Key Activities and Roles for Microbiology Laboratory Staff in Antibiotic Stewardship Programs

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Purpose

To outline the ways in which microbiology laboratory staff can impact antibiotic stewardship programs.

In the CDC's Core Elements of Hospital Antibiotic Stewardship Programs, 2019 (https://www.cdc.gov/antibiotic-use/core-elements/hospital.html) there are several areas where the activities of microbiology laboratory staff, as part of the antibiotic stewardship program team, have been further expanded and highlighted. This document outlines these activities. It is important for the members of the antibiotic stewardship program to regularly communicate and collaborate. This can be challenging in instances where laboratory services are provided offsite from clinical care settings and there is not daily interaction between clinical infectious diseases, stewardship program, and microbiology personnel. The following areas are highlighted in the Core Elements of Hospital Antibiotic Stewardship where microbiology staff should provide input.

Hospital Leadership Commitment

- Integrate microbiology laboratory staff into the functions of the antibiotic stewardship program. Their expertise is important in the areas of diagnostic stewardship, development of antibiograms to support optimal antibiotic use, the introduction of new diagnostic tests into the laboratory, the implementation of new antibiotic susceptibility testing interpretative criteria, and education of clinicians on laboratory testing practices. All of these areas will be further highlighted and discussed in the sections below.

Education

- Promote education and communication between the laboratory and clinicians about test characteristics (e.g., test performance, expected turn-around-time, etc.).
  - Educate clinicians about how specific tests should be used in clinical situations (e.g., whether a particular test is better for 'ruling in' or 'ruling out' a condition).
  - Whenever possible, communicate test characteristics in the electronic health record at the point of ordering.
  - Educate clinicians when new tests or order sets are introduced at your facility.
- Teach staff about best practices in specimen collection.
  - In conjunction with diagnostic stewardship actions described below that monitor

specimen quality, provide regular education to optimize test specimen quality and reliability of results.

- Educate clinicians how to interpret test reports, including:
  - o Understanding report language used, such as categorical interpretations (e.g. intermediate vs. susceptibly dose-dependent). [1]
  - o Understanding the principles behind selective reporting and how to contact the laboratory if questions arise regarding additional drug susceptibility results: Selective Reporting of Antimicrobial Susceptibility Testing Results: A Primer for Antibiotic Stewardship Programs [PDF - 3 pages] (*https://www.cdc.gov/antibiotic-use/healthcare/pdfs/selective-reporting.pdf*).

Diagnostic Stewardship (included in Stewardship Elements Action, Reporting, and Education)

- Optimize testing practices that impact antibiotic stewardship. Examples include:
  - o Improve test ordering menus and order sets in the electronic health record (e.g., removing urine cultures from order sets where they are not indicated).
    - Some electronic health records have clinical decision support tools that can be used to guide appropriate test ordering (e.g., orders for a *Clostridioides difficile* test are automatically cancelled if the patient is on laxatives, orders for a stool culture or multiplex gastrointestinal pathogens panel are automatically cancelled if the patient has been hospitalized for more than 72 hours). [2]
  - o Improve sample collection practices and quality of specimens processed by the microbiology laboratory (e.g., rejecting sputum cultures if there are >10 squamous epithelial cells per low power field).
    - Monitor key microbiology specimen quality indices (e.g., blood culture contamination rates) and perform quality control interventions (e.g., education, review of procedures, review best practices to implement new solutions).
  - o Ensure laboratory procedures reflect best practices in the workup of specimens, antimicrobial susceptibility testing [AST], and result reporting (e.g., not identifying or performing AST for commensal organisms cultured from non-sterile sites).
  - o Report microbiology laboratory results in a way that encourages appropriate antibiotic therapy and de-escalation (e.g., reporting "usual respiratory flora, no *S. aureus* or *P. aeruginosa* found" instead of "usual respiratory flora" for a sputum culture). [3]
  - o Consider optimizing and contextualizing results reporting for non-culture based syndromic multiplex panels (e.g., mentioning "probable blood culture contaminant, antibiotic treatment not indicated" on reports where coagulase-negative *Staphylococcus* is found in the blood). [4]
- Involve multidisciplinary personnel in the decision to introduce new diagnostic tests with antibiotic stewardship implications.
  - o Consider adopting diagnostic tests that can help optimize antibiotic therapy (e.g., using negative nasal methicillin-resistant *Staphylococcus aureus* (MRSA) screening tests to stop vancomycin). [5]

Action

- Prospective Audit and Feedback
  - Ensure the antibiotic stewardship program is notified of positive cultures from normally sterile body sites (e.g., bloodstream infections), ideally in an automated fashion through the electronic health record. Invasive infections present opportunities for interventions to improve antibiotic use because they are easily identified from microbiology results, have a high positive predictive value for true infection, and sub-optimal therapy often leads to worse outcomes.
- Regularly review the way AST is performed in the laboratory, the drugs tested, interpretation, and communication of results.
  - Highlight all relevant changes in breakpoints or interpretative criteria from Clinical and Laboratory Standards Institute (CLSI) or other relevant breakpoint setting organizations (e.g., FDA).
    - Because the antibiotic stewardship program's primary objective is to optimize antibiotic use and improve patient safety and outcomes, prioritize implementation of changes with greatest potential clinical impact when there are resource limitations, conflicting breakpoint recommendations, or changes that cannot be immediately implemented due to factors such as Automated Testing Instrument card availability. [6]
  - Tailor AST performance and reporting to formulary decisions and the stewardship principle of encouraging narrower spectrum antibiotic use whenever possible.
    - Routinely report AST results only for those drugs included on hospital formulary.
      - Use cascade reporting to promote preferential use of narrowest spectrum drugs, with the following caveats:
        - Never suppress, for cascade purposes alone, a resistant or intermediate result. For example, if an *E. coli* is resistant to one of the carbapenems yet appears susceptible to third generation cephalosporins, and the laboratory would normally suppress the carbapenem results, the resistant results should be released in this case.
        - Results suppression for cascade purposes should occur at the level of the laboratory information system or electronic health record and not before results migration from the automated susceptibility testing instrument. This allows unsuppressed results to be seen by the infection control and antibiotic stewardship teams.
  - Discuss upcoming formulary changes and discuss how AST will be obtained for these agents
    - Decide on the intended use of the new drug (i.e., clinical indications, first- or second-line, empiric vs. directed therapy only) and whether preauthorization will be required.
    - Determine whether AST will be performed on all isolates or only in subsets of isolates (e.g., upon request or only if resistant to first-line agents) and how AST will be

> > performed and the method's impact on turnaround-time and workload (e.g., ATI, gradient diffusion strip, disk diffusion).
> > - Regularly review any comments included with AST results in the clinical record and update as indicated. For example, such comments could include "Rifampin should not be used alone for antimicrobial therapy" or "This organism commonly possesses a repressed gene for resistance to third generation cephalosporins that can begin to express while a patient is on therapy, resulting in clinical failure." [7]
> - Resources include CLSI documents and the CDC tool for non-laboratory personnel to understand selective reporting:
>   - Primer on selective reporting: [Selective Reporting of Antimicrobial Susceptibility Testing Results: A Primer for Antibiotic Stewardship Programs [PDF - 3 pages]](https://www.cdc.gov/antibiotic-use/healthcare/pdfs/selective-reporting.pdf)
> (https://www.cdc.gov/antibiotic-use/healthcare/pdfs/selective-reporting.pdf)
>   - CLSI document M100 [1]
>   - IDSA stewardship guideline [8]

Reporting: AST Reporting

- At least annually, update institution antibiograms following published guidance in the M39 CLSI document. [9]
  - Important aspects of developing an antibiogram that are useful for both selection of empiric antibiotic therapy and antibiotic stewardship include the following:
    - Report on the percent of isolates tested and found susceptible.
    - Only present results for those organisms and settings with sufficient numbers of isolates tested (i.e., if too few organisms are available to create an antibiogram, consideration could be given to combining multiple years of data or using regional resistance data with understanding of the limitations of these approaches).
    - Follow standardized procedures for de-duplication of multiple results from the same patient.
    - Where possible, stratify data by major clinical settings including ICUs vs. wards, community onset vs. hospital onset, and specimen type (blood vs. respiratory vs. urine vs. other).
    - Avoid biases in the proportion susceptible that may be introduced by cascade reporting.

Tracking: Facilitate use of Antimicrobial Resistance (AR) Option in CDC's National Healthcare Safety Network (NHSN)

- Work with hospital leadership, in-house information systems technology, electronic health record systems, or third-party AR surveillance systems to enroll and successfully submit data to the NHSN AR Option.

- o Determine where cascade results suppression is occurring (e.g., on the AST instruments vs. laboratory information system vs. electronic health record system) and facilitate reporting of all AST results to the NHSN AR Option.
- Facilities are encouraged to complete the AR Option data validation. Antimicrobial Resistance (AR) Option Data Validation [PDF - 10 pages] (https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/aur/ar-validation-508.pdf) upon initial setup and implementation as well as on an annual basis or when undergoing a change in vendor system.

References

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