government of those programs that are essential for building health security," said center senior associate Crystal Watson and senior analyst Matthew Watson in a January memo to President Trump on biosecurity. [36]

Many health experts want the Trump administration to appoint a leader to coordinate all the federal health security programs. The Blue Ribbon Study Panel on Biodefense, a bipartisan nonprofit created in 2014 to assess U.S. biodefense readiness, said that person should be in the White House — preferably the vice president. [37]

"We have questions about who is overseeing the $6 [billion] or $7 billion [for biosecurity] in multiple agencies which seemed to be siloed from one another," said panel co-chair Ridge. "Who is coordinating it? We want it to be the vice president." [38]

Health security experts also worry that spending on U.S. preparedness and response has declined. A frugally minded Congress worried about wasteful spending has cut the CDC's budget about 20 percent since 2008 — to $7.3 billion in fiscal 2017. Meanwhile, public health emergency preparedness spending has dropped from a high of $940 million in 2002 (the year after the Sept. 11 terror attacks on the United States) to $660 million in 2017. [39]

"The threat environment isn't dwindling," says James Blumenstock, chief of health security at the Association of State and Territorial Health Officials, representing various public health agencies. "It's getting more intense, more difficult and more challenging, but resources are leveling off or [have] declined. That isn't a healthy situation."

Despite the cuts, Blumenstock and a number of other experts say U.S. pandemic preparedness has improved dramatically since the 2001 anthrax and terrorist attacks. The U.S. government created national strategies to prevent or respond to an infectious disease outbreak or a bioterrorist event. And this year, the National Health Security Preparedness Index, a collaboration of the nation's health security experts, including the Association of State and Territorial Health Officials and the Robert Wood Johnson Foundation, said the U.S. government has made progress in "health security surveillance" and information-sharing systems. [40]

But the index also said work remains to be done, which is why many health security experts worry about the huge budget cuts Trump has proposed for fiscal 2018 to agencies involved in preparedness. They include an 18 percent cut at the Health and Human Services Department, which would mean a $1.2 billion reduction in funds to the CDC; the latter provides grants to hospitals and international infectious disease programs.

Trump also proposed reducing the National Institutes of Health (NIH) budget by $5.8 billion, including $838 million from the NIH's National Institute of Allergy and Infectious Diseases, which oversees flu and Zika vaccine programs. [41]

The "proposed CDC budget [is] unsafe at any level of enactment," said former CDC Director Tom Friedan. "It would increase illness, death, risks to Americans, and health care costs." [42]

Trump has also proposed a 33 percent cut in the State Department budget, which could reduce U.S. funding for WHO and USAID health-related programs. And he has proposed a 21 percent cut in the Agriculture Department's budget, even though the Government Accountability Office (GAO) said in a report in April that the department faces "ongoing challenges" getting poultry farmers to control viruses in birds with pandemic potential. [43] Controlling bird viruses is especially important because eggs are used to produce flu vaccines.

As funding for health security preparedness has declined, Congress has funded the U.S. response to outbreaks disease by disease, after a disease reaches crisis level, health officials say. With the Ebola and Zika outbreaks, the Obama administration had to ask for supplemental money to fight both. "We literally had to rob Peter to pay Paul," said Ron Klain, President Obama's Ebola czar. [44]

Health experts prefer a permanent emergency-response fund for public health threats, similar to that earmarked for natural disasters at the Federal Emergency Management Agency (FEMA). When a hurricane or flood strikes, FEMA can

---

* Lassa, spread by rodents, is a hemorrhagic illness that kills about 1 percent to 15 percent who contract it and is endemic in parts of Africa. Nipah, spread by fruit bats, can cause severe brain inflammation. It can be found in parts of Asia and Australia and has a fatality rate of 40 to 75 percent. MERS, spread through contact with camels, causes severe respiratory disease and has a mortality rate of about 36 percent.

Ebola Killed Thousands in West Africa

The largest outbreak of the Ebola virus in history occurred primarily in three West African countries between 2014 and 2016. Sierra Leone had the most cases and Liberia the most deaths. The World Health Organization declared the virus a "public health emergency of international concern" in August 2014, but the epidemic did not spread widely enough to be classified as a pandemic.

Source: "Ebola Situation Reports," World HealthOrganization, March 27, 2016, http://tinyurl.com/q4j88p7

tap the fund to help local communities.

"It would be an example of good government if we were able to put something in place to ensure that [health emergency] responses can get dealt with quickly," said Matthew Watson, former managing senior analyst of the Center for Health Security at the University of Pittsburgh Medical Center. Watson is now a senior managing analyst at Johns Hopkins Center for Health Security. [45]

Should governments mandate quarantines and vaccinations to prevent pandemics?

The U.S. government has the authority to restrict the movement of Americans and can block sick people from entering the country. But many public health officials say quarantines can spark panic and worsen an outbreak. [46]

Quarantines involve sequestering individuals who may have been exposed to an infection and monitoring them during the contagious period.

In extreme cases when an epidemic has no known medical treatment, a nation can close its borders to all travelers from a country experiencing an outbreak — something Trump as a private citizen recommended in 2014 during the Ebola outbreak. [47]

With Ebola spreading that year, Liberia deployed riot police to shut off neighborhoods in the capital after people raided an Ebola center and stole medical equipment. When people tried to flee the quarantine, the government cracked down. Violence followed, and the country had to end the quarantine. In neighboring Sierra Leone, the government imposed a three-day national quarantine, but some people fled instead. [48]

"If you tell people that a deadly disease is afoot and you can't leave, people will always try to leave," says In-Q-Tel's O'Toole.

A WHO task force in 2014 said traveler quarantines are ineffective and recommended nations not impose them during the Ebola crisis. Quarantines on trade and travel bans "can create a false impression of control," it said. "Such measures may also adversely reduce essential trade, including shipments of food, fuel and medical equipment to the affected countries, contributing to their humanitarian and economic hardship." [49]

Quarantines can work if a person with an incubating disease is identified and complies with the quarantine, said Richard Schabas, former chief of staff at Canada's York Central Hospital in Richmond Hill, Ontario. [50]

To get people to comply, authorities must engage communities and seek their cooperation, says Khan, former director of the CDC's Office of Public Health Preparedness and Response. "Making an effort to understand what people are going through, what they believe, what they fear and then trying to come up with a solution that doesn't push people to hide or flee can solve an outbreak of a magnitude like Ebola," he said.

The 2014 Ebola crisis in Sierra Leone and Guinea was contained after health care workers learned to track patients with potential exposure and got them to agree to limit their exposure to others for 21 days. [51]

In the United States, the CDC has authority to impose a quarantine on people with cholera, diphtheria, tuberculosis plague, smallpox, yellow fever, hemorrhagic illnesses such as Ebola or severe respiratory syndromes like a flu that can cause a pandemic. [52]

The CDC in January issued new guidelines giving it broad authority to quarantine individuals for 72 hours if officials suspect someone poses a risk. [53] The new rules were necessary because the agency "has been operating its infectious disease powers under really antiquated regulations," said Lawrence Gostin, a professor of global health law at Georgetown University. [54]

However, the new powers raise concerns that Americans' civil liberties could be threatened, said Northeastern University health policy law professor Wendy Parmet. [55]

When American nurse Kaci Hickox returned from volunteering in Sierra Leone during the Ebola outbreak, she landed at Newark Liberty International Airport in New Jersey and was flagged for extra screening. Although she had no symptoms, Republican Gov. Chris Christie ordered her quarantined in a tent at the airport; she was released three days later. Hickox sued the state, saying "my liberty,

my interests and consequently my civil rights were ignored because some ambitious governors saw an opportunity to use an age-old political tactic: fear." Christie defended his actions, and New Jersey is contesting the suit. [56]

As for mandating vaccinations, public health experts say vaccines are the most effective way to stem the spread of infectious diseases, such as diphtheria and measles. Each year, vaccines for infectious diseases save 3 million lives, and 3 million more children around the world could be saved if they were vaccinated, according to the Children's Hospital of Philadelphia. [57]

"Immunizations are the safest, longest-lasting and most effective way to prevent communicable diseases," said Dr. Ian Gemmill, past chair of the Canadian Coalition for Immunization Awareness and Promotion, a nongovernmental advocacy organization. [58]

In the United States, in the event of a spreading contagion overseas, the federal government could ask immigrants at the border to show proof of vaccination. But inside the country, only the states have the authority to mandate vaccinations.

All 50 states and the District of Columbia require children to be vaccinated — typically for diphtheria, measles, rubella and polio — before they can attend public school, but some states allow exemptions for medical, religious or philosophical reasons. [59]

Since 1998, a small but growing number of parents have been refusing vaccinations for their children due to fears that vaccines cause autism. The fears stem from a now discredited study that a British scientist said demonstrated an association between autism and vaccination. [60]

Countless studies have shown the safety of vaccinations. Nevertheless, childhood vaccination rates have fallen. The decline has caused measles outbreaks to flare, most recently in Minnesota, where 44 unvaccinated children in a Somali community contracted the disease. [61]

Parental fears have been supported by some celebrities and prominent politicians such as Christie; Housing and Urban Development Secretary Ben Carson, a neurosurgeon; and Sen. Rand Paul, a physician and Kentucky Republican, who say vaccination decisions should be left to parents.

"I think the parent should have input," Paul said. "The state doesn't own your children. You own your children, and it is an issue of freedom." [62]

Trump invigorated the anti-vaccine movement when he said — contradicting the numerous studies — during a 2015 Republican presidential debate: "You take this little beautiful baby, and you pump — I mean, it looks like just it's meant for a horse and not for a child," he said. "We had so many instances . . . a beautiful child, went to have the vaccine and came back and a week later got a tremendous fever, got very, very sick. Now is autistic." He is considering creating a commission to look into vaccine safety. [63]

At least 19 states have passed legislation since 2001 allowing mandated vaccinations during a health emergency, but experts say ongoing doubts about vaccines' safety could make people resistant to such requirements. Opponents, on the other hand, say the measures "could allow governments to abuse their power," said the American Civil Liberties Union. [64] ■

AFP/Getty Images/Zoom Dosso

Workers prepare to bury an Ebola victim in Monrovia, Liberia, on Jan. 5, 2015. The largest outbreak of the Ebola virus, spread by bats, monkeys and other animals, occurred primarily in West Africa between 2014 and 2016. More than 11,000 people died. Experts say the toll would have been lower if the global health community had responded more quickly to the crisis.

BACKGROUND

First Pandemics

Humans have been threatened by pandemics for most of history.

Scientists believe widespread infections began when humans domesticated animals about 10,000 to 15,000 years ago, coming in contact with an army of bacteria, viruses and fungi that could pass to humans. Most of these microbes were harmless, but some evolved to become pathogenic. Throughout history, 60 to 75 percent of emerging infectious diseases can be traced to furred or winged animals. [65]

The animal microbes that became harmful to humans spread by direct person-to-person contact, such as through coughing, sneezing, sweating or sexual interaction. Fleas, mosquitos and other carriers (known as vectors) can spread disease when they bit animals and then humans. From cows came measles and tuberculosis; from pigs and birds, influenza; from primates and mosquitos, malaria; and from bats, Ebola. Rats have been particularly lethal to humans as the source, through fleas, of the bubonic plague of the Middle Ages, which killed an estimated 20-25 million in Europe over five years.

At first, dangerous diseases spread slowly because people lived in small, isolated groups. But as agriculture took hold in about 9,000 B.C., populations grew and humans ventured farther from their homes to trade and wage war. [66]

"Global transportation networks, exploration, conquest and trade" enabled diseases endemic in one region to spread, blossoming into epidemics elsewhere as new populations without immunity were exposed to them, said Peter Daszak, a scientist who is president of the EcoHealth Alliance, a global health research group. [67]

For centuries, people were virtually helpless to stop the spread of disease. People thought diseases were caused by imbalances in the body, evil spirits or the will of God. Living conditions, meanwhile, contributed to the spread of contagions. Many humans lived in houses along with their livestock. Human excrement and garbage were dumped onto streets. One of the few tools societies had to prevent disease was to separate sick people from the healthy. [68]

Plague and Quarantines

Bubonic plague prompted one of the first society-wide responses to a pandemic.

In October 1347, a dozen Genoese trading ships docked in Sicily after journeying to ports along the Black Sea. The ships likely contained rats that harbored *Yersinia pestis*, the bacterium causing bubonic plague. The bacterium lived inside the fleas that fed off the rats. When the rats died, the fleas jumped to the nearest warm mammal, usually humans. Eventually the pathogen became known as "the Black Death" because people would develop skin boils that turned black before they died. [69]

The plague spread throughout Italy, wiping out entire towns. In 1348, Venetian leaders cut off access to outsiders. Boats from areas suspected of having a plague outbreak were kept away. Travelers coming from areas beyond Venice were told to wait up to 40 days before they could enter. "Quarantine" is derived from the Italian words *quarante giorni*, or 40 days. [70]

The containment was effective because symptoms became visible within 40 days and after that people could be considered "medically harmless." Some historians credit the use of quarantines with Europe's ultimate control of the plague, which largely disappeared by the mid-19th century. [71]

Quarantines also were used during the worst pandemic in modern history — the Spanish flu outbreak in 1918. Governments in the United States and Europe closed schools, churches and theaters and banned most public gatherings. However, the CDC said the quarantines and closures were ineffective because "the measures were implemented too late and in an uncoordinated manner." [72]

Modern quarantines face new challenges, as the 2003 SARS outbreak showed. SARS is a respiratory coronavirus that scientists had never seen before. It originated in Guangdong province in China and became a global threat because it spread rapidly along air-travel routes. The illness went from Hong Kong to Southeast Asia, to Canada and then Europe. It sickened more than 8,000 worldwide and killed 774. [73]

China's government quickly imposed quarantines, closing off buildings inhabited by infected individuals and imposing checkpoints. Violators were punished.

SARS died out at the end of 2003. Some public health officials believe the quarantines worked because SARS had an incubation period of two to 10 days, which gave governments time to limit people's interactions. [74]

Vaccines and Antibiotics

As far back as A.D. 1000, the Chinese used an inoculation technique, called variolation, against smallpox, a virus that causes fever and disfiguring pustules. Physicians would take ground smallpox scab and insert it in the noses of healthy people, inducing a mild form of the disease and thus creating immunity against smallpox. [75]

Vaccination began in 1796 with English doctor Edward Jenner. He had long heard stories of how milkmaids were immune from smallpox, which according to one estimate was killing 400,000 Europeans a year during the 18th century. Jenner found a milkmaid with fresh lesions from cowpox, a mild virus related to smallpox, and he inserted pus from her cowpox into a cut on an 8-year-old boy's arm. The boy became immune to smallpox, proving a person could be protected from smallpox without being directly exposed to it. [76]

By the end of the 19th century, governments in Egypt, Germany began mandating vaccination against smallpox. Great Britain in 1853 required children to be vaccinated, while in the United States, Massachusetts in 1809 became the first state to mandate smallpox vaccination. In 1813, President James Madison created the National Vaccine Agency to encourage vaccinations. [77]

In the late 1880s, microscopes had improved enough that scientists could see bacteria and viruses, paving the way for medical treatments, the understanding of how disease spreads from animals

Continued on p. 468

Chronology

1300s-1800s

Medical breakthroughs give hope for preventing pandemics.

1347
"The Black Death" — a bubonic plague — travels from Crimea to Europe; 20 to 25 million die over the next five years.

1348
Venice responds to the plague by imposing the world's first quarantine, isolating incoming ships for 40 days.

1796
English physician Edward Jenner inoculates a boy with cowpox, immunizing him against smallpox, ushering in vaccination.

1817
Cholera spreads worldwide from Calcutta, India.

1851
Sanitary conference focusing on cholera meets in Paris, marking the first gathering of international health leaders.

1854
Physician John Snow recognizes dirty water as the source of a cholera outbreak. He hastens end of the outbreak by shutting off a London water pump.

1894
Alexandre Yersin, a French bacteriologist, discovers the bacillus responsible for bubonic plague.

1900s-1940s

Health cooperation expands.

1918
"Spanish flu," the first pandemic involving the H1N1 influenza, kills 20-50 million.

1928
Scottish biologist Alexander Fleming discovers penicillin at a London hospital.

1940
Japan spreads plague-infested fleas over China during World War II; it also is accused of encasing disease-causing microbes in bombs.

1948
United Nations creates the World Health Organization (WHO).

1950s-1970s

As global cooperation ends many diseases, others emerge.

1953
U.S. researcher Jonas Salk creates the polio vaccine.

1967
WHO begins immunization campaign to eliminate smallpox, declaring it eradicated in 1980.

1972
Biological Weapons Convention, the first multilateral disarmament treaty banning development, production and stockpiling of biological weapons, is signed.

1974
WHO launches vaccine campaign to eliminate six diseases — diphtheria, pertussis, tetanus, measles, polio and tuberculosis.

2000s-Present

Antibiotic-resistant microbes fuel pandemic fears.

2001
An American scientist is accused of sending anonymous letters containing anthrax spores to news organizations in two states and to the Washington offices of two Democratic senators, killing five people and infecting 17 others. The attacks spur heavy investment in bioterrorism prevention.

2003
Severe acute respiratory syndrome (SARS), a type of pneumonia, spreads rapidly from China.

2005
U.S. creates the National Strategy for Pandemic Influenza, outlining how the nation would respond to a flu pandemic.

2009
"Swine flu" pandemic spreads worldwide; up to 575,000 die.

2013
The Centers for Disease Control and Prevention issues first-ever report on the threat the U.S. faces from antibiotic-resistant organisms, or "superbugs."

2014
Ebola emerges in three West African countries, killing more than 11,000. . . . U.S. expands the Global Health Security Agenda, an international partnership aimed at bolstering safeguards against infectious disease.

2016
WHO declares Zika a global health emergency as the mosquito-borne virus hits the southern U.S. . . . A Nevada woman dies from an infection resistant to all 26 antibiotics approved for use in the U.S.

2016-2017
China experiences its fifth epidemic of H7N9 influenza, a bird flu virus.

Waging War on Superbugs

"In China and India, there are bacteria resistant to all antibiotics."

Inside the sprawling Walter Reed Army Institute of Research in Silver Spring, Md., microbiologist Patrick McGann spends much of his time growing "superbugs" — antibiotic-resistant strains of bacteria.

A year ago, McGann and his team learned of a Pennsylvania woman infected with a strain of *E. coli* bacteria resistant to colistin, an antibiotic used when all others fail. Other antibiotics were effective against the bug, but public health officials were still alarmed. If the woman's strain combined with other antibiotic-resistant bugs, the world could be on the brink of an unstoppable outbreak. [1]

"In some ways, I think we aren't on the cusp of a post-antibiotic world; we are already there," says McGann, chief of molecular research and diagnostics at Walter Reed's Multidrug Resistant Organism Repository and Surveillance Network (MRSN). "In China and India, there are now bacteria resistant to all antibiotics."

McGann points to a 70-year-old woman who died in September 2016 in Nevada from a bacterium resistant to all approved antibiotics in the United States. The woman had traveled to India and been hospitalized there for a broken leg. [2]

At least 2 million people in the United States contract an antibiotic-resistant bacterium each year and 23,000 die as a result, according to estimates from the Centers for Disease Control and Prevention (CDC). Antibiotic-resistant bugs may kill 700,000 people worldwide annually. [3]

Microbes have mutated to resist human attempts to kill them ever since antibiotics became widely used in the 1940s. Antibiotics have all but eliminated the threat of sepsis, tuberculosis, plague, cholera and other diseases that once killed millions. But antibiotics' overuse on humans and animals has spawned a growing number of resistant superbugs.

The Army created the MRSN in 2009 to monitor potential outbreaks of dangerous pathogens inside the military. Part of McGann's work is to quickly identify superbugs and then seek to keep them from spreading. His lab houses genome-sequencing machines that categorize bacteria and search for pathogens that may have mutated to resist antibiotics.

Such work allowed McGann to discover the Pennsylvania woman's superbug, which carried a colistin-resistant gene called mcr-1. Researchers first found the gene in 2015 in pigs and people in China, where farmers had regularly used colistin in animal feed to promote growth. [4]

The colistin-resistant bacteria has since spread and been found in more than 30 additional countries, including the United States. In response, China has banned the use of colistin in animal feed.

McGann found a second U.S. patient, a former military officer living in Bahrain, with bacteria carrying the mcr-1. His body

Continued from p. 466

to humans and the connection between sanitary conditions and health.

Physicians now understood that contaminated water was making people sick with cholera and that bacterium carried by fleas had caused the bubonic plague. Breakthroughs followed. Researchers developed vaccines for plague (1897), typhoid (1899), cholera (1911), diphtheria (1914) and tuberculosis (1921). Vaccines for polio (1955), measles (1963), mumps (1967) and rubella (1969) came next. [78]

In 1928, Alexander Fleming discovered antibiotics, which came to be widely used to treat soldiers during World War II. Antibiotics changed the course of medicine because they could kill most bacteria that plagued humans at the time. [79]

After World War II, the world community expanded efforts to work together to prevent pandemics. In 1948, the newly founded United Nations created the World Health Organization to coordinate global efforts on health issues, and WHO became the leading global institution on epidemic control.

"The bottom line is, readiness for a pandemic is connected to our world solidarity," Laurie Garrett, a senior fellow at the Council on Foreign Relations think tank, says of WHO's importance.

Scientists, meanwhile, continued reducing the death toll from infectious diseases. With dozens of vaccines and antibiotics to use, average life expectancy in the United States rose to 78.8 by 2015, up from 48.3 for women and 46.3 for men in 1900. [80]

But nature had some surprises. Flu viruses can't be contained. Although flu virus was discovered in 1933 and the first vaccine produced in 1942, scientists learned that flu viruses constantly mutate. Frequent vaccinations are necessary to prevent flu. Because flu changes so quickly, drug companies don't always make a vaccine that is an exact match for a virus.

Since 1500, 14 or more flu pandemics have been recorded, with six occurring in the past 140 years — in 1889, 1918, 1957, 1968, 1977 and 2009, according to a 2010 report in the journal *Public Health*. [81]

The 2009 outbreak of H1N1, or swine flu, moved from birds to pigs and then to humans. It was first reported as a cluster of cases in Mexico. Initially, death rates were said to be 8 percent, making it almost as deadly as the 2003 SARS outbreak. The CDC then began receiving reports of swine flu spreading in the United States and five other countries. [82]

Hospitals, at the beginning, were overwhelmed with patients. It took more than six months for drug companies to

fought the bacteria on its own and he recovered, says McGann. The woman who died in Nevada didn't have a bacterium with the mcr-1 gene, and scientists are still working on understanding how her bacteria became resistant.

McGann's lab is part of the CDC's National Action Plan for Combating Antibiotic Resistant Bacteria, which coordinates efforts across federal agencies and sets goals for reducing the spread of antibiotic-resistant bugs and inappropriate use of antibiotics in medicine and agriculture. [5]

In April, the CDC tapped state health department laboratories in Maryland, Minnesota, New York, Tennessee, Texas and Washington to help with testing for antibiotic-resistant bugs, according to McGann. The CDC chose these labs for strategic regional reasons. Before this, state and local labs weren't equipped to perform such tests, so it is unclear how many superbugs may be circulating in the United States.

"The more we watch for these bugs, the faster we will pick up on this," McGann says of the fight to prevent a pandemic of antibiotic-resistant disease.

— Bara Vaida

Getty Images/*The Washington Post*/Bill O'Leary

Microbiologist Patrick McGann, with research scientist Rosslyn Maybank, studies "superbugs" at the Walter Reed Army Institute of Research in Silver Spring, Md.

[1] Lena H. Sun and Brady Dennis, "The superbug that doctors have been dreading just reached the U.S.," *The Washington Post*, May 27, 2016, http://tinyurl.com/mmsqnhl.

[2] Lei Chan *et al.*, "Notes from the Field: Pan-Resistant New Delhi Metallo-Beta-Lactamase-Producing Klebsiella Pneumonia — Washoe County, Nevada, 2016," Centers for Disease Control and Prevention, Jan. 13, 2017, http://tinyurl.com/zklmrwb.

[3] "Antibiotic/Antimicrobial Resistance," Centers for Disease Control and Prevention, http://tinyurl.com/la3tgtj; Maryn McKenna, "The Coming Cost of Superbugs: 10 Million Deaths per Year," *Wired*, Dec. 15, 2014, http://tinyurl.com/m7prunp.

[4] Sun and Dennis, *op. cit.*; Chris Dall, "Studies show spread of MCR-1 gene in China," Center for Infectious Disease Research and Policy, Jan. 27, 2017, http://tinyurl.com/mkw2t8e.

[5] "National Action Plan for Combating Antibiotic-Resistant Bacteria," The White House, March 2015, http://tinyurl.com/nylq9ey.

create an H1N1 vaccine. Fortunately, the flu proved not to be as lethal as the first reports from Mexico. Within the year, about 24 percent of the world was infected with the swine flu, showing how quickly a flu can spread, but the death rate was just 0.02 percent. Approximately 24,000 Americans die annually from the flu, but only about 17,000 Americans died from the swine flu. [83]

"With H1N1, we got lucky," says Dr. Stacey Schultz-Cherry, deputy director of St. Jude Children's Research Hospital's Center of Excellence in Influenza Research and Surveillance.

Bioterror Threats

On many occasions during the past 2,000 years, military leaders have used biological agents in the form of disease, human cadavers and animals. In preparing for a naval battle against King Eumenes of Pergamum (modern-day Turkey) in 184 B.C., Hannibal, the leader of Carthage (Tunisia), directed his sailors to fill earthen pots filled with "serpents of every kind" and launch them at enemy ships.

During the French and Indian War (1754-63), Sir Jeffrey Amherst, commander of the British forces in North America, devised a plan to send blankets infected with smallpox to Indians hostile to the British. The move triggered an epidemic among tribes in the Ohio River Valley.

Biological warfare efforts accelerated during the two world wars. In World War I, vials of anthrax were found in the luggage of a captured German spy, intended to infect animals used by the Allies. During World War II, Japan unleashed plague-infested fleas and contaminated rice in China, causing 10,000 casualties.

By the 1960s, the U.S. military had developed a biological arsenal that included numerous weaponized pathogens. Canada, France, Britain and the Soviet Union also had germ-warfare research programs. [84]

During the late 1960s, international concerns arose about the risks such programs posed to society. In 1972 a U.N. convention prohibited the development, production and stockpiling of infectious diseases. The agreement was signed by 103 countries, and since then the United States and most other countries have engaged only in biodefense research. The Soviet Union, however, continued its biological weapons program, called Biopreparat. During the late 1990s, the United States learned that before its demise, the Soviet Union had been developing dangerous pathogens, including anthrax, plague, smallpox and toxic bugs.

Experts Warn of Growing Bioterrorism Threat

"The risk of bioterrorism goes up every day."

In 2014, a laptop belonging to an Islamic State fighter fell into the hands of Syrian rebels. Its contents raised fresh alarms about the jihadist group's plans. The ISIS fighter, a chemist and physicist identified as Muhammad S., had been teaching himself to develop biological weapons and, most alarmingly, to weaponize the bubonic plague.

"The advantage of biological weapons is that they do not cost a lot of money, while the human casualties can be huge," said a document found on the laptop. [1]

Just how close ISIS and other jihadist groups are to developing such a weapon is unknown, but U.S. intelligence sources believe "there are a lot of terrorists that keep working on it," says Jeff Schlegelmilch, deputy director of the National Center for Disaster Preparedness at Columbia University's Earth Institute.

Under the 1972 Biological Weapons Convention, all United Nations member countries pledged not to develop or stockpile weaponized biological and toxic agents. [2] But the convention had no enforcement mechanism, and states like North Korea, China, Iran and Israel are believed to have developed weapons. Syria violated the accord by using chemical weapons on at least four occasions since December 2016, including one in April on a rebel-held town, which prompted the Trump administration to order a U.S. missile attack on a Syrian air base in April. [3]

The Soviet Union developed a program called Biopreparat that produced tons of anthrax and smallpox virus, some for use in intercontinental ballistic missiles. After the Soviet Union collapsed in 1991, the United States worked with the Russians to dismantle the Biopreparat lab. [4]

Accessing pathogens and turning them into a biological weapon doesn't require the backing of a nation-state, experts say. Only determination and access to medical supplies or a laboratory are required, as the Oregon town of The Dalles discovered in 1984. A religious sect called the Rajneeshees obtained a bacterial strain of salmonella from a commercial medical supply company and spread it on salad bars to try to disrupt a local election. More than 750 in the town of 10,000 were sickened. At the time, this was the largest bioterrorist attack in the country.

Then in 2001, someone created a blend of anthrax spores and weaponized them. According to investigators, Army scientist Bruce Ivins sent the spores to the media and members of Congress in the mail, killing five people in what remains the nation's worst bioterrorist attack. Some scientists, however, questioned the investigation's findings and doubts remain whether Ivins was the culprit. He killed himself before he was charged in the case. [5]

Many security experts today remain worried that another rogue scientist or an individual with some laboratory skills could wreak havoc. New technology can alter viruses and bacteria and make them more infectious or impervious to current treatments. These tools are widely available on the internet.

"Technology gets simpler and easier every day, and the risk of bioterrorism goes up every day," says Dr. Ali Khan, former director of the CDC's Office of Public Health Preparedness and Response.

Tara O'Toole, executive vice president at In-Q-Tel, a venture capital firm in Arlington, Va., specializing in security technology, says even nonscientists could use gene-editing tools available on the internet to develop dangerous biological agents and devise ways to disperse them.

All were ready to be deployed via a missile. [85]

In 2001, just weeks after the Sept. 11 terrorist attacks on New York City and the Pentagon, letters filled with anthrax were sent to some news media and members of Congress. A massive investigation concluded that a mentally ill biodefense researcher was the source of the letters, which infected 22 people and killed five. The suspect killed himself before he was charged, and some experts doubt he was the culprit. [86]

The government by some estimates spent as much as $1 billion testing and cleaning up the contaminated government buildings and the mail-sorting centers that handled the letters. The incident awoke many Americans to the possibility that the country was vulnerable to bioterrorism attack, not only from a terrorist organization but also from a deranged scientist. [87]

With advances in genetic engineering, a skilled scientist could alter a virus or bacterium in a lab and design it to be impervious to vaccines and antibiotics. "We no longer can concern ourselves just with highly funded national and international defense labs," wrote Michael Osterholm and Mark Olshaker in their 2017 book, *Deadliest Enemy: Our War Against Killer Germs*. "Information on how to gin up a potential killer microbe with new lab technology tools is readily available on the Internet." [88] ■

CURRENT SITUATION

Emerging Threats

Hundreds of infections are constantly emerging around the world and spreading among and between animals and humans.

During one week at the beginning of May, there were 847 alerts about a patient or group of patients with potentially dangerous infectious diseases ranging from

In the bioterror version of a suicide bombing, a terrorist group also could infect people with a contagious respiratory disease and send them on multiple airline flights to spread the virus worldwide, along the lines of the 1995 movie "12 Monkeys."

"Bioterrorism remains one of the top two threats to the country, the other one being a nuclear attack," says O'Toole.

After the anthrax attacks in 2001, the United States spent more than $30 billion on programs to respond to a potential biological attack. For example, Project BioShield directs the federal government to stockpile medical countermeasures in case of a chemical, biological or nuclear attack. [6] Another program, BioWatch, is designed to detect airborne disease in major U.S. cities. [7]

"Those systems proved to be extremely valuable for the whole of the U.S. health system," says Schlegelmilch.

But Congress has cut spending on bioterrorism response by hundreds of millions of dollars in recent years. Further, BioWatch's systems for detecting airborne pathogens are old and unreliable, former Homeland Security Secretary Tom Ridge told a National Association of County and City Health Officials (NACCHO) conference on April 25. [8]

"We need a better disease and surveillance system to replace BioWatch," he said. Ridge, the nation's first Homeland Security secretary, co-chairs the Blue Ribbon Study Panel on Biodefense, created in 2014 to address gaps in the nation's biodefenses. The organization has made 33 recommendations to Congress including designating the vice president to be the lead federal coordinator in the event of a bio emergency.

"We have a lot in place to respond to and prevent biological and pandemics and biological terrorist attack, but the programs have atrophied," former Sen. Joseph Lieberman, an independent from Connecticut who is co-chair of the Blue Ribbon panel, said at the April NACCHO conference. "You get less focused on a problem that hasn't occurred lately. That makes you unprepared for when it does happen. So God forbid there should be another bioterrorism attack or infectious disease outbreak." [9]

— Bara Vaida

---

[1] Harald Doornbos and Jenan Moussa, "Found: The Islamic State's Terror Laptop of Doom," *ForeignPolicy.com*, Aug. 28, 2014, http://tinyurl.com/kqjkxes.

[2] "Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction (BWC)," U.S. Department of State, March 26, 1975, http://tinyurl.com/m9ywuje.

[3] "North Korea's Biological Weapon Program," *Biological Warfare Blog*, April 2, 2014, http://tinyurl.com/kcel9jw; Missy Ryan, "Chemical attack in Syria that drew U.S. response was just one in a series, rights group alleges," *The Washington Post*, May 1, 2017, http://tinyurl.com/mh63voo.

[4] Michael T. Osterholm and Mark Olshaker, *Deadliest Enemy: Our War Against Killer Germs* (2017).

[5] Mara Bovsun, "750 sickened in Oregon restaurants as cult known as the Rajneeshees spread salmonella in town of The Dalles," *N.Y. Daily News*, June 15, 2013, http://tinyurl.com/karkvvk; Joby Warrick, "FBI investigation of 2001 anthrax attacks concluded; U.S. releases details," *The Washington Post*, Feb. 20, 2010, http://tinyurl.com/ybgtvr2.

[6] Milton Leitenberg, "Assessing the Biological Weapons and Bioterrorism Threat," Strategic Studies Institute, December 2005, http://tinyurl.com/k34nbv3.

[7] Frank Gottron, "Science and Technology Issues in the 115th Congress," Congressional Research Service, March 14, 2017, http://tinyurl.com/k6fzook.

[8] Tom Ridge remarks via webcast of Preparedness Summit, National Association of County and City Health Officials conference, April 25-28, 2017, http://tinyurl.com/lbhfd5d. For more on the conference, see Preparedness Summit, http://tinyurl.com/ozfwfb5, and "Biodefense advocates take on U.S. preparedness funding fight," *Homeland Preparedness News*, April 25, 2017, http://tinyurl.com/lkk637z.

[9] *Ibid.*, webcast of the April 25-28 conference.

Zika, Ebola and measles to yellow fever. Poultry, swine and cow illnesses were reported, too, according to HealthMap, a website that tracks infectious disease outbreaks worldwide. [89]

"Are we sitting on the edge of the next pandemic? I hope not," says Osterholm of the Center for Infectious Disease Research and Policy. "But could it happen tomorrow? Yes."

WHO is tracking these outbreaks through its Global Outbreak Alert and Response Network, which links local, regional, national and international networks of laboratories and medical centers. The organization also monitors flu outbreaks through its Global Influenza Surveillance and Response System, which is connected to hundreds of laboratories around the world. [90]

The most worrisome potential outbreak could be in China. A growing market for poultry in that nation has led to an explosion in chicken farming. In Shanghai alone, farmers hatch 100 million chickens a month, increasing the opportunity for novel influenza viruses to thrive.

One of those, the H7N9 virus, has been circulating among birds for years but has mutated to become more dangerous for both birds and humans handling the birds. The virus' changes are raising worries that it might lead to a pandemic, according to *Eurosurveillance*, Europe's journal of infectious disease epidemiology. [91]

China has reported more than 700 cases of H7N9 in humans and 203 deaths since October 2016. Nearly every victim was exposed to poultry, although a few cases may have been transmitted between individuals. [92]

Other outbreaks at the end of April included measles in Italy and Romania and yellow fever in Brazil. There also were outbreaks of MERS and three viruses — Lassa fever, Nipah and Crimean-Congo hemorrhagic fever. In early May, WHO reported an outbreak of Ebola in the Democratic Republic of Congo; by mid-May, four people had died and the number of cases had risen to 37. [93]

Experts say climate change increases the pandemic risk because certain dis-

eases, such as Zika, thrive in hot and humid regions. Warming temperatures also increase the populations of disease carriers — mosquitos and parasites — making disease transmission easier. [94]

Leadership Vacuum

During this time of global risk, health policy experts are particularly worried about leadership gaps in the health community. [95]

Within the White House, the Trump administration's National Security Council (NSC) doesn't have a point person on global health security, although the White House told *The Washington Post* that Trump's homeland security adviser at the NSC, Thomas Bossert, has global health in his overall portfolio. Both Presidents George W. Bush and Obama dedicated one person solely to global health security.

At the Health and Human Services Department, Trump has yet to nominate anyone to serve as assistant secretary for preparedness and response. [96]

The president also has not named a permanent director at the CDC. Dr. Anne Schuchat, a respected CDC veteran, is running the agency, but because she's only acting director, her ability to mobilize resources during an emergency could be stymied, experts say. [97]

At the Defense Department, the administration has not nominated an assistant secretary for nuclear, chemical and biological defense, who would oversee the global emerging infectious disease surveillance and response programs, as well as the National Center for Medical Intelligence. [98]

"No one is in charge" of bioterrorism strategy, says In-Q-Tel's O'Toole, which is worrisome because "this is a national security issue. As Bill Gates says, the only thing that can kill millions of people is a bioterrorist attack or a pandemic."

Many health security experts were pleased when the Trump administration in early May nominated former Rep. Mark Green, R-Wis., to run USAID. Green was an ambassador to Tanzania under President George W. Bush and worked on his global AIDS initiative. Many health experts see him as an advocate for international aid programs.

Getty Images/Mario Tama

One-year-old twins Heloisa and Heloa Barbosa of Areia, Brazil, were born with microcephaly after their mother was bitten by a mosquito with the Zika virus. Although technological advances have enabled scientists to develop new vaccines faster, including one for Zika, vaccines exist for only a fraction of the 300 or so known infectious diseases.

"Mark Green is a really strong choice to head USAID," Jeremy Konyndyk, former head of the agency's Office of U.S. Foreign Disaster Assistance, told NPR. [99]

The U.N. Foundation's Lange says he is not too worried about the lack of nominees. Most of the positions are filled by experienced acting caretakers such as Schuchat at the CDC, he says. "The people that are there are of very high caliber and in a real emergency, their expertise [would] prevail," Lange says.

Health and Human Services Secretary Tom Price assured Congress in March that health security is a top priority for the administration and that it would provide resources to fund preparedness.

"This is an absolute priority," Price testified at a March 29 hearing of the House Appropriations Subcommittee on Labor, Health and Human Services, Education and Related Agencies. When asked if HHS would have the money it needs to fund public health emergency preparedness, he said: "The American people expect us to be prepared and to be able to respond in the event of a challenge, especially in a bioterror area." [100]

WHO, too, is in the middle of a leadership transition as Tedros readies to become director-general. His election came as the organization struggles with financial challenges and an ongoing restructuring to better respond to emergency health outbreaks like Ebola. In May, The Associated Press published a scathing report criticizing WHO's $200 million travel budget, which is more than the agency devotes to AIDS, malaria and tuberculosis combined. [101]

Although WHO began a capital drive in 2015 for an emergency contingency fund for pandemics, some experts say that without decisive leadership the organization has been unable to reach its goal of $100 million. Tedros is a malaria expert who will have his work cut out for him. He is best known for drastically reducing deaths from malaria, AIDS, tuberculosis and neonatal problems when he was Ethiopia's health minister. [102]

Continued on p. 474

Should governments mandate quarantines?

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

EXCERPTED FROM CDC WEBSITE

Isolation and quarantine help protect the public by preventing exposure to people who have or may have a contagious disease. Isolation involves separating sick people with a contagious disease from people who are not sick. . . .

The duration and scope of quarantine measures would vary, depending on their purpose and what is known about the incubation period (how long it takes for symptoms to develop after exposure) of the disease-causing agent.

If people in a certain area were potentially exposed to a contagious disease, this is what would happen: State and local health authorities would let people know that they may have been exposed and would direct them to get medical attention, undergo diagnostic tests, and stay at home, limiting their contact with people who have not been exposed to the disease. Only rarely would federal, state, or local health authorities issue an "order" for quarantine and isolation.

However, both quarantine and isolation may be compelled on a mandatory basis through legal authority as well as conducted on a voluntary basis. States have the authority to declare and enforce quarantine and isolation within their borders. This authority varies widely, depending on state laws. It derives from the authority of state governments granted by the U.S. Constitution to enact laws and promote regulations to safeguard the health and welfare of people within state borders.

Further, at the national level, the CDC may detain, medically examine or conditionally release persons suspected of having certain contagious diseases. This authority applies to individuals arriving from foreign countries, including Canada and Mexico, on airplanes, trains, automobiles, boats or by foot. It also applies to individuals traveling from one state to another or in the event of "inadequate local control."

The CDC regularly uses its authority to monitor passengers arriving in the United States for contagious diseases. In modern times, most quarantine measures have been imposed on a small scale, typically involving small numbers of travelers (airline or cruise ship passengers) who have curable diseases, such as infectious tuberculosis or cholera. No instances of large-scale quarantine have occurred in the U.S. since the "Spanish Flu" pandemic of 1918-1919.

Based on years of experience working with state and local partners, the CDC anticipates that the need to use its federal authority to involuntarily quarantine a person would occur only in rare situations — for example, if a person posed a threat to public health and refused to cooperate with a voluntary request.

JEFFREY A. TUCKER
DIRECTOR OF CONTENT, FOUNDATION FOR ECONOMIC EDUCATION; POLICY ADVISER, HEARTLAND INSTITUTE

EXCERPTED FROM FOUNDATION FOR ECONOMIC EDUCATION WEBSITE

The government already has the power to create sick camps, kidnap and intern people upon suspicion that they are diseased, and keep people in camps for an undetermined amount of time. Anyone concerned about human freedom should be uncomfortable with this policy, especially given the hysteria that surrounds the issue of communicable diseases. It is easy to imagine a scenario in which such powers end up exposing undiseased people rather than protecting people from the disease.

Quarantine powers have been around since the ancient world and have been invoked through U.S. history since colonial times. But government can use those powers any way it wants. In World War I, prostitutes were routinely arrested and quarantined in the name of preventing the spread of diseases.

In the 1892 typhus outbreak, it became common to arrest and quarantine any immigrant from Russia, Italy or Ireland, even without any evidence of disease. In 1900, the San Francisco Board of Health quarantined 25,000 Chinese residents and gave them a dangerous injection to prevent the spread of bubonic plague (it turned out later to have been entirely pointless). In more recent times, fears of AIDS have led to calls for arresting Mexican immigrants. And it's not just about disease. The quarantine power has been used by despotic governments worldwide to round up political enemies.

Does the government really need quarantine power? Let's think rationally and normally about this. Government power is not necessary, nor is it likely to be effective. And when it is not effective, the tendency is to overreact, clamping down and abusing, as we've seen with the war on terror. People assume government is doing its job, but government fails and then government gets more power and does awful things with it.

Remember, it is not government that discovers the disease, treats it, keeps diseased patients from wandering around or otherwise compels sick people to stay in their sick beds. Institutions do this, institutions that are part of the social order and not exogenous to it.

Individuals don't like to get others sick. People don't like to get sick. Given this, we have a mechanism that actually works. Society has an ability and power of its own to bring about quarantine-like results without introducing the risk that the state's quarantine power will be used and abused for political purposes.

Continued from p. 472

Meanwhile, the Global Fund to Fight AIDs, Tuberculosis and Malaria also is seeking a new leader. The organization gets one-third of its money from the United States and estimates that it saves 2 million lives a year worldwide. It is unclear whether the United States will continue providing money under Trump and whether a new leader can fulfill the organization's goals without U.S. aid. [103]

Global Collaboration

The uncertainty surrounding the Trump administration's commitment to international health funding has created anxiety among global researchers who have been working together on vaccines and other medical countermeasures for a potential pandemic.

The first successful Ebola vaccine, which is awaiting regulatory approval in the United States, demonstrates the importance of global collaboration, experts say. The vaccine was developed in conjunction with WHO and companies, governments and universities from the United States, Canada, Europe and West Africa. Brazilian and European researchers collaborated with U.S. researchers to produce a Zika vaccine. [104]

But Trump's proposed temporary ban on travel from six Muslim countries alarmed researchers, who say the ban, although on hold, has slowed collaboration on tropical-disease vaccines and other emerging infectious-disease treatments. It also leaves international researchers wary of working with Americans and could place the United States at risk over the long term, said infectious disease expert Peter Hotez at the Baylor College of Medicine in Houston.

"Scientific communities across the world need collaborators in these countries who can combat epidemics before they arrive in the U.S.," said Hotez. [105]

The United States also needs to continue working with international researchers on influenza vaccines, because the flu spreads so quickly between borders, global health experts say. WHO maintains centers in Australia, the United States, China, Japan and the United Kingdom for collaborating on influenza vaccine research. The CDC developed three vaccines for H7N9 and stockpiled 12 million doses. Officials say, however, that virus has mutated, making the stockpiled vaccine less effective against the current H7N9 strain. [106]

To create another vaccine to match the version of H7N9 that is circulating now, the United States needs to keep working with China and other international colleagues, says Richard Webby, director of WHO's Collaborating Center for Studies on the Ecology of Influenza in Animals in Memphis, Tenn.

Further, the United States needs international partners when it comes to manufacturing vaccines. Companies produce a flu vaccine by growing it in fertilized eggs. The United States relies on four pharmaceutical companies for flu vaccines, but only one has a manufacturing facility in the U.S. If a flu pandemic struck and killed the chickens needed to produce eggs, the United States might have trouble getting enough vaccine produced, because the three non-U.S. companies may decide to withhold the vaccines for their own populations, the Government Accountability Office said. [107]

If the United States can develop technologies that do not use eggs to produce vaccines, it would be less vulnerable, said Osterholm of the Center for Infectious Disease Research and Policy. "It would be the single most important thing we can do in public health today," he said. [108]

Researchers are making progress toward that goal. University of Georgia scientists are working to create a vaccine with genetic sequences of flu strains that have circulated over the past century. At Mount Sinai Hospital researchers are using genome sequencing to help the immune system better target a flu virus. [109] ■

OUTLOOK

Preventing Pandemics

Public health leaders agree that, statistically, the world is overdue for a lethal pandemic. They don't know whether it would begin with a rapidly evolving regional outbreak such as occurred with Ebola and Zika or a flu virus that has mutated to a point that no vaccine is effective; or a bioterrorist attack.

Preventing massive loss of life will require the world to continue working together to help poor and middle-income countries bolster their health systems, public health officials say, adding that the United States must maintain its investments in vaccine research and emergency preparedness.

"We should always have a good, high guard and never be complacent," said David Nabarro, an international health expert from Great Britain who was a candidate to lead WHO. [110]

Global health experts are optimistic that the Ebola and Zika crises have awakened leaders to the potential threats and that countries are on guard. They say the Global Health Security Agenda, the G-20 countries and individual nations are laying the groundwork to fight a pandemic. Further, advances in computing power and genetic engineering could bolster scientists' efforts to develop vaccines to fight the flu and other diseases.

Possibly as soon as the end of 2017, a total of 68 countries are expected to be evaluated by a multilateral body associated with WHO. The G-20 and World Bank have pledged funding to help them close preparedness gaps. The efforts involve wide swaths of governments — from the health ministries to environmental agencies to agriculture departments. The private sector also is stepping up.

"I am encouraged about the future," says Georgetown's Katz. "There are

some smart people who have awakened to this threat."

Efforts by vaccine researchers and the Coalition for Epidemic Preparedness Innovations are expected to bear fruit within the decade, says John-Arne Rottingen, chief executive of the Research Council of Norway.

"We will probably have developed six to 10 vaccines for what we believe will be the most likely threats," he says of the next 10 years. "Hopefully we will have a couple of technology platforms based on [genetic engineering] techniques, so we can fast-track new vaccines for new, emerging pathogens, and that will increase our capacities to prevent and stop a new epidemic."

Microsoft's Gates and former Harvard University President Lawrence Summers are among the private-sector leaders whom Katz says are aggressively pushing leaders worldwide to see pandemic preparedness as a matter of national security and economics — and not just of health. Ebola cost the world economy about $32 billion, and Zika could cost North and South America and the Caribbean up to $18 billion by the end of 2017. [111]

"This is a big deal," Katz says. "Public health experts can bang the drums all day about pandemic threats, but ministers of health tend not to be politically important. Gates, Sands and Summers, however, are able to make strong arguments to ministers of finance to encourage their governments that investing in this [affects business]," she says, "and they are changing the framework of this discussion." ■

Notes

[1] "Human infection with avian influenza A(H7N9) virus — China," World Health Organization, April 20, 2017, http://tinyurl.com/mrwycej.

[2] Lisa Schnirring, "China reports 23 more H7N9 cases, 7 fatal," Center for Infectious Disease Research and Policy, May 12, 2017, http://tinyurl.com/kutlvk8; Jeffrey K. Taubenberger and David M. Morens, "Influenza: The Once and Future Pandemic," *Public Health Reports*, U.S. National Library of Medicine, 2010, http://tinyurl.com/ldh4rfu.

[3] Dan Vergano, "Mystery of 1918 Flu That Killed 50 Million Solved?" *National Geographic*, April 29 2014, http://tinyurl.com/moxx767.

[4] Rob Schmitz, "Why Chinese Scientists Are More Worried Than Ever About Bird Flu," *Goats and Soda blog*, NPR, April 11, 2017, http://tinyurl.com/mjnk6yk.

[5] James Joyce, "Why the nation must prepare for future pandemic threats," *San Diego Union-Tribune*, Nov. 24, 2016, http://tinyurl.com/morjhhy.

[6] Bill Gates, "A new kind of terrorism could wipe out 30 million people in less than a year and we are not prepared," *Business Insider*, Feb. 18, 2017, http://tinyurl.com/z5pc9rn.

[7] Annie Sparrow, "Who isn't equipped for a pandemic or a bioterror attack? The WHO," *Bulletin of the Atomic Scientists*, June 20, 2016, http://tinyurl.com/msrpmy2; Sheri Fink, "Cuts at W.H.O. Hurt Response to Ebola Crises," *The New York Times*, Sept. 3, 2014, http://tinyurl.com/m4ppmys.

[8] "The WHO Contingency Fund for Emergencies," World Health Organization, November 2015, http://tinyurl.com/k7xdkbo.

[9] "Fact Sheet: The Global Health Security Agenda," Office of the Press Secretary, The White House, July 28, 2015, http://tinyurl.com/m6ybyd9; "The Global Health Security Agenda," http://tinyurl.com/m8wjl5k; "Coalition for Epidemic Preparedness Innovations (CEPI) Presentation to the WHO," World Health Organization, July 21, 2017, http://tinyurl.com/l3msobz.

[10] Donald G. McNeil Jr., "The Campaign to Lead the World Health Organization," *The New York Times*, April 3, 2017, http://tinyurl.com/kylbmmu; Julia Belluz, "Trump has set the US up to botch a global health crises," *Vox.com*, April 3, 2017, http://tinyurl.com/ksvb83q.

[11] Lena H. Sun, "The Trump administration is ill-prepared for a global pandemic," *The Washington Post*, April 18, 2017, http://tinyurl.com/n3ocur8; Lawrence Gostin and Eric Friedman, "Global Health: A Pivotal Moment of Opportunity and Peril," *Health Affairs*, Feb. 28, 2017, http://tinyurl.com/mf6gmht.

[12] "Emergency Preparedness and Response 2016," World Health Organization, http://tinyurl.com/l25xwpa; "First Global Estimates of 2009 H1N1 Pandemic Mortality Released by CDC-Led Collaboration," Centers for Disease Control and Prevention, June 25, 2012, http://tinyurl.com/lunzuhk; Denise Grady, "Suspected Cases of Ebola Rise to 29 in Democratic Republic of Congo," *The New York Times*, May 18, 2017, http://tinyurl.com/l4kw7ya.

[13] Anmar Frangoul, "Counting the costs of a global epidemic," CNBC.com, Feb. 5, 2014, http://tinyurl.com/kkh8nep; "World Bank Group Launches Groundbreaking Financing Facility to Protect Poorest Countries Against Pandemics," World Bank, May 21, 2016, http://tinyurl.com/mwtgsjd.

[14] Gates, *op. cit.*

[15] "Antibiotic/Antimicrobial Resistance," Centers for Disease Control and Prevention, April 27, 2017, http://tinyurl.com/la3tgtj; Helen Branswell, "A Nevada woman dies of a superbug resistant to every available antibiotic in the US," *STAT*, Jan. 12, 2017, http://tinyurl.com/hdxdcmq.

[16] Ali S. Khan with William Patrick, "The Next Pandemic: On the Front Lines Against Humankind's Gravest Dangers," *PublicAffairs*, 2016, p. 250, http://tinyurl.com/mk8gneo.

[17] Tom Ridge remarks via webcast of Preparedness Summit, National Association of County and City Health Officials conference, April 25-28, 2017, http://tinyurl.com/lbhfd5d.

[18] Michael Osterholm and Mark Olshaker, *Deadlist Enemy: Our War Against Killer Germs* (2017), chap. 11, http://tinyurl.com/myacoga.

[19] "Fact Sheet: The Global Health Security Agenda," *op. cit.*

[20] "International Health Regulations," World Health Organization, 2005, http://tinyurl.com/n5lv3qz; Haitham Shoman, "The link between the West African Ebola outbreak and health systems in Guinea, Liberia, and Sierra Leone: A systematic review," *Globalization and Health*, Oct. 17, 2016, http://tinyurl.com/mqqmphl.

[21] "U.S. Launches Global Health Security Agenda, Partners With 26 Countries," Henry J. Kaiser Family Foundation, Feb. 14, 2014, http://tinyurl.com/lkfn745.

[22] "African Union launches Africa CDC, a continent-wide public health agency," *ReliefWeb*, Feb. 2, 2017, http://tinyurl.com/mpbv5yx.

[23] "USAID announces second phase of Predict project with global partners," EcoHealth Alliance, Nov. 21, 2014, http://tinyurl.com/lyt2zk4; "Fact-sheet: Emerging Pandemic Threats," USAID, http://tinyurl.com/n86geuu.

[24] Bryan Walsh, "The World Is Not Ready for the Next Pandemic," *Time*, May 3, 2017, http://tinyurl.com/mopxrys.

[25] Sun, *op. cit.*

[26] Peter Sands *et al.*, "The Neglected Dimension of Global Security — A Framework for Countering Infectious-Disease Crises," *The New England Journal of Medicine*, March 31, 2016, http://tinyurl.com/lfqkub4.

[27] McNeil Jr., *op. cit.*; "Budget Fact Sheets,"

Centers for Disease Control and Prevention, http://tinyurl.com/mw9ox53.

[28] Suerie Moon *et al.*, "Will Ebola Change the Game? Ten Essential Reforms Before the Next Pandemic," *The Lancet*, Nov. 22, 2015, http://tinyurl.com/lyq6o89.

[29] Sparrow, *op. cit.*

[30] "World Health Assembly elects Dr. Tedros Adhanom Ghebreyesus as new WHO Director-General," World Health Organization, May 23, 2017, http://tinyurl.com/lhj7yn7; McNeil Jr., *op. cit.*

[31] Helen Branswell, "Finding the World's Unknown Viruses — Before They Find Us," *STAT*, Dec. 13, 2016, http://tinyurl.com/keruja7.

[32] "What is CEPI?" Center for Epidemic Preparedness Innovations, http://tinyurl.com/m29tyam.

[33] Crystal Watson and Matthew Watson, "Funding and Organization of US Federal Biosecurity Security Programs," Johns Hopkins Bloomberg School of Public Health Center for Health Security, January/February 2017, http://tinyurl.com/mu3lwf4.

[34] "2017 United States Budget Estimate," *Inside Gov*, http://tinyurl.com/mtc2fc3.

[35] "The U.S. Government and the World Health Organization," Henry J. Kaiser Family Foundation, March 16, 2017, http://tinyurl.com/mcoswva.

[36] Watson and Watson, *op. cit.*

[37] "Biodefense Indicators: One Year Later, Events Outpacing Federal Efforts to Defend the Nation," Blue Ribbon Study Panel on Defense, December 2016, http://tinyurl.com/y97jvw3q.

[38] Ridge, *op. cit.*

[39] "FY2010 Budget Overview," CDC Coalition, http://tinyurl.com/k64o4v6; "Division H — Departments of Labor, Health and Human Services, and Education and Related Agencies Appropriations Act 2017," House of Representatives, May 2017, http://tinyurl.com/lao845n.

[40] "Prepared, National Health Security Preparedness Index," Robert Wood Johnson Foundation, http://tinyurl.com/ltj8wyh.

[41] Ilene MacDonald, "Trump budget proposal cuts billions and would 'devastate' healthcare programs," *FierceHealthcare*, May 23, 2017, http://tinyurl.com/lkeauwx.

[42] Tom Friedan tweet by Friedan, May 23, 2017.

[43] Donovan Slack and Gregory Korte, "Trump's first budget slashes education, health spending to make way for military buildup," *USA Today*, March 16, 2017, http://tinyurl.com/kw8c977; "Avian Influenza: USDA Has Taken Actions to Reduce Risks but Needs a Plan to Evaluate Its Efforts," U.S. Government Accountability Office, April 2017, http://tinyurl.com/mcptyjj.

[44] Walsh, *op. cit.*

[45] Zoë Carpenter, "The United States Has an Emergency Fund for Natural Disasters. Why Not for Pandemics?" *The Nation*, Aug. 25, 2016, http://tinyurl.com/k4q2lh5.

[46] "Specific Laws and Regulations Governing the Control of Communicable Diseases," Centers for Disease Control and Prevention, March 21, 2017, http://tinyurl.com/mkbzxbd.

[47] Lenny Bernstein, "Trump wanted to keep Americans critically ill with Ebola out of the U.S.," *The Washington Post*, Aug. 24, 2016, http://tinyurl.com/mhyzqdu.

[48] Norimitsu Onishi, "Clashes Erupt as Liberia Sets an Ebola Quarantine," *The New York Times*, Aug. 20, 2014, http://tinyurl.com/k2d5ggn; Adam Nassiter, "Sierra Leone to Impose 3-Day Ebola Quarantine," *The New York Times*, Sept. 6, 2014, http://tinyurl.com/lnh7dgu.

[49] "Statement from the Travel and Transport Task Force on Ebola virus disease outbreak in West Africa," World Health Organization, Nov. 7, 2014, http://tinyurl.com/lprlxaz.

[50] Richard Schabas, "Severe Acute Respiratory Syndrome: Did Quarantine Help?" *Canadian Journal of Infectious Diseases and Medical Microbiology*, July/August 2004, http://tinyurl.com/krr8jbf.

[51] Shoman, *op. cit.*

[52] "Legal Authorities for Isolation and Quarantine," Centers for Disease Control and Prevention, Oct. 8, 2014, http://tinyurl.com/n8xx33a.

[53] Kyle Edwards, Wendy Parmet and Scott Burris, "Why the C.D.C.'s Power to Quarantine Should Worry Us," *The New York Times*, Jan. 23, 2017, http://tinyurl.com/l3bsrhk.

[54] Rob Stein, "CDC Seeks Controversial New Quarantine Powers to Stope Outbreaks," *Shots blog*, NPR, Feb. 2, 2017, http://tinyurl.com/zm6azve.

[55] *Ibid.*

[56] Matt Arco, "Ebola Nurse Lawsuit Against Christie Continues Despite Judge Tossing Federal Claims," NJ.com, Sept. 9, 2016, http://tinyurl.com/kus22dx.

[57] "Global Immunization: Worldwide Disease Incidence," Children's Hospital of Philadelphia, December 2014, http://tinyurl.com/jktr3ot.

[58] Erin Walkinshaw, "Mandatory Vaccinations: No Middle Ground," *Canadian Medical Association Journal*, Nov. 8, 2011, http://tinyurl.com/lfynf5f.

[59] Kathleen S. Swendiman, "Mandatory Vaccinations: Precedent and Current Laws," Congressional Research Service, March 10, 2011.

[60] "Background of the Issue" ProCon.org, March 22, 2016, http://tinyurl.com/zmqo9xq.

[61] "Health, United States, 2015," Department of Health and Human Services, 2016, http://tinyurl.com/m8uz5gs; Lena H. Sun, "Anti-vaccine activists spark a state's worst measles outbreak in decades," *The Washington Post*, May 5, 2017, http://tinyurl.com/l9wjpto.

[62] "Hardball with Chris Matthews," NBCNews.com, Feb. 3, 2015, http://tinyurl.com/ko2bwrb.

[63] Lena H. Sun, "Trump energizes the anti-vaccine movement in Texas," *The Washington Post*, Feb. 20, 2017, http://tinyurl.com/n5cnzom; Dylan Scott, "Robert K. Kennedy Jr. Says He Expects Trump Vaccine Panel Will Move Forward," *STAT*, Feb. 16, 2012, http://tinyurl.com/jhor5gb.

[64] "The Model State Emergency Health Powers Act," Network for Public Health Law, Aug. 1, 2011, http://tinyurl.com/l2shxah; "Q&A Model State Emergency Health Powers Act," American Civil Liberties Union, http://tinyurl.com/mzutrgh.

[65] Sonia Shah, *Pandemic: Tracking Contagions, from Cholera to Ebola and Beyond* (2016), chap. 1.

[66] *Ibid.*

[67] Marcia Clemmitt, "Emerging Infectious Diseases," *CQ Researcher*, Feb. 13, 2015, pp. 145-168.

[68] "Black Death," History.com, http://tinyurl.com/bk3z46l.

[69] *Ibid.*; Eugenia Tognotti, "Lessons from the History of Quarantine, From Plague to Influenza A," Centers for Disease Control and Prevention, February 2013, http://tinyurl.com/lmd34wx.

[70] Shah, *op. cit.*

[71] *Ibid.*; Tognotti, *op. cit.*

[72] *Ibid.*, Tognotti.

[73] For background see Mary H. Cooper, "Fighting SARS," *CQ Researcher*, June 20, 2003, pp. 569-592.

[74] "Lessons from the History of Quarantine, From Plague to Influenza A," *op. cit.*

About the Author

Bara Vaida is a Washington-based freelancer with more than 25 years' experience as a journalist, covering primarily health care policy issues. She has worked for Agence France-Presse, Bloomberg News, *National Journal* and *Kaiser Health News.* She also has published articles in, among others, *Cancer Today*, *Stateline*, *WebMD* and *Washingtonian* magazines.

[75] "Background of the Issue," *op. cit.*
[76] "Edward Jenner," Science Museum, http://tinyurl.com/my93qbn; Max Roser, "Eradication of Diseases," *Our World in Data*, http://tinyurl.com/n42crl6.
[77] "Background of the Issue," *op. cit.*; Cole and Swendiman, *op. cit.*
[78] *Ibid.*, Swendiman.
[79] Rustam I. Aminov, "A Brief History of the Antibiotic Era: Lessons Learned and Challenges for the Future," *Frontiers in Microbiology*, Oct. 29, 2010, http://tinyurl.com/lv4elnd.
[80] "Life Expectancy in the USA," University of California, Berkeley, http://tinyurl.com/l3qzudg; Rob Stein, "Life Expectancy in U.S. Drops For First Time In Decades, Report Finds," NPR, Dec. 6, 2016, http://tinyurl.com/grf86xv.
[81] Taubenberger and Morens, *op. cit.*
[82] James A. Wilde, "A(H1N1) 'Swine Flu' 2009/2010: Where We've Been, What We Know, Where We May Be Heading," AHC Media, March 1, 2010, http://tinyurl.com/kgoafgq.
[83] Robert Roos, "Study Puts Global 2009 Pandemic H1N1 Infection Rate at 24%," Center for Infectious Disease Research and Policy, Jan. 24, 2013, http://tinyurl.com/k2sa5r3; Joe Neel, "How Many People Die From Flu Each Year? Depends On How You Slice The Data," *Shots blog*, NPR, Aug. 26, 2010, http://tinyurl.com/jlo9wtd.
[84] Osterholm and Olshaker, *op. cit.*, chap. 11.
[85] *Ibid.*
[86] Joby Warrick, "FBI investigation of 2001 anthrax attacks concluded; U.S. releases details," *The Washington Post*, Feb. 20, 2010, http://tinyurl.com/ybgtvr2.
[87] Khan and Patrick, *op. cit.*, chap. 5.
[88] Osterholm and Olshaker, *op. cit.*
[89] "Alerts for the Week," *HealthMap*, May 14, 2017, http://tinyurl.com/24eyvvh.
[90] "Global Influenza Surveillance and Response System," World Health Organization, http://tinyurl.com/72ex3oa; "Global Outbreak Alert and Response Network," World Health Organization, http://tinyurl.com/hpblh9j.
[91] "Eurosurveillance: Preliminary Epidemiology and Analysis of Jiangsu's 5th H7N9 Wave," *Avian Flu Diary*, March 30, 2017, http://tinyurl.com/kb9sbyv.
[92] Schnirring, *op. cit.*
[93] Stephanie Soucheray, "WHO: 37Ebola cases in the DRC, 4 Deaths" Center for Infectious Disease Research and Policy, May 22, 2017, http://tinyurl.com/mwlbvkm.
[94] "Climate Change and Infectious Diseases," World Health Organization, http://tinyurl.com/o9ylyme.

FOR MORE INFORMATION

Association of State and Territorial Health Officials, 2231 Crystal Drive, Suite 450, Arlington, VA 22202; 202-371-9090; www.astho.org. Represents public health agencies and professionals.

Center for Global Health Science and Security, Georgetown University Medical Center, N.W., 306, Medical-Dental Building, 3900 Reservoir Rd., N.W., Washington, DC 20007; 202-687-9823; https://ghss.georgetown.edu/. Works on global health security with policy leaders worldwide.

Center for Infectious Disease Research and Policy, University of Minnesota, Academic Health Center, 420 Delaware St., S.E., MMC 263, C315 Mayo, Minneapolis, MN 55455; 612-626-6770; www.cidrap.umn.edu/. Provides research and news on infectious-disease outbreaks and policy response.

Centers for Disease Control and Prevention, Division of Global Health Protection and Security, 1600 Clifton Rd., Atlanta, GA 30329-4027; 800-232-4636; www.cdc.gov/globalhealth/healthprotection/index.html. Federal agency that works with international partners on global health and infectious-disease surveillance and response.

HealthMap, Boston Children's Hospital, Computational Epidemiology Lab, Landmark Center, Seventh Floor, 401 Park Drive, Boston, MA 02215; 617-355-6000; www.healthmap.org/en/. Internet-based reporting system.

International Society for Infectious Disease, 9 Babcock St., Unit 3, Brookline MA 02446; 617-277-0551; www.isid.org. Membership organization for professionals specializing in infectious diseases.

Trust for America's Health, 1730 M St., N.W., Suite 900, Washington, DC 20036; 202-223-9870; http://healthyamericans.org/. Public health advocacy group.

World Health Organization, Regional Office for the Americas, 525 23rd St., N.W., Washington, DC 20037; 202-974-3000; www.who.int/about/regions/amro/en/. United Nations agency that helps shape global policy and research.

[95] Belluz, *op. cit.*
[96] "Political Appointee Trackers," Partnership for Public Service, May 23, 2017, http://tinyurl.com/lxxhv6k.
[97] Sun, "The Trump administration is ill-prepared for a global pandemic," *op. cit.*
[98] "Political Appointee Tracker," *op. cit.*
[99] Jason Beaubien, "Trump's Proposed USAID Head Knows Aid — And Politics," *Goats and Soda blog*, NPR, May 11, 2017, http://tinyurl.com/k7d8k6l.
[100] Testimony of Tom Price, Budget Hearing, Department of Health and Human Services, March 29, 2017, http://tinyurl.com/mvvc85z.
[101] "AP Exclusive: UN Health Agency Slammed for High Travel Costs," The Associated Press, *The New York Times*, May 22, 2017, http://tinyurl.com/n5ezobw.
[102] McNeil Jr., *op. cit.*; Donald G. McNeil Jr. and Nick Cumming-Bruce, "WHO Elects Ethopia's Tedros as First Director General from Africa," *The New York Times*, May 23, 2017, http://tinyurl.com/lx6gw7d.
[103] Jeremy Youde, "Wanted: A New Executive Director for the Global Fund," *Duck of Minerva*, March 4, 2017, http://tinyurl.com/mjmdl8m.
[104] Belluz, *op. cit.*
[105] Amy Maxmen, "Trump immigration ban upends international work on disease," *Nature*, Feb. 1, 2017, http://tinyurl.com/l7afwuc.
[106] "Asian Lineage Avian Influenza A (H7N9)," Centers for Disease Control and Prevention, May 9, 2017, http://tinyurl.com/l7qd6ou.
[107] "Avian Influenza: USDA Has Taken Actions to Reduce Risks but Needs a Plan to Evaluate Its Efforts," *op. cit.*
[108] Marlene Cimons, "There may someday be a way to avoid the yearly flu shot," *The Washington Post*, Jan. 7, 2017, http://tinyurl.com/k4g3gy3.
[109] *Ibid.*
[110] Stephanie Nebehay, "World must not miss early signals of any flu pandemic: WHO," Reuters, Jan. 23, 2017, http://tinyurl.com/kkf2mb5.
[111] Deb Reichmann, "World Bank: Economic impact of Ebola epidemic could top $32.6 billion by end of year," The Associated Press, *USA Today*, Oct. 8, 2014, http://tinyurl.com/lqkp5ff; "Report says cost of Zika estimated at up to $18 billion," The Associated Press, WTOP.com, April 6, 2017, http://tinyurl.com/mc5kf7e.

Bibliography

Selected Sources

Books

Khan, Ali S., *The Next Pandemic: On the Front Lines Against Humankind's Gravest Dangers*, PublicAffairs, 2016.
The former head of the Office of Public Health Preparedness and Response at the Centers for Disease Control and Prevention (CDC) recalls investigating frightening disease outbreaks and offers advice on how to prevent pandemics.

Osterholm, Michael T., and Mark Olshaker, *Deadliest Enemy: Our War Against Killer Germs*, Little Brown & Company, 2017.
The founder of the University of Minnesota's Center for Infectious Disease Research and Policy recounts the history of pandemics and explains how political leaders can implement policy initiatives to prevent them.

Shah, Sonia, *Pandemic: Tracking Contagions from Cholera to Ebola and Beyond*, Picador USA, 2016.
A science journalist summarizes past pandemics and explains how dealing with cholera helped prepare the world to prevent future pandemics.

Articles

"AP Exclusive: UN Health Agency Slammed for High Travel Costs," The Associated Press, *The New York Times*, May 22, 2017, http://tinyurl.com/n5ezobw.
The World Health Organization is spending $200 million a year on travel expenses, more than what it spends fighting AIDS, malaria and tuberculosis combined, according to an Associated Press investigation.

"Lessons from the History of Quarantine, from Plague to Influenza A," Centers for Disease Control and Prevention, February 2013, http://tinyurl.com/lmd34wx.
The federal agency in charge of preventing the spread of infectious diseases reflects on lessons learned from quarantines imposed during pandemics and how quarantines can be used to safeguard public health without violating civil rights.

Boyce, Nell Greenfield, "Inside a Secret Government Warehouse Prepped for Health Catastrophes," NPR, June 27, 2016, http://tinyurl.com/jyxgply.
The CDC is stockpiling drugs, vaccines and medical equipment in preparation for potential health emergencies.

Gostin, Lawrence, and Eric Friedman, "Global Health: A Pivotal Moment of Opportunity and Peril," *Health Affairs*, January 2017, http://tinyurl.com/lyvxkac.
Two Georgetown University researchers highlight policies they say are needed to strengthen global health security.

McNeil, Donald G. Jr., "Turning the Tide Against Cholera," *The New York Times Magazine*, Feb. 6, 2017, http://tinyurl.com/hzlx7uq.
A journalist examines efforts to eliminate cholera, an infectious disease that can be contracted from contaminated water or food.

Rull, Monica, Ilona Kickbusch and Helen Lauer, "Policy Debate: International Responses to Global Epidemics: Ebola and Beyond," International Development Policy, February 2015, http://tinyurl.com/kuo6l6k.
Researchers look at a policy debate about the World Health Organization's response to Ebola.

Saunders-Hastings, Patrick R., and Daniel Krewski, "Reviewing the History of Pandemic Influenza: Understanding Patterns of Emergence and Transmission," *Pathogens*, Dec. 6, 2016, http://tinyurl.com/n5fqu7l.
Researchers from the University of Ottawa offer a historical primer on influenza pandemics.

Reports and Studies

"Avian Influenza: USDA Has Taken Actions to Reduce Risks but Needs a Plan to Evaluate Its Efforts," Government Accountability Office, April 2017, http://tinyurl.com/mcptyjj.
A government report outlines steps the Agriculture Department has taken to protect the country from an avian pandemic and raises questions about whether the nation is too reliant on a single U.S.-based egg producer for the manufacturing of influenza vaccines.

"Biodefense Indicators: One Year Later, Events Outpacing Federal Efforts to Defend the Nation," Blue Ribbon Study Panel on Biodefense, December 2016, http://tinyurl.com/m9lsq3z.
A bipartisan group, created in 2014 to assess the nation's biodefense readiness, updates efforts to encourage Congress to devote more attention and funding to preparing for health emergencies.

"Ready or Not? Protecting the Public's Health From Diseases, Disasters and Bioterrorism," Trust for America's Health, December 2016, http://tinyurl.com/mafd4gf.
A public health advocacy group provides a snapshot of federal and state investment in emergency health preparedness.

"Tackling Drug Resistant Infections Globally: Final Report and Recommendations," Review on Antimicrobial Resistance, Wellcome Trust, May 2016, http://tinyurl.com/zxxjmww.
A report funded by the British government focuses on the growing number of antibiotic-resistant bacterial infections and discusses policy recommendations for halting their spread.

Gottron, Frank, "The Project BioShield Act: Issues for the 113th Congress," Congressional Research Service, June 18, 2014, http://tinyurl.com/mreoqgu.
Congress' nonpartisan research arm updates the status of U.S. spending on bio-preparedness.

The Next Step:

Additional Articles from Current Periodicals

Bioterrorism

Fox, Maggie, "Worse Than Ebola: U.S. Not Preparing for the Next Bio-Threat," NBC News, May 1, 2017, https://tinyurl.com/mlfuzky.

Disease experts, who have urged the United States to prepare for potential outbreaks or bioterrorist strikes, say little planning or funding has been implemented to protect against pandemics.

Selk, Avi, "Bill Gates: Bioterrorism could kill more than nuclear war — but no one is ready to deal with it," *The Washington Post*, Feb. 18, 2017, https://tinyurl.com/mdrvqog.

Microsoft co-Founder Bill Gates warned world leaders in February to prepare for bioterror attacks, which he said are easier to execute than nuclear weapons and could trigger pandemics that could kill more people.

International Agencies

Disparte, Dante, and Tom Ridge, "The World Needs a DARPA-Style Project to Prevent Pandemics," *Harvard Business Review*, April 24, 2017, https://tinyurl.com/k3z8wkq.

Two experts say world governments should prepare for pandemics through transnational, cross-sector coordination, similar to how the Defense Advanced Research Projects Agency, the Defense Department's research arm, collaborates with academia, industry and other government agencies to help develop emerging technologies.

Levey, Noam N., "Trump pushes historic cuts in global health aid, stoking fears of new disease outbreaks and diminished U.S. clout," *Los Angeles Times*, April 10, 2017, https://tinyurl.com/kt9pjst.

International aid groups said President Trump's proposed cuts to U.S. foreign aid in the health field could cause higher levels of disease outbreaks around the world.

Sun, Lena H., "New global coalition launched to create vaccines, prevent epidemics," *The Washington Post*, Jan. 18, 2017, https://tinyurl.com/lozb8dx.

The Bill & Melinda Gates Foundation, Britain's Wellcome Trust and the Japanese, Norwegian and German governments have formed an international coalition to create vaccines to stop future pandemics.

New Diseases

Klint, Chris, "Alaskan gets infected with Zika virus in Central America," *Alaska Dispatch News*, April 28, 2017, https://tinyurl.com/mdca5xy.

An Alaskan resident returning from Central America contracted the state's third recorded Zika virus infection.

MacMillan, Amanda, "Powassan Virus Is the Scary New Reason to Avoid Ticks," *Time*, May 4, 2017, https://tinyurl.com/llthyjj.

The Powassan virus, a rare contagious disease that causes brain swelling and is transmitted mostly by ticks, is reportedly becoming more common in the Northeast.

Walsh, Bryan, "The World Is Not Ready for the Next Pandemic," *Time*, May 4, 2017, https://tinyurl.com/mopxrys.

A new bird flu called H7N9 circulating across China is mostly infecting poultry, but humans who have contracted the disease during a recent spike have a 41 percent mortality rate.

Vaccination Controversies

Sepic, Matt, "Public health workers push back against anti-vaccine claims at Somali community meeting," Minnesota Public Radio News, May 1, 2017, https://tinyurl.com/mz8gj84.

Anti-vaccination groups gathered in Minnesota to discuss their beliefs that measles vaccinations can and have caused autism in children, but pediatricians in the audience refuted the claims.

Sisson, Paul, "Tougher law is indeed getting more students vaccinated in San Diego and statewide," *The San Diego Union-Tribune*, April 17, 2017, https://tinyurl.com/n3jpsja.

The California Department of Public Health announced the immunization rate for San Diego County kindergarteners is up to 94.7 percent after a new law banned personal-belief exemptions for vaccinations.

Tracy, Abigail, "Donald Trump Taps Anti-Vaccine Activist To Investigate Vaccine Science," *Vanity Fair*, Jan. 10, 2017, http://tinyurl.com/hvlx6bh.

President Trump appointed a noted vaccine skeptic to chair a vaccination safety commission.

In-depth Reports on Issues in the News

Are you writing a paper?

Need backup for a debate?

Want to become an expert on an issue?

For 90 years, students have turned to *CQ Researcher* for in-depth reporting on issues in the news. Reports on a full range of political and social issues are now available. Following is a selection of recent reports:

Civil Liberties
Privacy and the Internet, 12/15
Intelligence Reform, 5/15
Religion and Law, 11/14

Crime/Law
High-Tech Policing, 4/17
Forensic Science Controversies, 2/17
Jailing Debtors, 9/16
Decriminalizing Prostitution, 4/16
Restorative Justice, 2/16
The Dark Web, 1/16
Immigrant Detention, 10/15

Education
Charter Schools, 3/17
Civic Education, 2/17
Student Debt, 11/16
Apprenticeships, 10/16

Environment/Society
Anti-Semitism, 5/17
Native American Sovereignty, 5/17
Women in Prison, 3/17
Guns on Campus, 1/17
Mass Transit, 12/16
Arctic Development, 12/16

Health/Safety
Sports and Sexual Assault, 4/17
Reducing Traffic Deaths, 2/17
Opioid Crisis, 10/16
Mosquito-Borne Disease, 7/16

Politics/Economy
North Korea Showdown, 5/17
Rethinking Foreign Aid, 4/17
Troubled Brazil, 4/17
Reviving Rural Economies, 3/17
Immigrants and the Economy, 2/17
Trump Presidency, 1/17

Upcoming Reports

Trust in Journalism, 6/9/17 | Food Labeling, 6/16/17 | Christian Right, 6/23/17

ACCESS

CQ Researcher is available in print and online. For access, visit your library or www.cqresearcher.com.

STAY CURRENT

For notice of upcoming *CQ Researcher* reports or to learn more about *CQ Researcher* products, subscribe to the free email newsletters, *CQ Researcher Alert!* and *CQ Researcher News*: http://cqpress.com/newsletters.

PURCHASE

To purchase a *CQ Researcher* report in print or electronic format (PDF), visit www.cqpress.com or call 866-427-7737. Single reports start at $15. Bulk purchase discounts and electronic-rights licensing are also available.

SUBSCRIBE

Annual full-service *CQ Researcher* subscriptions—including 44 reports a year, monthly index updates, and a bound volume—start at $1,131. Add $25 for domestic postage.

CQ Researcher Online offers a backfile from 1991 and a number of tools to simplify research. For pricing information, call 800-818-7243 or 805-499-9774 or email librarysales@sagepub.com.