NATIONAL ACTION PLAN FOR COMBATING ANTIBIOTIC-RESISTANT BACTERIA

2020-2025

October 2020

From the Federal Task Force on
Combating Antibiotic-Resistant Bacteria

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SECTION 1

INTRODUCTION & BACKGROUND

Executive Summary

The National Action Plan for Combating Antibiotic-Resistant Bacteria (CARB), 2020-2025, presents coordinated, strategic actions that the United States Government will take in the next five years to improve the health and wellbeing of all Americans by changing the course of antibiotic resistance.

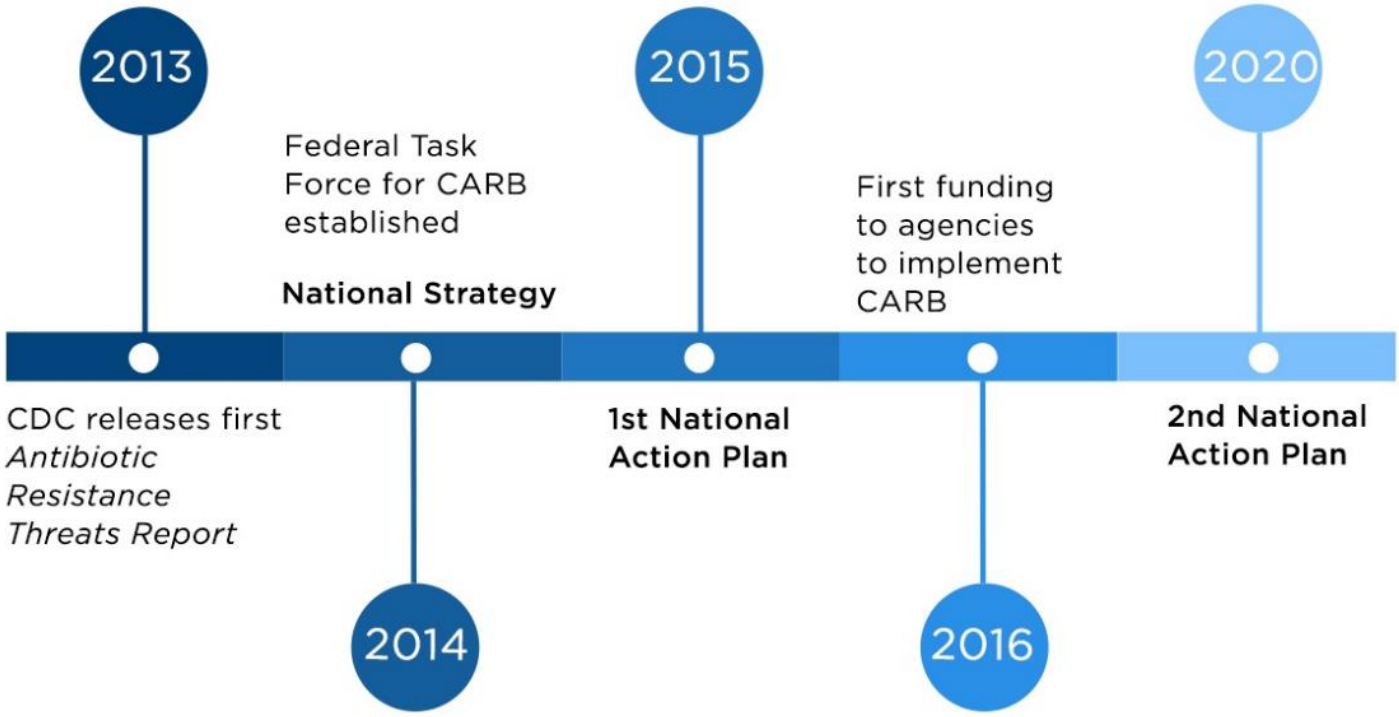
This Plan is based on the U.S. Government's 2014 National Strategy for CARB, and builds on the first National Action Plan released in 2015 by expanding evidence-based activities that have already been shown to reduce antibiotic resistance, such as optimizing the use of antibiotics in human and animal health settings.

This Plan continues to prioritize infection prevention and control to slow the spread of resistant infections and reduce the need for antibiotic use. To ensure that patients receive the right antibiotic care, the Plan supports innovative approaches to developing and deploying diagnostic tests and treatment strategies. A One Health approach, which recognizes the relationships between the health of humans, animals, plants, and the environment, is integrated throughout the Plan, with an expanded effort to understand antibiotic resistance in the environment. The Plan also focuses on collecting and using data to better understand where resistance is occurring, support the development of new diagnostics and treatment options, and advance international coordination.

The U.S. Government will report annually on progress toward the objectives set in the Plan.

About the National Action Plan for Combating Antibiotic-Resistant Bacteria, 2020-2025

This Plan describes activities that the U.S. Government will undertake from 2020 through 2025 to reduce the impact of antibiotic and antimicrobial resistance on the nation.[1]



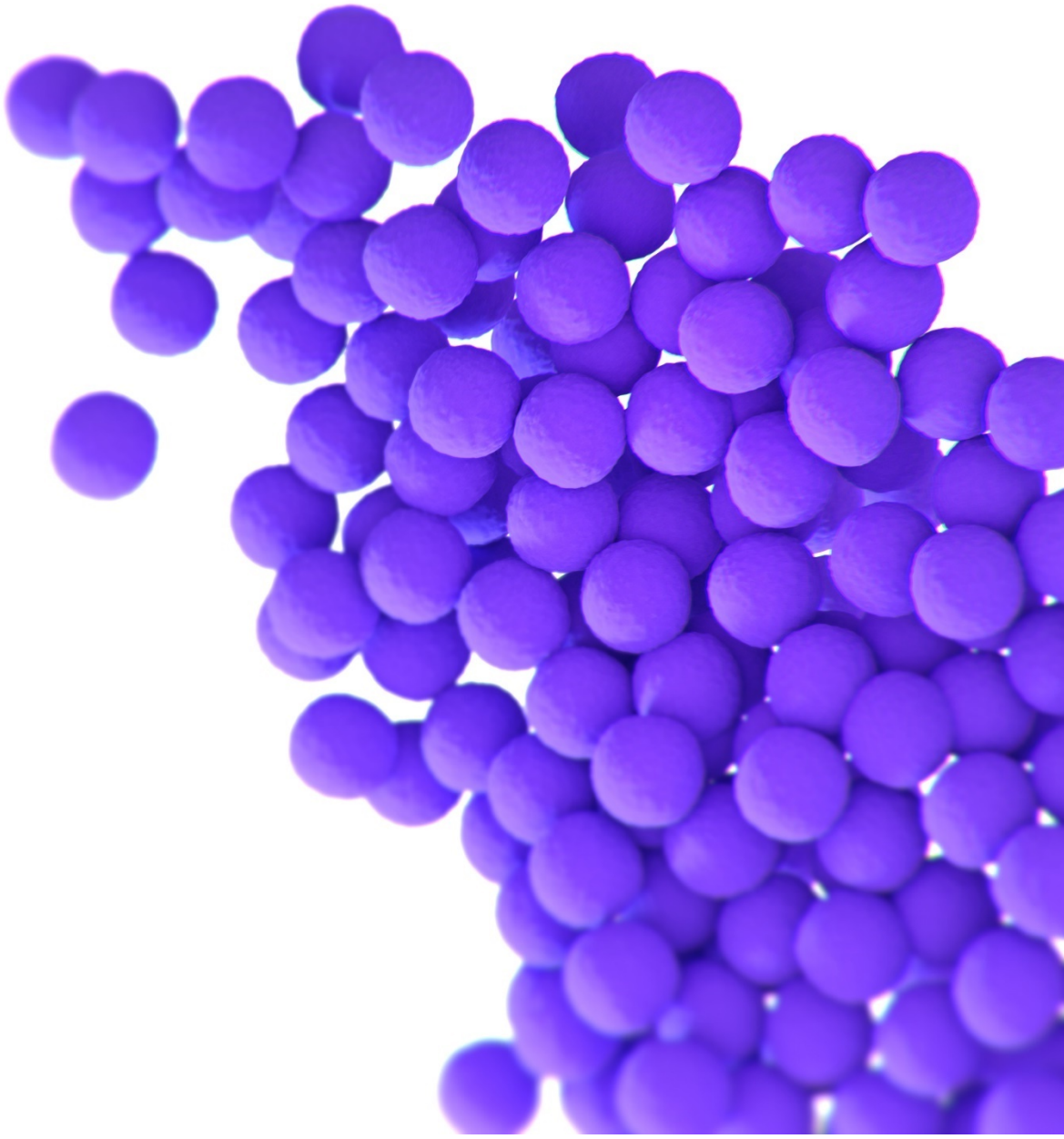
To address the growing threat of antibiotic resistance, the U.S. Government released the National Strategy for CARB in September 2014, which outlined five inter-related goals to guide Federal action. At the same time, Executive Order 13676 established the Federal Task Force for CARB to identify actions to implement the National Strategy. In March 2015, the Task Force released the first National Action Plan for CARB, aimed at moving the nation toward the goals of the National Strategy through specific objectives, strategies, and milestones to be achieved within 1, 3, and 5 years. The Task Force has issued reports on progress toward these milestones for years 1 and 2, year 3, and year 4 of the original plan. A forthcoming final report will cover year 5 and an overall assessment of progress.

The new National Action Plan for 2020-2025, presented here, maintains the original 5 goals of the National Strategy and includes new objectives and targets aimed at achieving those goals.

The Task Force is co-chaired by the Secretaries of the U.S. Departments of Health and Human Services (HHS), Agriculture (USDA), and Defense (DoD), and also includes the Departments of Interior (DoI), State (DoS), and Veterans Affairs (VA), the Environmental Protection Agency (EPA), the U.S. Agency for International Development (USAID), the National Science Foundation, and representatives from the Executive Office of the President. The HHS Office of the Assistant Secretary for Planning and Evaluation coordinates the Task Force, prepares annual progress reports, and led the development of this document.

[1] This Plan follows the framework of CDC's 2019 AR Threats Report and uses the term "antibiotic" to describe antibacterial and antifungal drugs, which kill bacteria and fungi, respectively. "Antimicrobial resistance" is a broader umbrella term that also includes resistance in other microbes not included in this Plan, such as viruses and parasites.

The Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria (PACCARB), also established by Executive Order 13676, is composed of both Federal and non-Federal subject-matter experts in human and agricultural health. The PACCARB provides information and recommendations to the HHS Secretary regarding programs and policies to combat antibiotic resistance and to improve capabilities to prevent, diagnose, mitigate, or treat antibiotic-resistant infections.[2]



[2] The activities and duties of the PACCARB are governed by Public Law 92-463, the Federal Advisory Committee Act (FACA), and are assigned in section 505(b) of Public Law 116-22 (June 24, 2019), the Pandemic and All-Hazards Preparedness and Advancing Innovation Act of 2019 (PAHPAIA).

The Task Force for Combating Antibiotic-Resistant Bacteria

The Department of Health and Human Services (HHS) and its following components:

AHRQ	Agency for Healthcare Research and Quality
ASPE	Assistant Secretary for Planning and Evaluation
ASPR	Assistant Secretary for Preparedness and Response
BARDA	Biomedical Advanced Research and Development Authority within ASPR
CDC	Centers for Disease Control and Prevention
CMS	Centers for Medicare and Medicaid Services
FDA	Food and Drug Administration
NIH	National Institutes of Health
OGA	Office of Global Affairs

The United States Department of Agriculture (USDA) and its following components:

APHIS	Animal and Plant Health Inspection Service
ARS	Agricultural Research Service
FAS	Foreign Agriculture Service
FSIS	Food Safety and Inspection Service
NIFA	National Institute of Food and Agriculture
OCS	Office of the Chief Scientist

The Department of Defense (DoD) and its following components:

DHA	Defense Health Agency
GEIS	Global Emerging Infections Surveillance
IDCRP	Infectious Disease Clinical Research Program
MIDRP	Military Infectious Diseases Research Program
MRSN	Multidrug-Resistant Organism Repository and Surveillance Network
PVC	Pharmacovigilance Center
WRAIR	Walter Reed Army Institute of Research

Department of the Interior (DoI)

Department of State (DoS)

Environmental Protection Agency (EPA)

United States Agency for International Development (USAID)

Department of Veterans Affairs (VA)

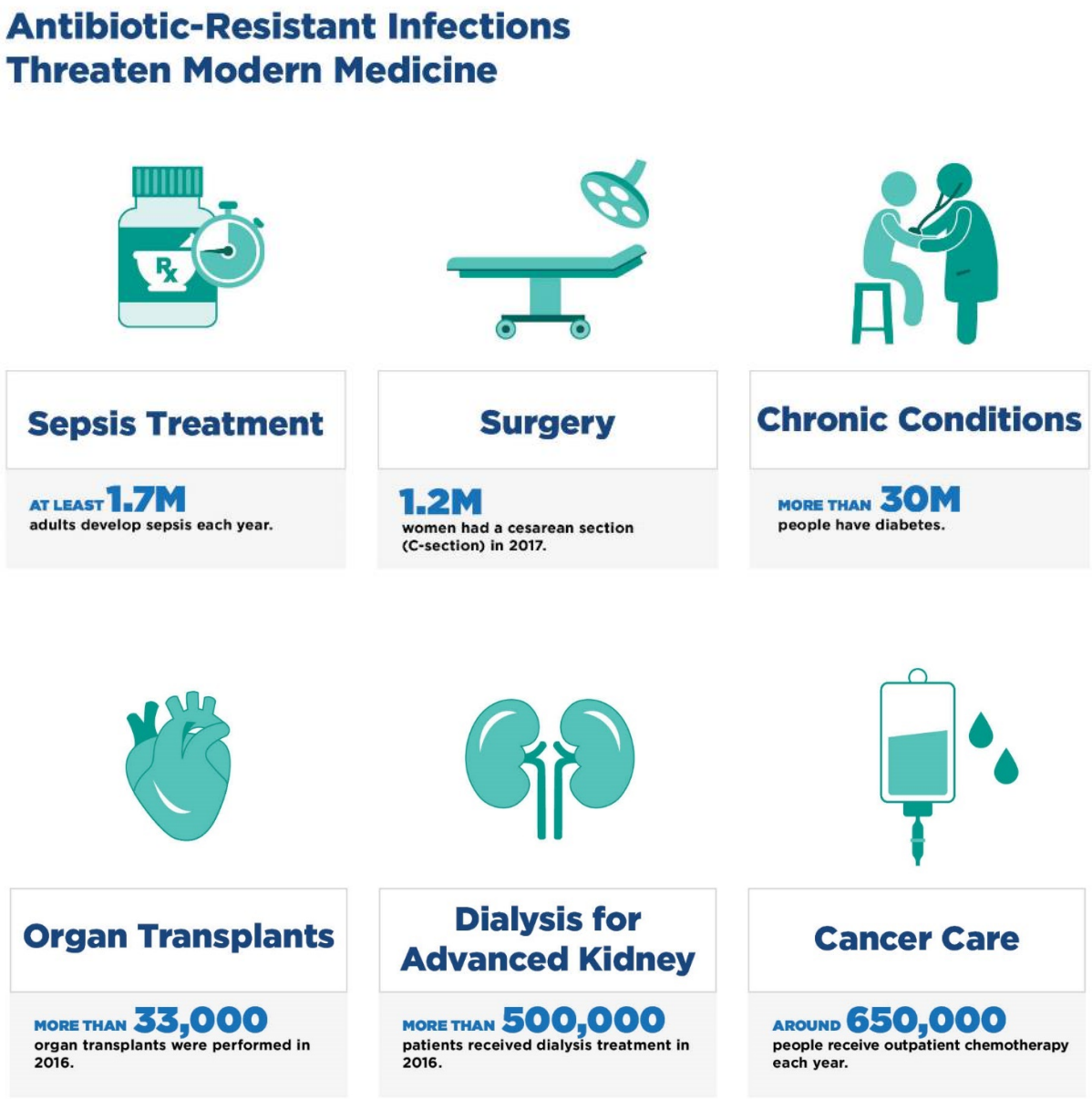
Abbreviations

AMR	Antimicrobial resistance
AR	Antibiotic resistance
CARB	Combating Antibiotic-Resistant Bacteria
CARB-X	Combating Antibiotic-Resistant Bacteria Biopharmaceutical Accelerator
ESBL	Extended-spectrum beta-lactamase
FAO	Food and Agriculture Organization
GEIS	Global Emerging Infections Surveillance
GLASS	Global Antimicrobial Resistance Surveillance System
HAI	Healthcare-associated infections
IPPS	Inpatient Prospective Payment System
LTC	Long-term care
NAHMS	National Animal Health Monitoring System
NARMS	National Antimicrobial Resistance Monitoring System
NHSN	National Healthcare Safety Network
OIE	World Organization for Animal Health (formerly the Office International des Epizooties)
PACCARB	Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria
TATFAR	Transatlantic Taskforce on Antimicrobial Resistance
UNEP	United Nations Environment Programme
WASH	Water, sanitation, and hygiene
WHO	World Health Organization

Background

The Threat of Antibiotic Resistance

The landmark discovery of the first modern antibiotics in the early 20th century contributed to historic improvements in human health and life expectancy. Along with improved sanitation systems, hygiene, and vaccination, antibiotics and other medicines have greatly reduced the incidence of deaths from bacterial infections. However, these advances must not be taken for granted, because microbial pathogens continually evolve new ways to evade the drugs designed to kill them. Pathogens and their drug-defeating genes can also be transferred among humans, animals, and the environment. The evolution and spread of antibiotic resistance challenge our continued ability to prevent and treat infectious diseases in humans and animals.



(Source: CDC's 2019 AR Threats Report)

Antibiotic-resistant infections can also complicate the response to and recovery from public health emergencies. For example, during the 2009 H1N1 influenza pandemic, many patients acquired secondary bacterial infections in addition to influenza, and some of these infections were resistant to antibiotics. While the implications of antibiotic resistance are not yet clear for the ongoing response to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and associated COVID-19 illness, increased use of antibiotics and other antimicrobial medicines—both appropriate and inappropriate—to address primary or secondary infections has the potential to further accelerate the emergence of antibiotic resistance.

In 2013, the U.S. Centers for Disease Control and Prevention (CDC) reported on the most worrisome antibiotic-resistant threats in the U.S., sounding the national alarm and identifying necessary actions to face these threats. In 2019, the CDC updated these national estimates and found that each year, more than 2.8 million antibiotic-resistant infections occur in the United States, resulting in the deaths of more than 35,000 Americans. Although the total economic impact of antibiotic resistance is difficult to determine, the CDC estimates that just a subset of resistant infections caused more than $4.8 billion in medical costs in 2017.[3] Similarly, antibiotic-resistant pathogens can harm animal health, though the scope of resistance in animals is less well characterized than in humans. Antibiotic resistance is a challenging threat, but aggressive actions now can prolong the effectiveness of existing antibiotics and prevent infections in the future, ultimately saving lives and money.

[3] Sum of estimated attributable healthcare costs in 2017 for carbapenem-resistant *Acinetobacter*, drug-resistant *Campylobacter*, extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae, vancomycin-resistant Enterococci, multidrug-resistant *Pseudomonas aeruginosa*, and methicillin-resistant *Staphylococcus aureus*. Source: CDC 2019 AR Threats Report.

The U.S. Government Response

The U.S. Government is responding to antibiotic resistance with a comprehensive and coordinated suite of actions implemented by a diverse set of agencies using a One Health approach. The National Strategy for Combating Antibiotic-Resistant Bacteria (CARB) lays out five goals to reduce the incidence and impact of antibiotic-resistant infections:

Goal 1: Slow the Emergence of Resistant Bacteria and Prevent the Spread of Resistant Infections

Goal 2: Strengthen National One Health Surveillance Efforts to Combat Resistance

Goal 3: Advance Development and Use of Rapid and Innovative Diagnostic Tests for Identification and Characterization of Resistant Bacteria

Goal 4: Accelerate Basic and Applied Research and Development for New Antibiotics, Other Therapeutics, and Vaccines

Goal 5: Improve International Collaboration and Capacities for Antibiotic-resistance Prevention, Surveillance, Control and Antibiotic Research and Development.

These goals are pursued by the Federal Departments and Agencies of the CARB Task Force, which is co-chaired by the Secretaries of Health and Human Services, Agriculture, and Defense. In 2015, the Task Force launched the first National Action Plan for CARB, and substantial progress has been made in the past five years. Working with local, State, tribal, territorial, and international partners, the U.S. Government has:

- Established a new national Antibiotic Resistance Laboratory Network (AR Lab Network);
- Launched a strategic initiative to support antibiotic stewardship in veterinary settings;
- Developed new programs to improve antibiotic use across healthcare settings;
- Launched a biopharmaceutical accelerator, CARB-X;
- Supported the development and approval of new diagnostic and treatment options;
- Pursued alternatives to antibiotics in agriculture; and
- Obtained hundreds of commitments to global action from a broad range of sectors and stakeholders.

(Source: CDC's 2019 AR Threats Report)

One Health is a collaborative, multisectoral, and transdisciplinary approach—working at the local, regional, national, and global levels—with the goal of achieving optimal health outcomes by recognizing the interconnection between people, animals, plants, and their shared environment.

Human, animal, plant, and environmental health are all connected**.** The antibiotics used to treat infections may be the same or similar in humans and animals; the manufacture, use, and disposal of antibiotics in all settings can potentially drive the emergence of resistance. When antibiotic-resistant bacteria arise, they may spread among humans, animals, and the environment. A One Health approach recognizes the interconnectedness between the health of people, animals, plants, and the environment and encourages a collaborative response to the threat of antibiotic resistance. The CARB Task Force employs a One Health approach by engaging U.S. Government agencies that oversee human, animal, and environmental health and by promoting collaboration and communication to address antibiotic resistance in every relevant sector.

Collaborations among U.S. Government Departments and Agencies have produced important efforts to fight antibiotic resistance. For example, the strong relationship between USDA and the Food and Drug Administration (FDA) within HHS led to an innovative strategy to help ensure that medically important antibiotic drugs (those that are important for therapeutic use in humans) fed to food-producing animals are limited to uses necessary for assuring animal health. FDA sought broad public input and engaged affected stakeholders over several years on plans to work with pharmaceutical companies to voluntarily withdraw production uses (e.g., growth promotion, increased feed efficiency) of medically important antibiotics and to require veterinary oversight of their remaining therapeutic uses. FDA and USDA jointly participated in workshops across the U.S. that brought together producers, veterinarians, and feed suppliers to create a shared understanding of these new initiatives and to discuss the management challenges to implementing them. All pharmaceutical companies with affected products agreed to adopt FDA's judicious use approach, withdrew affected drugs from the market, and fully implemented the recommended changes by the three-year target. In 2019, FDA reported a 38 percent decline between 2015 and 2018 in medically important antibiotics sold for use in food-producing animals. USDA continues to monitor antibiotic use practices on farm, as well as other practices used to address animal health challenges through national studies of animal agriculture. These studies will help experts understand the effects of FDA policy changes on producers. USDA also conducts and funds research to find effective alternatives to antibiotics and other interventions to help maintain animal health and welfare, food security, and agriculture sustainability.

Antibiotic Resistance Spreads Easily Across the Globe

Resistant bacteria and fungi can spread across countries and continents through people, animals, and goods.

(Source: CDC's 2019 AR Threats Report)

Recognizing that domestic action alone is insufficient, the U.S. Government works with multisectoral organizations, partner nations, the private sector, civil society, and other stakeholders to address the threat of antibiotic resistance. Internationally, the U.S. Government has helped to secure high-level commitments to address antibiotic resistance by national leaders, organizations, and Ministers. These commitments include the development and adoption of the World Health Organization (WHO) Global Action Plan on Antimicrobial Resistance, the Declaration of the United Nations High Level Meeting on Antimicrobial Resistance, commitments made at the G7 and G20 meetings, and additional actions by the WHO, the Food and Agriculture Organization of the United Nations (FAO), the World Organization for Animal Health (OIE), and the United Nations Environment Programme (UNEP).

The National Action Plan for Combating Antibiotic-Resistant Bacteria, 2020-2025

Efforts to reduce the effects of antibiotic resistance are working: from 2012 to 2017, the overall number of U.S. deaths from antibiotic-resistant infections fell by 18 percent, and the number of U.S. deaths from resistant infections in hospitals fell by nearly 30 percent as a result of efforts to prevent infections and control their spread. However, antibiotic resistance continues to harm too many Americans, and worrisome trends are emerging, including the discovery of new resistant pathogens, such as *Candida auris,* and an increase in resistant *Neisseria gonorrhoeae* infections. Other drug-resistant, community-acquired bacterial infections from group A *Streptococcus* and ESBL-producing Enterobacteriaceae, for example, are also increasing. The U.S. Government is therefore committed to sustained and enhanced work to combat antibiotic resistance.

In September 2018, the CARB Task Force began developing an updated National Action Plan for CARB, which would cover activities in the years 2020 through 2025. The Task Force reviewed prior efforts and anticipated future challenges and opportunities. The PACCARB solicited and reported on public input, which the Task Force considered alongside perspectives from Federal experts. The result is a set of coordinated, strategic actions aimed at changing the trajectory of antibiotic resistance and improving the health and wellbeing of all Americans, as well as the health of animals, plants, and the environment.

Many of the actions build on and expand evidence-based activities initiated under the 2015-2020 National Action Plan for CARB that have already shown impact, such as the appropriate use of antibiotics in human health, animal health, and in the environment. The Task Force continues to consider infection prevention and control, especially within healthcare facilities, to be high priorities, to both slow the spread of antibiotic-resistant infections and to reduce the need for antibiotic use. Many actions focus on collecting data and turning it into information that can be used to better understand where resistance is occurring, to support the development of new diagnostics and treatment options, and to advance international coordination.

Implementing the activities outlined in this plan will depend on the availability of resources and capacity. The new National Action Plan for CARB, 2020-2025, does not exhaustively list all Federal activities that address antibiotic resistance. Rather, it includes the continuing and new actions that are considered the highest priority for reducing antibiotic resistance in the next five years.

Measuring and Reporting Progress

The 2020 Plan maintains the original five goals of the 2014 National Strategy but establishes a new set of objectives to move the country toward those goals. Whereas the 2015 plan included 1-, 3-, and 5-year milestones meant to capture the activities of specific Federal Departments and Agencies, the 2020 plan includes targets, many of which are composites of multiple activities pursued by multiple agencies. Each listed Department and Agency will report on progress toward these targets within the relevant timeframe. Where possible, the 2020 Plan has established targets to be achieved by 2021, with some targets set for longer timeframes. Each annual report on this Plan will provide updated or added targets as relevant along with rationale for these changes. For example, the first annual report might note that a 2021 target has been achieved and establish a new 2022 target for that objective.

Task Force members reviewed the barriers faced in the past five years while implementing the 2015 Plan and anticipated challenges over the next five years. Certain challenges apply to all five goals, including the allocation of limited resources, obstacles to data gathering and sharing, and uncertainty about the participation of research and industry partners. Implementing the activities outlined in this plan will depend on the availability of resources and capacity. The COVID-19 pandemic has necessitated redirection of public-health, infection control, and antibiotic stewardship resources and will continue to affect implementation of the activities described here. In future annual progress reports, the CARB Task Force will discuss challenges encountered during the preceding year, how it addressed these challenges, and any new challenges identified. Specific challenges are also noted for each Goal below. Appendix B lists all the Challenges.

In most cases, the CARB Task Force will not have direct evidence that the activities listed in this plan cause changes in relevant outcomes. This is because important human, animal, plant, and environmental health metrics are influenced by a variety of interdependent factors, making it difficult to establish single cause-and-effect relationships between specific activities and specific outcomes. However, tracking progress toward the targets listed here should inform the Task Force's understanding of relevant changes over time, allowing agencies to change course when necessary to more effectively achieve the objectives and make progress toward the goals.

Work under the 2015 Plan has clarified the Task Force's understanding of the challenges inherent in collecting and analyzing the data needed to combat antibiotic resistance. The 2020 Plan therefore designates several "Data Development" objectives that aim to develop new or improved data infrastructure, collection, or analysis options. Appendix A lists the Data Development strategies.

The Task Force will continue to report annually on progress, including challenges identified and actions taken to address those challenges. The Task Force may make changes to objectives or targets to accommodate potential new data sources or other unforeseen but informative changes to this work. These changes and their rationale will be included in annual reports.

SECTION 2

NATIONAL GOALS

Goal 1

Slow the Emergence of Resistant Bacteria and Prevent the Spread of Resistant Infections

Bacteria and fungi have developed unique mechanisms to resist the effects of antibiotics and antifungals, and continual evolution of antibiotic resistance is inevitable. However, the development of resistance can be slowed and its effects on human and animal health can be minimized. One way to achieve this is through primary prevention of infections through infection control and other interventions. Using antibiotics only when needed in humans and animals reduces the likelihood that bacteria will develop resistance and extends the effectiveness of current antibiotics. Appropriate antibiotic use also minimizes potential healthcare-related harms to patients, such as adverse drug events and the overgrowth of harmful bacteria (e.g., *Clostridioides difficile* infection, which causes severe diarrhea, toxic colon inflammation, and sometimes death). The objectives below build on recent improvements in infection prevention and control that have saved lives, particularly in hospital settings.

Anticipated Challenges

Prevention and containment efforts, along with improved use of antibiotics, can slow the emergence and spread of antibiotic resistance genes and antibiotic-resistant pathogens and can limit their impact on humans and animals. However, many challenges to these efforts exist. Some of these challenges are related to changing behaviors to ensure optimal infection-control practices and appropriate prescribing of antibiotics. Others could be part of identifying and scaling up best practices across spectrums of care, ensuring their continuity, and coordinating these practices across One Health. Still others could be related to engaging all relevant stakeholders for buy-in and support of best practices.

Objective 1

Expand national, regional, and State capacity for detecting, containing, and preventing antibiotic-resistant infections.

Objective 1.1

Reduce the number of infections and deaths from pathogens identified as antibiotic-resistant threats by CDC.

CDC

Decrease healthcare-associated antibiotic-resistant infections by 20 percent by 2025 and community-acquired antibiotic-resistant infections by 10 percent by 2025.

Objective 1.2

Support investments in U.S. health departments (including in all States and select tribes, territories, and large cities) to detect, contain, and prevent antibiotic-resistant infections.

CDC
Award an average of $2.5 million to Epidemiology and Laboratory Capacity Cooperative Agreement-funded health departments by 2025.

Objective 1.3

Support responses to identify, prevent, and contain antibiotic-resistant pathogens.

CDC, DoD/MRSN
Increase capacity nationwide to contain antibiotic-resistant infections and control outbreaks.

Objective 1.4

Conduct consultations or assessments related to antibiotic-resistant cases, outbreaks, and transmission in healthcare and the community for prevention and containment.

CDC, DoD/MRSN
Increase collaborative efforts at national, regional, and/or state levels to assist with antibiotic resistance response and prevention efforts in the general and military populations.

Objective 1.5

Monitor and report on antibiotic resistance among selected animal pathogens to detect new resistance patterns.

APHIS
Publish one report on an animal pathogen describing emerging antibiotic resistance by 2021.

Objective 2
Engage the public and other stakeholders to develop, expand, and increase national and State education, training, and communication campaigns focused on using antibiotics responsibly, stopping the spread of antibiotic resistance, and preventing infections and life-threatening conditions like sepsis.

Objective 2.1

Expand the scope and reach of CDC's awareness campaigns, including *Be Antibiotics Aware* and *Get Ahead of Sepsis*.

CDC
Each year, increase clicks, impressions, and earned or paid media.

Objective 2.2

Develop new or expanded educational training guidelines, outreach, and awareness activities to educate stakeholders, such as consumers, healthcare providers, and industries, on best practices for using antibiotics responsibly, stopping the spread of antibiotic resistance, and preventing infections.

CDC, CMS, APHIS
Increase and expand outreach activities each year.

Objective 2.3

Expand the promotion and utility of training guidelines and other communication materials.

CDC, APHIS
Each year, increase the number of individuals trained, continuing education units earned, and reach of efforts.

Objective 3
Develop and implement policies and practices to promote the responsible use of antibiotics.

Objective 3.1
Improve national outpatient antibiotic use.

CDC, DoD
Lower the annual rate of outpatient antibiotic dispensing per 1,000 U.S. population, overall and among specified subpopulations.

CDC, DoD
Lower the annual proportion and rate of antibiotic prescriptions for outpatient visits where antibiotics are not needed (according to evidence-based guidelines) and provide descriptive statistics for trends in unnecessary prescribing patterns.

Objective 3.2
Help healthcare providers adopt recommended antibiotic use practices.

CDC, DoD
Each year, increase the number of facilities and providers that implement CDC's best practices.

Objective 3.3
Support national and State policies that improve the use of antibiotics across healthcare settings and communities.

CDC, CMS
Develop and optimize interpretative guidance for the antibiotic stewardship requirements within the conditions of participation for Medicare and Medicaid programs.

Objective 3.4
Partner with clinical societies to consider options for improving the development, speed, and harmonization of antibiotic use and diagnostic guidelines that reflect clinical and public health needs for major syndromes.

CDC
Initiate at least one coordinated effort to improve antibiotic or diagnostic guidelines by 2021.

Objective 3.5

Support research to improve the responsible use of antibiotics across settings and translate important findings into practice.

AHRQ, CDC, DoD
Increase research on the responsible use of antibiotics and translate significant findings into practice.

Objective 3.6

Evaluate data on antibiotic use and stewardship practices in production animal species, including cattle, swine, poultry, goats, and sheep.

APHIS
Publish information on relevant practices by 2021.

Objective 3.7

Engage the animal health community, crop protection community, and other relevant stakeholders to advance strategies intended to foster the responsible use of medically important antibiotics in plants and animals.

FDA, CDC, EPA
Develop and implement strategies by 2025.

Objective 4

Develop and implement evidence-based policies and practices to prevent infections and stop the spread of antibiotic resistance across One Health.

Objective 4.1

Support further prevention of healthcare-associated infections (HAIs) prioritized in the National HAI Action Plan.

AHRQ, CDC, CMS, DoD
Meet the targets identified in the National HAI Action Plan.

Objective 4.2

Support national and State policies to help prevent HAIs and stop the spread of antibiotic resistance within and between settings and communities.

CDC, CMS
Develop and optimize guidance for improving infection control standards across healthcare settings.

Objective 4.3

Promote biosecurity practices on farms and other animal care facilities to reduce the risk from antibiotic-resistant pathogens.

APHIS
Develop updated biosecurity educational materials by 2022.

Objective 4.4

Collect information about biosecurity practices on farms to optimize educational materials about biosecurity for different industries.

APHIS
Report results of biosecurity data from National Animal Health Monitoring System from 2019 (Goats) and 2021 (Feedlot, Swine) by 2022.

Objective 4.5

Increase research on infection prevention and the emergence and spread of antibiotic resistance and use this research to prevent infections and the spread of antibiotic resistance.

AHRQ, CDC, DoD
Increase research in this area and translate significant findings into practice.

Goal 2

Strengthen National One Health Surveillance Efforts to Combat Resistance

Antibiotic resistance is unquestionably a One Health issue, impacting the health of humans, animals, plants, and the environment. Efforts to identify antibiotic-resistant organisms, track the spread of resistance, and measure the effect of antibiotic use require surveillance across human, animal, and plant populations and the environment, as well as collaboration from the U.S. Government agencies and partners across each of these settings. The following objectives aim to create a stronger coordinated national One Health effort with more extensive surveillance of antibiotic use and resistance to combat this threat.

Anticipated Challenges

Challenges to strengthening the national infrastructure for surveillance of antibiotic use and resistance could arise when encouraging local, State, and private partners and stakeholders to collect and share data across the human, animal, plant, and environmental (e.g., water, soil) sectors. Enhancing training and testing capacities will require laboratories to maintain ongoing support for staff, continuously maintain their testing equipment, and advance their testing methodologies. The cost-effectiveness and quality of testing (including whole-genome sequencing) depends on appropriate assignment of laboratory roles and responsibilities in accordance with expertise and capacity. Improving electronic surveillance will be necessary for efficient, timely, and consistent submission of data from frontline sources to and across Federal Departments and Agencies. Many challenges are inherent to these activities, such as those associated with sharing electronic data on antibiotic use and resistance, developing and implementing minimum data-quality standards of measurement, and ensuring enough resources to support isolate and data repositories. Federal Departments and Agencies will need to write new policies and processes for the secure and confidential storage and sharing of data. Success in these activities will require extensive, coordinated, and comprehensive efforts by all partners across One Health.

Objectives begin on next page.

Objective 1
Strengthen testing and training capacities and capabilities, enhance integration and harmonization of testing data, and expand the reach of Federal antibiotic resistance laboratory networks across One Health.

Objective 1.1

Expand surveillance through existing systems to monitor antibiotic resistance from multiple sources across One Health.

CDC, FDA, APHIS, FSIS
Increase the amount of laboratory testing for antibiotic resistance, the number of isolates accompanied by test results and available data, and the number of different specimen sources and specimen types collected.

DoD/GEIS, MRSN
Submit all identified multidrug-resistant bacterial and fungal isolates of concern (e.g., antibiotic-resistant pathogens identified in the CDC 2019 AR Threats Report) from DoD Defense Health Agency Medical Centers for centralized and standardized genetic characterization at the Multidrug-Resistant Organism Repository and Surveillance Network (MRSN) by 2023.

Objective 1.2

Increase whole-genome sequencing and antibiotic resistance phenotypic and genotypic testing in laboratory networks for antibiotic-resistant pathogens listed in CDC's 2019 AR Threats Report and upload sequenced data to the National Institutes of Health (NIH) National Center for Biotechnology Information at the National Library of Medicine or to other approved, secure, and widely accessible databases.

CDC, APHIS, DoD/MRSN
Increase percentage of isolates with test results and uploaded sequence data.

Objective 1.3

Establish an accelerator program to advance implementation of whole-genome sequencing, metagenomics, and other molecular testing for antibiotic-resistant pathogens in humans, animals, plants, and the environment and to coordinate training guidance across agencies and among public and private organizations.

CDC, DoD
Establish at least one collaboration through this program to enhance whole-genome sequencing or metagenomics techniques by 2022.

Objective 2

Continue expanding and improving access to specimen and data repositories for research and innovation.

Objective 2.1

Expand the contents of current repositories across One Health of bacterial and fungal strains and their associated genotypic, phenotypic, and descriptive data and, where possible, improve and increase the accessibility, transparency, interoperability, security, storage, and utility of these data.

CDC, FDA, NIH, APHIS, FSIS, DoD/MRSN, EPA
Increase the number of isolates, panels, and data available and relevant publications in the scientific literature.

Objective 2.2

Support and expand efforts to provide rapid, accurate, and comprehensive access to antibiotic-resistant isolates, integrated data sources (including genomic, phenotypic, and functional data), and up-to-date computational analysis tools, and improve adherence to the "FAIR" (findability, accessibility, interoperability, and reusability) principles for scientific data management and stewardship.

NIH
Award new grants that support access to data and computational tools focused on antibiotic resistance.

NIH
Offer training opportunities and outreach for FAIR principles.

Objective 2.3

Through the National Antimicrobial Resistance Monitoring System (NARMS) and the Veterinary Laboratory Investigation and Response Network (Vet-LIRN), contribute antibiotic-resistant isolates from food and animals to the existing CDC and FDA AR Isolate Bank.

CDC, FDA, FSIS
Establish mechanisms for sharing food and animal isolates by 2021.

Objective 2.4

Migrate DoD's bacterial and fungal genome sequencing data and associated phenotypic data to a secure, cloud-based or equivalent environment, to allow authorized Federal users to access pathogen data.

DoD
Identify suitable storage solutions that will satisfy access requirements by 2021.

Objective 3

Strengthen the national infrastructure for antibiotic resistance surveillance data across One Health, by improving capacity, utility, timeliness, and the use of harmonized terminology.

Objective 3.1

Expand the number of sources for and quantity of antibiotic resistance surveillance data collected from inpatient healthcare facilities.

CDC, CMS, DoD, VA
Explore interagency collaborations to examine options for increased reporting to the CDC National Healthcare Safety Network (NHSN) Antibiotic Resistance Option.

CDC, DoD/MRSN, VA
75 percent of acute care hospitals, 100 percent of DoD hospitals, 100 percent of applicable VA hospitals that have transitioned to the VA's updated electronic health record, and 25 percent of critical access hospitals, reporting to the NHSN Antibiotic Resistance Option.

DoD/MRSN, VA
Expand DoD and VA collaborations to increase the number of VA medical centers submitting multidrug resistance data or isolates from multidrug-resistant pathogens to the MRSN

Objective 3.2

Expand the number of sources for and quantity of community-transmitted antibiotic resistance surveillance data from humans including sexually-transmitted infections, enteric diseases, respiratory illness, and other diseases caused by antibiotic-resistant pathogens.

CDC, DoD/GEIS
Each year, increase the number of human isolates collected and analyzed.

Objective 3.3

Expand the number of sources for and quantity of antibiotic resistance surveillance data from animals, farms, and production facilities.

CDC, FDA, NIH, APHIS, FSIS
Increase the number of animal, feed, or food isolates collected, analyzed, and used for prevention and response efforts.

Objective 3.4

Establish new capacities for collecting antibiotic resistance data from the environment, including water and soil.

CDC, FDA, ARS, EPA, U.S. Geological Survey (USGS) within the U.S. DoI
Establish at least two projects to expand antibiotic resistance data collection from the environment, including national-scale testing of surface waters as part of NARMS by 2022.

Objective 3.5

Establish a platform for more comprehensive understanding of the carriage of antibiotic resistance genes (also known as the resistome) present across One Health.

CDC, USGS
Establish a pilot sampling strategy to collect healthy human, animal, plant, and environmental specimens and epidemiological data by 2023.

Objective 4
Strengthen the national infrastructure for antibiotic use surveillance data across One Health, by improving capacity, utility, timeliness, and the use of harmonized terminology.

Objective 4.1

Expand the number of sources for and quantity of surveillance data on the use of antibiotics from inpatient and outpatient healthcare facilities to improve understanding and implementation of the optimal use of antibiotics.

CDC, CMS, DoD, VA
Explore interagency collaborations to examine options for increased reporting to the CDC National Healthcare Safety Network (NHSN) Antibiotic Resistance Option.

CDC, DoD
100 percent of acute care and 50 percent of critical access hospitals reporting to the CDC NHSN Antibiotic Use Option.

CDC
Improve timelines of annual outpatient antibiotic use tracking and reporting by 2021.

CDC, DoD/PVC
Implement tracking of antibiotic use in all DoD Military Health System facilities, using the Standardized Antimicrobial Administration Ratio (based on observed inpatient antimicrobial days of therapy), by 2021.

DoD
Increase the percentage of optimal antibiotic prescriptions in the DoD Military Health System.

Objective 4.2

Develop new or expand the number of sources for and quantity of surveillance data on the use of antibiotics collected from animals, farms, and production facilities to improve understanding and implementation of responsible use of antibiotics.

FDA, APHIS
Increase published reports and dashboards on antibiotic use in animals.

Goal 3

Advance Development and Use of Rapid and Innovative Diagnostic Tests for Identification and Characterization of Resistant Bacteria

New diagnostic tests are urgently needed to detect antibiotic resistance and to improve surveillance, the control of infections, and treatment decision-making by providers. One major impediment to introducing new diagnostics is a lack of research on their appropriate use in clinical and veterinary care and a lack of point-of-care antibiotic resistance diagnostics in outpatient settings. More information is needed to determine the impact of diagnostics on improving the use of antibiotics and related outcomes in humans and animals, to identify circumstances in which specific diagnostics improve outcomes, and to identify best practices for integrating diagnostics into relevant decision-making processes. Finally, there is a critical need to leverage existing capabilities to promote the validation, adoption, and appropriate use of new and currently available diagnostics.

Anticipated Challenges

When companies develop new diagnostic tests, they face challenges such as the high cost of some components of the tests, technical difficulties in preparing and obtaining clinical samples, and pathogen-drug interactions. Limited return on investment for new diagnostics is also a significant challenge. Determining the appropriate use of new and existing diagnostic tools requires an engaged response from the research community. Once diagnostics are developed, stimulating their appropriate adoption and use requires the creation of evidence-based guidelines and appropriate reimbursement policies, an often protracted and complex process.

Objective 1

Develop and validate new diagnostics.

Objective 1.1

Develop new or enhance existing diagnostics that use isolates and primary samples to determine the presence, severity, or antimicrobial susceptibility or resistance of bacterial or fungal infections and to identify appropriate treatment.

ASPR/BARDA, CDC, FDA, NIH, ARS, DoD
Support 10 new antibiotic resistance-related diagnostics projects across the U.S. Government by 2021, through funding or scientific or technical support.

Objective 2
Support research to determine the appropriate use of diagnostics.

Objective 2.1

Stimulate research to better understand the appropriate use of diagnostics to determine the presence, severity, or antimicrobial susceptibility or resistance of bacterial or fungal infections in human and veterinary care.

AHRQ, CDC, NIH, DoD/MIDRP
Invite research applications and support research on the appropriate use of CARB-related diagnostics in human clinical and veterinary care.

Objective 3
Stimulate the appropriate adoption and use of diagnostics.

Objective 3.1

Develop evidence-based guidance to promote the appropriate use of new diagnostics and to improve the use of existing diagnostics that determine the presence, severity, or antimicrobial susceptibility or resistance of bacterial or fungal infections in human clinical care.

CDC, FDA
Support the development of evidence-based guidelines for the use of new and existing antibiotic and antifungal resistance-related diagnostics.

Goal 4

Accelerate Basic and Applied Research and Development for New Antibiotics, Other Therapeutics, and Vaccines

Antibiotic effectiveness is continually reduced through the evolution of antibiotic resistance, requiring support for basic and applied research as part of a comprehensive One Health strategy. Research can improve our understanding of the many factors that contribute to the emergence, spread, and persistence of antibiotic resistance and can support new strategies for preventing and mitigating infections. Prolonging the effectiveness of an existing drug depends on research to determine its optimal dose, duration, regimen, and drug combinations. The pipeline of new antibiotics must be continually primed through discovery and development research. In addition, research on alternatives to antibiotics, including bacteriophages, monoclonal antibodies, immune modulators, and phytochemicals, suggests that these products can help prevent and treat infections in humans and animals without promoting antibiotic resistance. Effective vaccines that prevent infection may also reduce use of antibiotics, thereby avoiding resistance. Research on other innovative products (e.g., live biotherapeutics, including microbiome-based products, prophylactic monoclonal antibodies, and decolonizing agents) could expand the range of strategies and help reduce the impact of antibiotic resistance. Developing therapeutic and preventative products (including those directed at decolonization) requires intensified efforts to support basic research, turn discoveries into products, and facilitate clinical trials. The final objective of Goal 4 aims to promote the economic sustainability of the antibiotics market through collaboration with the private sector.

Anticipated Challenges

Across One Health, the multi-year process to develop new antibiotics, therapeutics, and vaccines includes a high rate of attrition within the discovery pipeline. Discovery of new classes of antibiotics with activity against gram-negative bacteria is also very challenging, and the development pathways for most non-antibiotic therapeutics remain uncharted. Additionally, the lag time between completing and publishing the results of basic and applied research studies can delay their real-world impact.

In addition to the targeted objectives of Goal 4 listed below, the U.S. Government will pursue several broad activities to accelerate research on antibiotic resistance.

Activity 1

Enhance basic research on antibiotic resistance mechanisms, as well as translational and clinical research on therapeutics, vaccines, and diagnostics.

NIH, ARS, NIFA
Support at least 1,000 publications focused on basic, translational, and clinical research to combat antibiotic resistance by 2021.

Activity 2

Support the training of new investigators and new entrants in the field to improve research capacity on antibiotic resistance.

NIH, ARS, NIFA
Provide support to at least 60 new or early-career investigators by 2021.

Activity 3

Enhance interagency collaborations to accelerate basic and applied research for developing new antibiotics, therapeutics, and vaccines.

ASPR/BARDA, CDC, FDA, NIH, ARS, DoD
Establish at least two new collaborations for human health and one for agriculture by 2021, through interagency agreements, collaborative programs, and interdisciplinary workshops.

Objective 1

Expand basic and applied interdisciplinary research to better understand the emergence, spread, and persistence of antibiotic resistance, and develop mitigation strategies for antibiotic resistance in human, animal, agricultural, and environmental settings.

Objective 1.1

Advance our understanding of the emergence, spread, and persistence of antibiotic resistance.

CDC, NIH, ARS, NIFA
Report success stories to disseminate new knowledge about antibiotic resistance and inform mitigation strategies in human health (at least two stories) and agriculture (at least one story) by 2021.

Objective 2
Intensify basic, translational, and clinical research to support the discovery and development of new treatments, including antibiotics, non-traditional therapeutics, and optimized treatment regimens.

Objective 2.1

Support the discovery and preclinical development of new therapeutics.

ASPR/BARDA, NIH
Award 100 new projects (e.g., grants, contracts, CARB-X awards) aimed at therapeutic discovery or development by 2024.

DoD
Identify one candidate therapeutic for bacterial infections in human medicine for further research and development by 2022.

ARS, NIFA
Identify one candidate therapeutic for bacterial infections in agriculture for further research and development by 2021.

NIH, ARS, NIFA, DoD
Report success stories about additional therapeutic options for human health (at least 5 stories) and agriculture (at least 1 story) by 2021.

Objective 2.2

Support clinical research into and development of new treatments, including antibiotics, non-traditional therapeutics, and optimized treatment regimens.

ASPR/BARDA, NIH, DoD
Facilitate development of 10 novel potential therapeutics for bacterial infections in humans by 2022.

FDA
Provide guidance on regulatory requirements, including clinical trial designs and other relevant topics.

ASPR/BARDA
Support New Drug Application (NDA) filings for three new therapeutics to treat bacterial infections in humans by 2025.

Objective 2.3

Provide specimens, testing, data, and evaluations to collaborations aimed at developing new agents or older agents for new uses and to support establishment or revision of antibiotic-susceptibility testing standards.

CDC, DoD/WRAIR
Establish at least two projects supporting the development of new agents and standards by 2021.

Objective 3

Intensify basic, translational, and clinical research to support the discovery and development of new preventative products or strategies.

Objective 3.1

Support the discovery and development of new preventative strategies.

ASPR/BARDA, NIH
Award 25 new projects aimed at discovering or developing new preventative products for use in human medicine by 2022.

ARS, NIFA
Support two candidate preventative agents for agricultural uses by 2021.

CDC, NIH, ARS, NIFA
Report success stories about improved preventative strategies for human health (at least two stories) and agriculture (at least one story) by 2021.

Objective 3.2

Clarify pathways for new pharmaceutical preventatives by defining appropriate clinical trial designs, including end points.

CDC, FDA, NIH, DoD
Convene two meetings to discuss developmental pathways and regulatory considerations, including clinical trial designs, by 2023.

Objective 3.3

Facilitate development of vaccines that prevent bacterial and fungal infections with known rates of resistance, and augment existing post-licensure evaluation systems to evaluate vaccination rates and antibiotic or antifungal use and resistant infections over time.

CDC
Establish at least two antibiotic-resistant pathogen-related projects to further vaccine development or uptake by 2022.

CDC
Further support existing active, laboratory, population-based bacterial and fungal monitoring activities to provide vital serotype distribution and resistance data to inform development of vaccine candidates for bacteria or fungi with known resistance.

Objective 4

Enhance efforts to promote sustainability of the commercial market for new antibiotic products.

Objective 4.1

Support the creation of a network of clinical trial sites to reduce barriers to research and to establish a comprehensive understanding of the safety and effectiveness of new antibiotic agents in challenging clinical settings and indications.

FDA
Provide scientific and technical support for establishing the network, including recommendations on platform trial design and other regulatory considerations.

ASPR/BARDA, NIH, DoD/WRAIR/IDCRP
Establish the network and begin enrolling patients by 2023.

Objective 4.2

Examine changes in new technology add-on payments under the CMS Inpatient Prospective Payment System (IPPS) Final Rules, starting with the FY 2020 IPPS/long-term care hospital prospective payment system final rule, to inform potential additional actions.

CMS
Report the number of applications, approvals, and renewals for new technology add-on payments and the estimated amount of those payments.

Objective 4.3

Strengthen commercial markets for antibiotic products through direct Public Health and National Security purchases.

ASPR/BARDA
Acquire antibiotics to ensure national security and to provide revenue to encourage commercialization.

Objective 4.4

Support efforts to secure U.S.-based manufacturing infrastructure.

ASPR/BARDA
Work with innovator companies to generate domestic production of critically needed products and expand U.S.-based manufacturing capabilities.

Goal 5

Improve International Collaboration and Capacities for Antibiotic-resistance Prevention, Surveillance, Control, and Antibiotic Research and Prevention

As outlined in the National Biodefense Strategy, the U.S. Government Global Health Security Strategy, and in accordance with the U.S. Government's engagement through the Global Health Security Agenda, the U.S. Government works to enhance the capacities of governments, civil society, academia, and the private sector in partner countries and the international community to address the emergence, spread, and impact of antibiotic resistance. To do this, rapidly detecting and containing antibiotic-resistant pathogens through enhanced laboratory networks is critical. Several objectives within this goal build on existing international research collaborations to combat antibiotic resistance. Concerted efforts to align resources internationally could support clinical trials to evaluate new products and provide data on the best way to use existing products. These efforts would also promote the translational development of diagnostics, treatments, and vaccines, support research to understand the development and spread of antibiotic resistance, identify risk factors linked to human health outcomes, and generate mitigation strategies.

Anticipated Challenges

Developing global consensus around updates to international guidance can be a difficult and protracted effort. Also difficult is the process of supporting the efforts of partner countries to better identify the emergence and spread of antibiotic resistance. Establishing a well-functioning international network that can detect and respond to antibiotic resistance requires substantial and well-aligned resources, including the ability to tap experts to help with the containment of resistance. Alternatively, a global network could focus on high-value locations, such as those with a high risk for developing outbreaks of new high-threat pathogens and with frequent embarkation points for travel to the U.S.

Objective 1

Enhance U.S. leadership in the global fight against antibiotic resistance.

Objective 1.1

Examine mechanisms for appointing a U.S. Federal Champion for International CARB, who would support the Secretaries of HHS, USDA, DoS, and the Administrator of USAID by advocating for U.S. policy positions on antibiotic resistance at international fora and organizations using a One Health approach, and who would report to the CARB Task Force to inform international engagements.

OGA, USDA, DoD, USAID
Convene a working group of the CARB Task Force to define interagency needs and develop options for appointing a Federal Champion for International CARB by 2021.

Objective 1.2

Enhance engagements with multilateral organizations to support progress on U.S. priorities to combat antibiotic resistance.

OGA, DoS, USDA, USAID
Support international antibiotic resistance policy efforts to prioritize and coordinate antibiotic resistance efforts within and across international partner organizations (e.g., FAO, the G7 and G20, the Asia-Pacific Economic Cooperation Forum, the Global Health Security Initiative, and the UN One Health Global Leaders Group on AMR) by 2022.

OGA
Chair the Global Health Security Agenda AMR Action Package by 2022.

ASPR/BARDA, CDC, FDA, OGA, USDA, NIH
Complete and implement the Work Plan of the Transatlantic Taskforce on Antimicrobial Resistance (TATFAR) for 2021-2025 and develop a new Scope of Work for TATFAR by 2021.

FDA, USDA
Work with international partners through the Codex Alimentarius Commission's Task Force on Antimicrobial Resistance to develop global, science- and risk-based guidance on managing foodborne antimicrobial resistance and surveillance, including revising the Codex Code of Practice to Minimize and Contain Foodborne Antibiotic Resistance and developing new Guidelines for Integrated Surveillance of Antimicrobial Resistance.

CDC, USAID
Continue to support member governments' sharing of antibiotic-resistant pathogen information to the relevant collaborating centers, including to the WHO Global Antimicrobial Resistance Surveillance System (GLASS).

Objective 1.3

Provide additional financial or technical support to public and private organizations to further U.S. priorities to combat antibiotic resistance.

OGA, USAID
Support international policy efforts to reduce antibiotic resistance beyond the current mandates of U.S. Government Departments and Agencies by 2022.

Objective 1.4

Increase the U.S. Government's presence in international organizations and other multilateral efforts to combat antibiotic resistance.

CDC, OGA, USDA, DoD, DoS, USAID
Provide at least one AMR expert either by secondment or appointment to a multilateral organization to enhance the U.S. Government's programmatic collaborations and provide high-level technical and policy guidance by 2022.

Objective 1.5

Enhance domestic and international communications about the U.S. Government's activities to combat antibiotic resistance and increase the coordination of Federal Departments and Agencies on the CARB Task Force around large-scale efforts and announcements.

All Departments and Agencies on the CARB Task Force
Increase coordination among the CARB Task Force on communication strategies by instituting regular calls by 2021.

CDC, OGA, NIH, USDA, DoD, DoS, USAID
Increase high-level social-media promotion of antibiotic-resistance activities among the Departments and Agencies on the CARB Task Force.

Objective 2

Promote increased awareness and capacity in countries to address the emergence and slow the spread of antibiotic resistance.

Objective 2.1

Improve capacity in partner countries to implement effective practices to prevent and control infection, including through the availability and proper use of water, sanitation, and hygiene (WASH).

CDC, FAS, DoS, USAID
Assist governments, civil society, and the private sector in a total of 10-15 low- or middle-income countries to develop national plans or capacity for preventing and controlling infections in both animals and humans by 2022.

CDC, USAID
Assist governments, civil society, and the private sector in 10 to 15 low- or middle-income countries to improve the monitoring of WASH in healthcare facilities or to create and/or implement standards for environmental health in healthcare settings.

Objective 2.2

Optimize the use of antibiotics in humans, animals, and agriculture outside of the U.S.

CDC, USAID
Assist governments, civil society, and the private sector in at least four low- or middle-income countries with capacity-building for antibiotic stewardship and regulation to address the appropriate use and availability of quality-assured antibiotics in humans and animals by 2022.

Objective 2.3

Promote the use of existing and new vaccines, including pneumococcal and typhoid-conjugate vaccines, to reduce the unnecessary use of antibiotics.

CDC, USAID
Promote prevention and vaccine use in low- and middle-income countries, including through the U.S. Government's partnership with Gavi, the Vaccine Alliance, supported by funding and technical assistance from USAID and CDC worldwide.

Objective 2.4

Conduct surveillance that identifies the presence and movement of antibiotic resistance genes of concern within partner nations as part of DoD/GEIS-funded surveillance to protect military force health.

DoD
Submit isolates of multi-drug-resistant pathogens to the MRSN for advanced characterization and provide reports to the labs that can also inform surveillance of antibiotic resistance, by 2021.

Objective 3

Generate consistent and actionable global data on antibiotic resistance, including by extending CDC's AR Lab Network to global sites to address the identification, emergence, spread, and effects of antibiotic resistance.

Objective 3.1

Expand the AR Lab Network and other networks (e.g., PulseNet International) internationally to implement networks for detection and containment that can rapidly test and respond to high-threat antibiotic-resistant pathogens in key regions.

CDC
Launch at least one international AR Lab Network project and make operational at least one international AR Lab Network laboratory by 2022. Incorporate five additional laboratories by 2026.

Objective 3.2

Charge the global AR Lab Network with detecting and containing new and critical antibiotic-resistance threats.

CDC, DoD
Establish the capacity of the global AR Lab Network to receive and test isolates and deploy rapid responses to control and contain infections.

Objective 3.3

Identify innovative and effective strategies for stopping the spread of antibiotic-resistant pathogens in low- and middle-income countries.

CDC
Establish "learning laboratories" through the AR Lab Network to develop or test innovative, cost-effective solutions for containing critical-threat antibiotic-resistant pathogens by 2021.

Objective 3.4

Improve the standardization of laboratory methodologies and data collection to improve the quality, reliability, and utility of data to facilitate global comparisons of antibiotic resistance.

CDC, DoD
Implement standardized or harmonized laboratory methods and data collection in AR Lab Network facilities to facilitate comparison of antibiotic-resistance trends when appropriate. Initiate data-reporting efforts with trusted partner nations by 2021.

Objective 3.5

Expand overseas screening of long-term visitors to the U.S. (e.g., international workers and students) from high-risk countries to prevent the importation of cases of multidrug-resistant tuberculosis.

CDC, DoS
Pilot screening in five countries by 2021. Expand to 45 countries by 2025.

Objective 4
Increase international collaborations to facilitate basic, translational, and clinical research into understanding the causes of antibiotic resistance and developing countermeasures.

Objective 4.1

Collaborate with international scientists and organizations to better understand the development, spread, and health risks of antibiotic resistance and resistance sources present in animals, the environment, the community, and healthcare settings.

CDC, ARS, DoD/GEIS/WRAIR, USAID
Conduct research and/or surveillance projects to evaluate sources of antibiotic resistance and mechanisms of persistence, with a focus on animal and environmental systems by 2023.

Objective 4.2

Promote the alignment of U.S. and international translational and clinical research activities to facilitate the development of new products to better diagnose, prevent, and treat infections or to provide data on the best use of existing products.

ASPR/BARDA, NIH
Report one success story about products or regimens undergoing preclinical or clinical testing by 2021.

FDA
Convene a meeting with international regulators to seek alignment on clinical trial designs for new products by 2023.

SECTION 3

APPENDICES

Appendix A: Data Development Objectives

These objectives aim to develop new or improved data infrastructure, collection, or analysis techniques.

Goal 1	• Objective 3.4: Partner with clinical societies to consider options for improving the development, speed, and harmonization of antibiotic use and diagnostic guidelines that reflect clinical and public health needs for major syndromes.
Goal 2	• Objective 1.3: Establish an accelerator program to advance implementation of whole-genome sequencing, metagenomics, and other molecular testing for antibiotic-resistant pathogens in humans, animals, plants, and the environment and to coordinate training guidance across agencies and among public and private organizations. • Objective 2.1: Expand the contents of current repositories across One Health of bacterial and fungal strains and their associated genotypic, phenotypic, and descriptive data and, where possible, improve and increase the accessibility, transparency, interoperability, security, storage, and utility of these data. • Objective 2.3: Through the National Antimicrobial Resistance Monitoring System (NARMS) and the Veterinary Laboratory Investigation and Response Network (Vet-LIRN), contribute antibiotic-resistant isolates from food and animals to the existing CDC and FDA AR Isolate Bank. • Objective 3.4: Establish new capacities for collecting antibiotic resistance data from the environment, including water and soil. • Objective 3.5: Establish a platform for more comprehensive understanding of the carriage of antibiotic resistance genes (also known as the resistome) present across One Health. • Objective 4.2: Develop new or expand the number of sources for and quantity of surveillance data on the use of antibiotics collected from animals, farms, and production facilities to improve understanding and responsible use of antibiotics.
Goal 3	• No Data Development strategies for Goal 3.
Goal 4	• Objective 3.3: Facilitate development of vaccines that prevent bacterial and fungal infections with known rates of resistance, and augment existing post-licensure evaluation systems to evaluate vaccination rates and antibiotic or antifungal use and resistant infections over time.
Goal 5	• Objective 3.1: Expand the AR Lab Network and other networks (e.g., PulseNet International) internationally to implement detection and containment networks that can rapidly test and respond to high-threat antibiotic-resistant pathogens in key regions.

Appendix B: Challenges

Anticipated Challenges to Implementing the National Action Plan for CARB, 2020-2025

As the Task Force drafted the 2020 Plan, its members reviewed the barriers faced in the past five years while implementing the 2015 Plan and anticipated challenges over the next five years. Certain challenges apply to all five goals, including the allocation of limited resources, obstacles to data gathering and sharing, and uncertainty about the participation of research and industry partners. Implementing the activities outlined in this plan will depend on the availability of resources and capacity. The COVID-19 pandemic has necessitated redirection of public-health, infection-control, and antibiotic stewardship resources and will continue to affect implementation of the activities described here. In future annual progress reports, the CARB Task Force will discuss challenges encountered during the preceding year, how it addressed these challenges, and any new challenges identified.

Goal 1: Slow the Emergence of Antibiotic-Resistant Bacteria and Prevent the Spread of Resistant Infections

Prevention and containment efforts, along with improved use of antibiotics, can slow the emergence and spread of antibiotic resistance genes and antibiotic-resistant pathogens and can limit their impact on humans and animals. However, many challenges to these efforts exist. Some of these challenges are related to changing behaviors to ensure optimal infection-control practices and appropriate prescribing of antibiotics. Others could be part of identifying and scaling up best practices across spectrums of care, ensuring their continuity, and coordinating these practices across One Health. Still others could be related to engaging all relevant stakeholders for buy-in and support of best practices.

Goal 2: Strengthen National One Health Capacity and Surveillance Efforts to Combat Antibiotic Resistance

Challenges to strengthening the national infrastructure for surveillance of antibiotic use and resistance could arise when encouraging local, State, and private partners and stakeholders to collect and share data across the human, animal, plant, and environmental (e.g., water, soil) sectors. Enhancing training and testing capacities will require laboratories to maintain ongoing support for staff, continuously maintain their testing equipment, and advance their testing methodologies. The cost-effectiveness and quality of testing (including whole-genome sequencing) depends on appropriate assignment of laboratory roles and responsibilities in accordance with expertise and capacity. Improving electronic surveillance will be necessary for efficient, timely, and consistent submission of data from frontline sources to and across Federal Departments and Agencies. Many challenges are inherent to these activities, such as those associated with sharing electronic data on antibiotic use and resistance, developing and implementing minimum data-quality standards of measurement, and ensuring enough resources to support isolate and data repositories. Federal Departments and Agencies will need to write new policies and processes for the secure and confidential storage and sharing of data. Success in these activities will require extensive, coordinated, and comprehensive efforts by all partners across One Health.

Goal 3: Advance the Development and Use of Rapid and Innovative Diagnostic Tests for Identifying and Characterizing Antibiotic-Resistant Bacteria

When companies develop new diagnostic tests, they face challenges such as the high cost of some components of the tests, technical difficulties in preparing and obtaining clinical samples, and pathogen-drug interactions. Limited return on investment for new diagnostics is also a significant challenge. Determining the appropriate use of new and existing diagnostic tools requires an engaged response from the research community. Once diagnostics are developed, stimulating their appropriate adoption and use requires the creation of evidence-based guidelines and appropriate reimbursement policies, an often protracted and complex process.

Goal 4: Accelerate Basic and Applied Research to Develop New Antibiotics, Therapeutics, and Vaccines

Across One Health, the multi-year process to develop new antibiotics, therapeutics, and vaccines includes a high rate of attrition within the discovery pipeline. Discovery of new classes of antibiotics with activity against gram-negative bacteria is also very challenging, and the development pathways for most non-antibiotic therapeutics remain uncharted. Additionally, the lag time between completing and publishing the results of basic and applied research studies can delay their real-world impact.

Goal 5: Improve International Collaboration and Capacities for Preventing, Tracking, and Controlling Antibiotic Resistance and for Antibiotic Research and Development

Developing global consensus around updates to international guidance can be a difficult and protracted effort. Also difficult is the process of supporting the efforts of partner countries to better identify the emergence and spread of antibiotic resistance. Establishing a well-functioning international network that can detect and respond to antibiotic resistance requires substantial and well-aligned resources, including the ability to tap experts to help with the containment of resistance. Alternatively, a global network could focus on high-value locations, such as those with a high risk for developing outbreaks of new high-threat pathogens and with frequent embarkation points for travel to the U.S.

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