Progress Report: Recommendations for Antimicrobial Resistance Surveillance in the United States
• **Introduction**

The Year 4 Antimicrobial Resistance Task Force (ARSTF) annual report describes the progress made from December 2019 to September 2020. The report summarizes ARSTF priority areas that were identified during the in-person Strategic Planning Meeting in February 2020, shares updates of current activities, summarizes discussion highlights during the ARSTF Year 4 Plenary Call on September 3, 2020, and outlines future directions of ARSTF.

*Due to impacts of the Coronavirus Disease 2019 (COVID-19) pandemic on ARSTF activities, Year 4 activities have continued into Year 5. The next public report will encompass both Year 5 and Year 6 activities as ARSTF continues to engage on public health priorities.*

• **ARSTF Strategic Planning Meeting, February 04, 2020**

The Task Force convened an in-person Strategic Planning Meeting in Atlanta, GA, on Tuesday, February 4th, 2020. Meeting participants were Task Force members from the Centers for Disease Control and Prevention (CDC), the Council of State and Territorial Epidemiologists (CSTE), the Association of Public Health Laboratories (APHL), healthcare institutions, and state and local health departments. The goals of this Strategic Planning Meeting were to discuss Task Force progress to date guided by the ARSTF Year 3 Progress Report, and solidify priorities, activities, and approaches for the coming year.

The following topics were discussed at the Strategic Meeting: 1) Overview of Year 3 activities, including workgroup progress and updates; 2) Review of CDC’s Division of Healthcare Quality and Promotion (DHQP) activities and initiatives, including data strategy and Antimicrobial Resistance Information Exchange (ARIE); 3) Prioritization of Year 4 activities and strategies for accomplishing the work; 4) Sustainability of the Task Force.

1) **Overview of ARSTF Year 3 Report and Activities**

At the ARSTF Strategic Planning Meeting on February 4, 2020, ARSTF Year 3 activities and progress were reviewed. In ARSTF Year 3 (July 2018 – June 2019), the Task Force established five workgroups to implement recommendations in the areas of data standardization needs, Antimicrobial Resistance (AR) surveillance challenges and opportunities, and stakeholder organizations engagement and collaboration. These five workgroups were 1) Data standardization, reporting, and linkage; 2) Data suppression and breakpoints; 3) Carbapenemase-producing carbapenem-resistant Enterobacterales (CP-CRE) message mapping guide (MMG); 4) National Healthcare Safety Network (NHSN), tracking AR in healthcare facilities; and 5) AR surveillance scope which seeks to develop a policy for surveillance of multidrug-resistant organisms (MDROs).

These five workgroups made significant progress and achievements during ARSTF Year 3. For example, connections were made with Regenstrief, the National Library of Medicine (NLM), and the Systemic Harmonization and Interoperability Enhancement for Laboratory Data (SHIELD) led by FDA to discuss the use and creation of LOINC and SNOMED codes for AR pathogens and corresponding test results. Year 3 succeeded in the adoption of a CLIA (Clinical Laboratory Improvement Advisory) requirement to use the most up-to-date breakpoints. Additional highlights included the release of Healthcare-Associated Infections (HAI) Multidrug-Resistant
Organisms (MDRO) Message Mapping Guide (MMG), identification of the state laboratory identification (ID) number as one of the likely best linking accession numbers for laboratory and epidemiologic case finding data, engaging stakeholders to understand and discuss data suppression, supporting the use of HL7 as the messaging standard for AR electronic lab reporting (ELR), discussing state and national efforts for developing registries for tracking MDRO across healthcare settings, and development and distribution of a national antibiogram assessment. A high-level summary of these activities is provided in the ARSTF Year 3 Progress Report, "Recommendations for Antimicrobial Resistance in the United States."

At the Feb 4, 2020 Strategic Planning Meeting, meeting participants reviewed the ARSTF Year 3 activities and progress, and an active listening sheet (Appendix 1) was used for meeting participants to categorize and prioritize future ARSTF activities. The Actionable category was for activities that had clear methods to achieve and measure progress. The Info Needed category was for activities that required more information to take actions. The Parking Lot category was for activities that may be considered low priority for ARSTF to pursue. The results of this active listening sheet were used to facilitate discussions on prioritization of Year 4 activities.

(2) DHQP Activities and Initiatives
Representatives from CDC’s DHQP overviewed their strategic plan to improve the use of data for action. Some examples from the National Healthcare Safety Network (NHSN) were presented. CDC’s DHQP also shared the progress made on guidance of AR Information Exchange (ARIE). The details of these DHQP activities and initiatives are shared in the appendix (Appendix 2).

(3) Prioritization of Year 4 Activities
A guided worksheet (Appendix 3) was used along with the active listening sheet in this session to generate discussions on prioritization of Year 4 activities. Questions in the following categories were used to guide discussions: continuations of existing Task Force efforts, collaboration efforts, funding, alignment with existing Task Force priorities, feasibility, and expected output.

The meeting participants identified the following areas of interest and discussed activities and potential deliverables. A summary of discussion highlights follows.

A. Linkage of laboratory data and epidemiologic case finding data
It is essential to highlight the importance of linking laboratory data and epidemiologic case finding data to allow programs to obtain and track information collectively. State laboratory ID number was one of the potential accession numbers to link laboratory data and epidemiologic case finding data. This should also apply to all data flows and directions in public health, including clinical laboratories, local and state health departments, and CDC. More future discussions are warranted to explore and determine the best accession number to apply to data linkage.

B. Data suppression
A potential deliverable would be generating a document to outline the public health challenges brought by AR data suppression and to specify what currently suppressed information is of public health importance and should be reported completely. The next step will be working with Antimicrobial Susceptibility Testing (AST) instrument manufacturers and/or laboratory information management system (LIMS) vendors to create guidance on pulling suppressed data, for example, to implement expert rules at either the instrument or LIMS levels. Following this step, guidance on public health use of these data can be generated. ARSTF is also planning to identify a representative to join the SHIELD group led by FDA.

C. NHSN, tracking AR in healthcare facilities
ARSTF will continue promoting the use of HL7 messages for data transmission. ARSTF will also continue working with NHSN and supporting promotion of NHSN Antimicrobial Use and Resistance (AUR) modules. Moreover, ARSTF will support the development and follow-up implementation of the ARIE guidance.

D. AR ELR
ARSTF will engage the CSTE National ELR Workgroup to discuss next steps to establish and disseminate AR/ELR best practices.

E. AR Surveillance Scope
The discussion under this area interfaced with the on-going CSTE Colonization Surveillance Workgroup. ARSTF plans to continue supporting the colonization surveillance workgroup to review the policy brief (publish date to be determined). ARSTF also plans to discuss and join efforts to potentially update position statements, specifically CP-CRE, in the future.

F. One Health
AR has a direct impact on human, animal, and environmental health. The complexity of AR highlights the need for cross-sector collaborations and an approach from a “One Health” perspective. The ARSTF shall strive to coordinate priority objectives across all relevant programs and stakeholders. New partners will need to be engaged, such as foodborne and waterborne epidemiologists, public health veterinarians, FDA, USDA, etc.

G. Workforce Development
AR is the intersection of epidemiology, laboratory science, and informatics. Continued education in the areas of AR, AU (antibiotic use), and informatics is needed.

(4) Sustainability of the Task Force and Action Items
The meeting participants defined four priority areas for the Task Force to focus on in Year 4. The four priority areas are 1) Promoting interoperable linkages between laboratory data and epidemiologic case findings; 2) Releasing suppressed Antimicrobial Susceptibility Test result data to inform public health action; 3) Developing capacity for a more informed workforce, including for antimicrobial resistance, antibiotic use and stewardship, and informatics; and 4) Approaching AR from a One Health perspective. Among the seven areas of interest discussed previously, the meeting participants combined four discussion topics, namely Linkage of laboratory data and epidemiologic case finding data, NHSN, tracking AR in healthcare facilities, AR ELR, and AR
Surveillance Scope, into priority area one. The four Year 4 priority areas will be discussed in detail in the next section of this report.

**ARSTF Year 4 Priority areas**

The Task Force combined the seven discussion topics into four priority areas to focus on in ARSTF Year 4 (Table 1). These four priority areas aligned with the strategic objectives outlined in the National Antimicrobial Resistance Surveillance Strategic Map: 2017-2020 (Appendix 4). These strategic objectives included the following:

- Enable capture of data using standardized vocabulary codes for new tests and other AR data
- Leverage shared technical infrastructure and services
- Establish and aligning standards for data collection, transmission, and provisioning
- Maintain epi, lab and clinical information systems with appropriate vocabulary and code sets
- Ensure sufficient data to track resistance patterns across settings and organisms
- Integrate epi, lab, and clinical data
- Provide technical information about AR testing
- Implement a strategy to extract suppressed AST results
- Provide timely delivery of guidance to detect and respond to novel/emerging AR threats
- Provide AR surveillance workforce development curriculum
- Build AR situational awareness at the facility, community, and regional levels
- Integrate lab, epi, and AU data for human, animal, and environmental health
- Nurture strategic partnerships

Due to public health response to the COVID-19 pandemic, many of the planned activities for ARSTF Year 4 were placed on hold. Nevertheless, the Task Force made progress on specifically priorities 1 and 3. The progress made, and next steps of each priority area are outlined below.

**Priority 1: Promoting interoperable linkages between laboratory data and epidemiologic case findings**

**Progress Update:** Existing related documents were reviewed, including Best Practices for Surveillance of Antimicrobial Resistance via Electronic Laboratory Reporting by the CSTE AR/ELR working group in 2017, and Operational Guidance for CP-CRE Position Statement (PS-17-ID-04). Some potential updates can be incorporated into the next iterations of these documents, for example, lessons learned and applied experiences from jurisdictions which used and implemented these documents.

**Next Steps:** The Task Force will monitor and support efforts about updating CP-CRE position statement and expanding it to carbapenem producing organisms (CPO) in the future. Other planned activities within this priority area were placed on hold for this project year; however,
the Task Force will revisit this priority and assess whether to update existing guidance documents or to create new guidance document(s).

**Priority 2: Releasing suppressed Antimicrobial Susceptibility Test result data to inform public health action**

Progress Update and Next Steps: The planned immediate next steps and activities, for example, to continue engaging clinical laboratory partners and SHIELD, were placed on hold for this project year; however, the Task Force will revisit this priority and assess efforts to engage partners.

**Priority 3: Developing capacity for a more informed workforce, including for antimicrobial resistance, antibiotic use and stewardship, and informatics**

Progress Update: The 2017 CSTE Epidemiology Capacity Assessment Report was reviewed to identify current capacity gaps or training needs in AU, AR, or informatics. The Assessment did not specifically collect much data related to AU or AR capacity. The assessment did highlight that jurisdictions have been limited in AR responses due to the following reasons, lack of staff, lack of training/skills, limited financial/human resources (HR) support to create and sustain AR-specific positions, and vulnerability in federal funding for these positions. Public health informatics capacity was discussed more in-depth in the Assessment. The greatest training needs across program areas were in public health informatics, while less than five percent of epidemiologists work in informatics and only eight percent of programs require cross training in informatics.

An AUR and informatics learning resource guide was created to provide a list of learning topics, learning competencies, and related existing resources (Table 2). The learning topics and focuses were generated by researching available published resources, reviewing related course syllabuses, and discussions with subject matter experts and the ARSTF Core Group. An extensive environmental scan was conducted to collect existing learning resources provided by reputable organizations and agencies, for example, CDC, APHL, CSTE, FDA, USDA, WHO, HL7, etc.

**Next Steps:** ARSTF plans to work with volunteers to review and assess the contents of draft AUR and informatics learning resource guide. At the ARSTF Year 4 Plenary Call on September 3, 2020, participants provided the following suggestions to be incorporated into the final AUR Informatics Learning Resource Guide. First, the current learning competencies focus more on knowledge acquisition. More learning competencies focusing on applying AUR/informatics knowledge to public health practice should be added. Second, some relevant learning topics are currently missing and should be added to the final document. These topics include: public health response activities and programs related to AR; infection control practices related to AR; creation, interpretation and use of cumulative antibiograms; AR containment efforts; hyperlinks to CDC DHQP’s resources; common antimicrobial classes used in both animals and humans (e.g. resources on WHO website); skills to educate a wide audience, including agency leadership, about AR; and skills to understand and evaluate the quality of antibiogram and AR surveillance data. A brief survey was sent after the ARSTF Year 4 Plenary Call on September 3, 2020 to recruit
potential volunteer reviewers. After the review and revisions are complete, the learning resource guide will be published on a platform, e.g., CSTE website or other, for wider distribution and use.

**Priority 4: Approaching AR from a One Health perspective**

**Progress Update and Next Steps:** The planned immediate next steps and activities, for example, engaging new partners, were placed on hold for this project year; however, the Task Force will revisit this priority and assess efforts to engage partners.

- **Next steps**
  - **Task Force Member Engagement:** a high-level framework to engage existing and new members
    - Official ARSTF membership was established in 2016; ARSTF participation in workgroups and activities has since grown and expanded beyond those original members in the official Task Force roster. It would be helpful to redefine what “ARSTF membership” entails and to whom it applies.
    - The ARSTF would like to refresh and re-organize membership, retaining those original members that would still like to participate and adding existing members to increase engagement.
    - There are most likely additional partners and organizations with which the ARSTF could engage to promote the identified priority areas.
  - **Next steps on the priorities**

ARSTF held a Year 4 Plenary Call on September 3, 2020. The objectives of this Plenary Call were to overview discussions at the February 2020 ARSTF Strategic Planning Meeting, discuss Year 4 Priorities, provide an update on the Task Force’s ongoing and forthcoming work, including the AUR and Informatics Learning Resource Guide, and discuss with call participants on how the Task Force can engage and coordinate to meet member needs for AR surveillance in the next year. During the interactive polls administered during the Plenary Call, most of the call participants (77%) expressed that the Year 4 Priorities accurately reflect their work needs, and the rest of the call participants (23%) agreed that the Year 4 Priorities somewhat met their work needs. The call participants all expressed interest to be engaged in ongoing ARSTF activities in some ways, which include receiving updates through the ARSTF newsletter (100%), receiving updates on CSTE Subcommittees and partners calls (93%), participating in future ARSTF calls (93%), participating in an ARSTF workgroup (86%), participating in virtual roundtable or ARSTF meetings (79%), presenting/sharing AR surveillance work projects on relevant ARSTF calls (64%), contributing to the ARSTF newsletter (29%), and co-chairing a workgroup (14%).

After the ARSTF Year 4 Plenary Call, a short survey was distributed to gather call participants’ interest and feedback. The survey questions included participants’ demographic information, previous attendance of ARSTF activities, ARSTF plenary call feedback, willingness to volunteer reviewing draft AUR and Informatics Learning Resource Guide, willingness to participate in future ARSTF activities, and additional comments. ARSTF Core Group plans to review the survey
results, and then engage interested individuals for continuing work on ARSTF activities in the future.

- **Acknowledgements**

The ARSTF sincerely thank and acknowledge all contributors to the activities mentioned within this report, including:

- ARSTF Co-Chairs: Dawn Sievert (CDC), Scott Troppy (MA), Sara Blosser (IN)
- ARSTF Core Group members and full Task Force members
- CSTE: Brooke Beaulieu, Puja Shah, Becky Lampkins
- February 4, 2020 ARSTF Strategic Planning Meeting Participants: Alexis Darden (CSTE), Amy Webb (CDC Contractor), Ann Kayser (MN), Benjamin Chan (NH), Dale LaValley (CDC DHQP), Dan Pollock (CDC DHQP), Dhara Shah (CSTE), DJ Shannon (Eszkenazi Health), Hsiu Wu (DHQP), Jeff Engel (CSTE), Jennifer Huang (CDC DHQP), John Stelling (Brigham and Women’s Hospital), Jon Lipsky (J Michael Consulting), Julian Grass (CDC DHQP), Lesliann Helmus (CDC DHIS), Megin Nichols (CDC), Meredith Lichtenstein Cone (CSTE), Nikki Marchan (APHL), Sheri Chernetsky Tejedor (CDC DHQP), Stephanie Bumpus McBride (CDC DHQP), Zachary Rubin (LA County)
- September 4, 2020 ARSTF Plenary Call Participants
- ARSTF Year 4 Consultants: Marion Tseng (J Michael Consulting), Nicole Kosacz (J Michael Consulting)
<table>
<thead>
<tr>
<th>Priority Description</th>
<th>Priority Context and Scope</th>
<th>Intended Deliverables and Immediate Next Steps</th>
</tr>
</thead>
</table>
| **Promoting interoperable linkages between laboratory data and epidemiologic case findings.** | This priority area is a continued effort from ARSTF Year 3. An interoperable linkage between laboratory data and epidemiologic case finding will allow programs to have collective information sharing to inform public health action. This interoperable linkage should apply to data flows of all levels, including clinical laboratories to state public health departments, state public health departments to CDC, and CDC back to the States. Laboratory accession number, e.g. State Lab ID numbers, will be converted to a top potential linking number. In addition to continuing the efforts in electronic laboratory reporting of AR, electronic case reporting (eCR) will also be included any future discussions around data exchange and system interoperability. | **Intended Deliverables:**  
- Update and/or create AR/ELR guidance document(s); update CP-CRE position statement and/or operational guidance  
- Determine if there is a need to conduct an assessment of the AR Lab Network to better understand 1) the challenges and barriers of data linkage between the state laboratories and epidemiology programs, and 2) what specific data elements are required for data linkage  
**Immediate Next Steps:**  
- Review existing related documents and assess whether to update existing guidance documents or to create new guidance document(s)  
- Engage the CSTE ELR Workgroup and other related CSTE steering committees and subcommittees  
- Engage clinical laboratory experts and others, which include but are not limited to SHEA and CLSI  
- Identify reportable conditions for which AR is relevant and engage with Digital Bridge and Reportable Conditions Knowledge Management System (RCKMS) to understand how resistance data factors into ongoing eCR initiatives, where applicable |
| **Strategic Objective B4:** Enable capture of data using standardized vocabulary codes for new tests and other AR data. | |  
| **Strategic Objective C2:** Leverage shared technical infrastructure and services. | |  
| **Strategic Objective C4:** Establish and align standards for data collection, transmission, and provisioning. | |  
| **Strategic Objective C5:** Maintain epi, lab and clinical information systems with appropriate vocabulary and code sets. | |  
| **Strategic Objective D2:** Integrate epi, lab and clinical data | |  
| **Releasing suppressed Antimicrobial Susceptibility Test result data to inform public health action.** | This priority area is a continued effort from ARSTF Year 3. The Task Force engaged AST instrument manufacturers in Year 3 to better understand AR data suppression. Public health use cases of accessing AR suppression data are needed. It is essential to specify why accessing suppressed data is important and what |  
| **Strategic Objective B3:** Provide technical information about AR testing. | |  

8
<table>
<thead>
<tr>
<th>Strategic Objective B5:</th>
<th>Implement a strategy to extract suppressed AST results.</th>
<th>currently suppressed information is needed for public health actions.</th>
<th>• Create a best practice guidance document to release suppressed data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic Objective C6:</td>
<td>Ensure sufficient data to track resistance patterns across settings and organisms.</td>
<td>By definition, AR is a cross-cutting topic, involving laboratory science, epidemiology, and informatics across pathogens and programs. Workforce development across this spectrum of disciplines would strengthen AR practice as a whole. Continuing education in AR/AU, specifically data analysis and informatics, is needed.</td>
<td>Immediate Next Steps:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>An HAI-focused mentorship program was previously proposed through the CSTE HAI Subcommittee. Lessons learned from the previous HAI mentorship program and other program areas can inform ARSTF’s efforts into broader AR workforce development.</td>
<td>• Engage clinical laboratory experts and others, which include but are not limited to SHEA and CLSI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Identify an ARSTF representative to Systemic Harmonization and Interoperability Enhancement for Laboratory Data (SHIELD) collaborative</td>
</tr>
<tr>
<td>Developing capacity for a more informed workforce, including for antimicrobial resistance, antibiotic use &amp; stewardship, and informatics.</td>
<td>• Define AUR training needs, including specific training topics and the levels of details needed</td>
<td>Intended Deliverables:</td>
<td></td>
</tr>
<tr>
<td>Strategic Objective A2:</td>
<td>Provide timely delivery of guidance to detect and respond to novel/emerging AR threats.</td>
<td>• Develop a module for AR workforce development, potentially leveraging the recently developed CSTE learning management system (LMS)</td>
<td>Immediate Next Steps:</td>
</tr>
<tr>
<td>Strategic Objective A4:</td>
<td>Provide AR surveillance workforce development curriculum.</td>
<td>• CSTE will review the most recent Epidemiology Capacity Assessment to identify existing training needs. Pending review results, future assessment may be needed to further elucidate AR workforce development needs</td>
<td>• Engage APIC, CSTE HAI subcommittee, ELC staff, and others to identify workforce development resources and needs</td>
</tr>
<tr>
<td>Strategic Objective D4:</td>
<td>Build AR situational awareness at the facility, community, and regional levels.</td>
<td>Approaching AR from a One Health perspective.</td>
<td>Intended Deliverables:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AR has a direct impact on human, animal and environmental health. For example, there have been reports of CRE isolation from companion animals in the US and other countries. The complexity of AR highlights the need of cross-sector collaborations and an approach from a “One Health” perspective. The ARSTF</td>
<td>• Identify use cases in human/animal healthcare settings, focusing on infection control. Springboard suggestions included CRE in companion animals.</td>
</tr>
<tr>
<td>Strategic Objective C2:</td>
<td>Leverage shared technical infrastructure and services.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic Objective C6: Ensure sufficient data to track resistance patterns across settings and organisms.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic Objective D4: Build AR situational awareness at the facility, community, and regional levels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic Objective D5: Integrate lab, epi, and antimicrobial use data for human, animal, and environmental health.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic Objective E3: Nurture strategic partnerships</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

shall strive to coordinate priority objectives across all relevant programs and stakeholders.

- Create a guidance document on a collaboration plan for State Health Departments to implement for established connections, outreach and sharing updates on check-in meetings or periodic (e.g., quarterly) meeting across One Health partners ahead of any outbreak/situation/need. The guidance document should include What, Who, Where, When, and Why.

### Immediate Next Steps:

- Engage new partners with the ARSTF. Suggestions include: National Association of State Public Health Veterinarians (NASPHV), American Association of Veterinary Laboratory Diagnosticians (AAVLD), Multi-State One Health Antibiotic Stewardship (led by the Minnesota Department Health), foodborne waterborne epidemiologists, FDA, American Veterinary Medical Association (AVMA). Identification and onboarding of additional partners will require further discussion.
- Identify ARSTF representative to participate in discussions with other stakeholders, e.g., NASPHV, AAVLD, AVMA
- Explore mechanisms or models for convening partners to approach AR challenges and solutions, with the ARSTF acting as a coordinating body as beneficial.
Table 2. Antimicrobial Use, Antimicrobial Resistance and Public Health Informatics Learning Resource Guide

**Goal:** To support Antimicrobial Resistance Surveillance Task Force (ARSTF)'s priority, “Developing capacity for a more informed workforce, including for antimicrobial resistance, antibiotic use & stewardship, and informatics.”

**Purpose:** To provide a list of learning topics, focuses, and related resources. The resources included in this document are primarily introductory level materials, with some advanced level materials. This document can be modified based on jurisdictions’ needs to become an on-boarding check list for new staff members. While this document is intended to provide a compilation of existing resources that may be helpful for those working in the field, the ARSTF will also use this repository to identify and address potential gaps in available resources.

**Target audience:** State and Local Health Departments’ staff, including public health laboratory staff, who work in the field of antimicrobial resistance/antimicrobial use surveillance
<table>
<thead>
<tr>
<th>No.</th>
<th>Learning Topic</th>
<th>Competency</th>
<th>Available Resources</th>
</tr>
</thead>
</table>
| 1   | The classifications of antimicrobial drugs and the mechanisms of action        | • Understand antimicrobial classifications and identify their different mechanisms of actions       | 1. [An ASM-CLSI Webinar Series on Antimicrobial Susceptibility Testing: Fundamentals of Susceptibility Testing, Reporting, and Test Validation](https://www.asmusa.org/education/); Introduction to Antimicrobials (ASM/CLSI, $5-15 per presentation)  
2. [Overview of Antibacterial Drugs](https://www.merckmanuals.com/); Merck Manual, free  
3. [Antimicrobial Resistance Learning Site for Veterinary Science: Pharmacology Module](https://www.umn.edu/); University of Minnesota/Michigan State University, free |
| 2   | Pharmacology of antimicrobials                                                 | • Understand fundamentals of pharmacokinetics and pharmacodynamics of antimicrobials                 | 1. [Antimicrobial Stewardship: A competency-based approach, Module C Pharmacology of Antimicrobials for Clinicians – Select Topics](https://www.who.int); WHO, free  
2. [Overview of Antibacterial Drugs](https://www.merckmanuals.com/); Merck Manual, free  
3. [Antimicrobial Resistance Learning Site for Veterinary Science: Pharmacology Module](https://www.umn.edu/); University of Minnesota/Michigan State University, free |
| 3   | Bacterial mechanisms for resisting antimicrobial agents                       | • Understand the many ways resistance can occur and spread, e.g., intrinsic and acquired resistance   | 1. [Antimicrobial Stewardship: A competency-based approach, Module D Antimicrobial resistance for clinicians](https://www.who.int); WHO, free  
2. [CDC Training on Antibiotic Stewardship: Module 1 - Antibiotic Resistance Threats and Combating the Spread of Antibiotic Resistance](https://www.cdc.gov); CDC, free  
3. [Animation of Antimicrobial Resistance video](https://www.fda.gov); FDA, free  
4. [How Antibiotic Resistance Happens, Antibiotic Resistance Threats in the United States](https://www.cdc.gov); CDC, free  
5. [ASM MICROBE 2019 - Antimicrobial Agents and Resistance Package](https://www.asmusa.org); ASM, $249-449  
6. [Multidrug Resistant Organism (MDRO) Primer](https://www.sheaweb.org); SHEA, $0-50  
7. [Antimicrobial Resistance Learning Site for Veterinary Science: Microbiology Module](https://www.umn.edu/); University of Minnesota/Michigan State University, free |
|   | Laboratory methods for detecting and measuring antimicrobial resistance | • Understand laboratory tests and their interpretations; e.g., Specimens vs Isolates  
• Understand Antimicrobial Susceptibility Test (AST)  
• Understand how to access, read, and interpret CLSI performance standard tables at a high level | 1. [Introduction to Public Health Laboratories](https://www.cdc.gov) (CDC, free)  
2. [Introduction to Laboratory Informatics Series-Life of a Specimen, Life of a Result](https://www.cdc.gov/cid) (CDC/APHL, free)  
3. [European Committee on Antimicrobial Susceptibility Testing (EUCAST) Introductory Videos, including guidance on the use of the breakpoint table](https://www.eucast.org) (EUCAST/WHO, free)  
|---|---|---|
| 5 | Principles of appropriate use of antimicrobials | • Understand AU as an AR driver  
• Understand antimicrobial dosing  
• Understand healthcare data and healthcare data systems | 1. [Antimicrobial Stewardship: A competency-based approach](https://www.cdc.gov) (WHO, free)  
2. [CDC Training on Antibiotic Stewardship Training Series: Module 4, 4B, 6 , Outpatient Antibiotic Use, Module 7A, 7B, 7C, 7D, Antibiotic Stewardship in Managing Different Medical Conditions](https://www.cdc.gov) (CDC, free)  
3. [Antimicrobial Resistance Learning Site for Veterinary Science: Pharmacology Module, Antimicrobial Drug Use](https://www.cdc.gov) (University of Minnesota/Michigan State University, free) |
| 6 | Principles of antimicrobial stewardship | • Understand why stewardship is important | 1. [CDC Training on Antibiotic Stewardship: Module 2 - What is Antibiotic Stewardship and Why Do We Need It?](https://www.cdc.gov) (CDC, free)  
2. [CDC Public Health Grand Rounds, May 2018: Be Antibiotics Aware: Smart Use, Best Care](https://www.cdc.gov) (CDC, free)  
| 7 | The role of humans, animals, and the environment (One Health) each plays in the emergence, evolution, and transmission of AR | • Understand the fundamental concept of One Health and its importance to AR/AU | 1. [The Collective Antimicrobial Resistance Ecosystem](https://www.usda.gov) (USDA, free)  
2. [ASM MICROBE 2019 - Antimicrobial Agents and Resistance Package](https://www.asmscience.org) (ASM, $249-449) |
| Use informatics standards | • Understand definitions of LOINC and SNOMED codes and distinguish between their uses  
• Become familiar and comfortable with IT and Informatics language | 3. OIE (World Organization for Animal Health) Antimicrobial Resistance Fact Sheet (OIE, free)  
4. FAO (Food and Agriculture Organization of the United Nations) AMR in Humans and Animals video (FAO, free) |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Practice applied public health informatics to support AU/AR work | • Become familiar and comfortable with IT and Informatics language to manage and monitor IT operations related to project or program  
• Evaluate information systems and applications  
• Support information system development, procurement, and implementation that meet public health program needs  
• Participate in applied public health informatics research for new insights and innovative solutions to health problems  
• Contributes to development of public health information systems that are | 1. An Intro to LOINC (LOINC, free)  
2. SNOMED CT Foundation Course (SNOMED, $400)  
3. Informatics for Everyone (Informatics Academy/PHII, free)  
4. HL7 Fundamentals Course (HL7, $420-790) |
<table>
<thead>
<tr>
<th>interoperable with other relevant information systems</th>
<th>5. <a href="http://example.com">AMIA (American Medical Informatics Association) 10X10 Virtual Informatics Education</a> (AMIA, $1999-2395)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Supports use of informatics to integrate clinical health, environmental risk, and population health</td>
<td></td>
</tr>
<tr>
<td>• Understand confidentiality, security, and data integrity as it relates to who can receive lab test data</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 1. Active Listening Sheet

At the ARSTF Strategic Planning Meeting on February 4, 2020, this Active Listening Sheet was used by the meeting participants to categorize and prioritize future ARSTF activities.

Worksheet Purpose: To demonstrate active listening during the morning informational sessions as a method to generate organized discussion in the afternoon sessions regarding the prioritization of future ARSTF activities.

Instructions: As ARSTF updates are being discussed, please think about which activities strike you as ready for continued action in the coming year. To facilitate compiling these thoughts, please make use of the corresponding worksheet which provides room to categorize your comments on activities into three buckets:

**Actionable:** The objective(s) and deliverables of this activity are clear, as are the methods to achieve and measure progress on those objectives. This activity will produce a clear impact for AR surveillance practice at the state, local, and federal level. Finally, this activity supports other ongoing initiatives or grant-funded work.

**Info Needed:** Certain aspects of this activity are ready for action; however more information is needed for the activity to be considered Actionable (as outlined above). Please briefly note what additional information or groundwork is necessary.

**Parking lot:** While the activity or topic area is important, there may be limited scope in what the ARSTF can contribute to furthering the work at this time. Generally, this activity is considered low priority and impact for the ARSTF to pursue in the coming year.

A general notes and comments section is also provided.

After the morning sessions, ARSTF staff and consultants will collect worksheets for high-level transcription to inform a visualization activity in the afternoon. Please write your name on your worksheet so that your notes can be returned to you after transcription.
<table>
<thead>
<tr>
<th>Topic: Terminusology/Data Standards, Use of Standardized Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIONABLE</td>
</tr>
<tr>
<td>Additional Comments and Questions:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic: Breakpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIONABLE</td>
</tr>
<tr>
<td>Additional Comments and Questions:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic: Data Suppression</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIONABLE</td>
</tr>
<tr>
<td>Additional Comments and Questions:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic: AR Electronic Lab Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIONABLE</td>
</tr>
<tr>
<td>Additional Comments and Questions:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic: Linking Lab and Epi Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIONABLE</td>
</tr>
<tr>
<td>Additional Comments and Questions:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic: MDRO Message Mapping Guide Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIONABLE</td>
</tr>
<tr>
<td>Additional Comments and Questions:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic: NHSN, Informatics to Track AR Among Healthcare Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIONABLE</td>
</tr>
<tr>
<td>Additional Comments and Questions:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Topic: AR Surveillance Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIONABLE</td>
</tr>
<tr>
<td>Additional Comments and Questions:</td>
</tr>
</tbody>
</table>
Appendix 2 DHQP Activities and Initiatives

AR:

Standardized Antimicrobial Administration Ratio (SAAR):

AU:
Appendix 3 Guided Worksheet for Prioritization of ARSTF Year 4 Activities

**Worksheet Purpose:** To use as a method to generate discussion on the prioritization of future ARSTF activities.

As a group, please use this table to discuss and rank your **top 5** future ARSTF activities. Keep the following questions in mind as you discuss each activity.

- **Continuation of Existing Efforts:**
  - Is this activity a continuation of ARSTF Year 3 activities or would this be a completely new project (starting from scratch, no existing system/process/conversations)?
  - Will this activity benefit other ARSTF activities?
  - Does this project tie back to the ARSTF Strategic Map?

- **Collaboration Efforts:**
  - Will new partners (beyond the partners that have already been involved) need to be engaged for this activity?
  - If so, how can partnerships/collaborations/coalitions be built, sustained, or utilized?

- **Funding:**
  - Is this a grant funded activity?
  - Are there additional costs involved in completing this activity?
  - Are there other resources that are available?

- **Alignment with Existing Priorities:**
  - How does this activity align with other priorities (DHQP, NHSN, State/Local activities, etc.)?
  - What work is already being done?

- **Feasibility:**
  - Are there measurable results that could be achieved in Year 4?

- **Output:**
- *Are there expected deliverables that could be achieved in Year 4 or in the future?*

On the following pages you will find space to list each activity and rank them on relevant criteria. Building on information from previous sessions, we will use this matrix to determine our Year 4 Priorities and drive further discussion.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Continuation of Existing Efforts</th>
<th>Utilizes Existing Partnerships</th>
<th>Grant Funded?</th>
<th>No Added Cost Associated?</th>
<th>Aligns with Existing Priorities</th>
<th>Feasible?</th>
<th>Outputs?</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID &amp; develop AR LOINC &amp; SNOMED codes; Develop a process for establishing new ones</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encourage adoption of most up-to-date breakpoints as a CLIA requirement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explore reasons for data suppression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop guidance for de-suppression of AST data for public health purposes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Establish and disseminate AR ELR best practices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promote adoption of ELR for public health reporting, specifically AR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promote adoption of standardized HL7 messages for AR Lab Network Public Health reporting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publish guidelines for linking lab &amp; case findings for both state/local and CDC programmatic needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Continuation of Existing Efforts</td>
<td>Utilizes Existing Partnerships</td>
<td>Grant Funded?</td>
<td>No Added Cost Associated?</td>
<td>Aligns with Existing Priorities</td>
<td>Feasible?</td>
<td>Outputs?</td>
<td>NOTES</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>-------------------------------</td>
<td>---------------</td>
<td>---------------------------</td>
<td>---------------------------------</td>
<td>-----------</td>
<td>----------</td>
<td>-------</td>
</tr>
<tr>
<td>Promote adoption of NHSN AUR module &amp; consider integrating it into public health reporting systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop surveillance infrastructure/registries to ID patients in outpatient settings during admission and transfer between facilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Promote integration of AR surveillance planning into ongoing processes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop a MDRO/AR colonization surveillance policy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop jurisdictional guidance for antibiograms for states &amp; large cities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 4 National Antimicrobial Resistance Surveillance Strategic Map: 2017-2020

National Antimicrobial Resistance Surveillance Strategic Map: 2017-2020

Strengthen Antimicrobial Resistance Surveillance in the United States

Provide Foundational Components for Surveillance

1. Encourage Appropriate Use of Diagnostic Testing/Culturing
2. Provide Timely Delivery of Guidance to Detect and Respond to Novel Emerging AR Threats
3. Promote Standards for Cumulative Antibiotics of the Facility, Regional and National Levels
4. Provide Antimicrobial Resistance Surveillance Workforce Development Curriculum
5. Increase Public Health, Lab and Clinical Informatics and Bioinformatics Capacity
6. Establish Roles, Responsibilities and Priorities of Public Health and the Clinical Sector

Enhance the Capacity and Use of Laboratory Diagnostics for Surveillance

B

1. Ensure Clinical Labs Have Access to Up-to-Date, FDA-Approved, Reimbursable Tests for Antimicrobial Resistance
2. Sustain Antimicrobial Resistance Work in Public Health Labs and Expand Where Needed
3. Provide Technical Education about Antimicrobial Resistance Testing
4. Enable Capture of Data Using Standardized Vocabulary Codes for New Tests and Other AR Data
5. Implement a Strategy to Extract Suppressed Antimicrobial Susceptibility Test Results
6. Establish Roles, Responsibilities and Priorities of Public Health and the Clinical Sector

Improve Quality and Availability of Surveillance Data

C

1. Evaluate, Enhance & Promote Existing Systems, Processes & Tools
2. Leverage Shared Technical Infrastructure and Services
3. Increase Automation across the Surveillance Continuum
4. Establish and Align Standards for Data Collection, Transmission and Provisioning
5. Build AR Situational Awareness at the Facility, Community and Regional Levels
6. Ensure Sufficient Data to Track Resistance Patterns across Settings and Organisms

Strengthen the Analysis and Use of Surveillance Data for Action

D

1. Improve and Automate Detection of Emerging Resistance
2. Integrate Epi, Lab and Clinical Data
3. Improve and Automate Outbreak/Cluster Detection
4. Build AR Situational Awareness at the Facility, Community and Regional Levels
5. Communicate Results and Suggested Actions

Secure Resources and Legal and Policy Supports to Implement, Govern, and Sustain the System

E

1. Establish and Implement a Governance Structure
2. Align with CARB and Successor Objectives
3. Nurture Strategic Partnerships
4. Support Stakeholders in Navigating the Regulatory Environment
5. Provide Timely Communication and Evaluation to Stakeholders

Leverage Public Health-Clinical Partnerships and Policy

F

Incorporate New Technology (e.g., Advanced Molecular Detection) and Epidemiological Analytic Methods

G