Supplemental Guide:
Medical Microbiology

ACGME

November 2020

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Milestones Supplemental Guide

This document provides additional guidance and examples for the Medical Microbiology Milestones. This is not designed to indicate any specific requirements for each level, but to provide insight into the thinking of the Milestone Work Group.

Included in this document is the intent of each Milestone and examples of what a Clinical Competency Committee (CCC) might expect to be observed/assessed at each level. Also included are suggested assessment models and tools for each subcompetency, references, and other useful information.

Review this guide with the CCC and faculty members. As the program develops a shared mental model of the Milestones, consider creating an individualized guide (Supplemental Guide Template available) with institution/program-specific examples, assessment tools used by the program, and curricular components.

Additional tools and references, including the Milestones Guidebook, Clinical Competency Committee Guidebook, and Milestones Guidebook for Residents and Fellows, are available on the Resources page of the Milestones section of the ACGME website.

Patient Care 1: Clinical Consultation **Overall Intent:** To provide effective and thorough clinical consultations	
Milestones	**Examples**
Level 1 *Describes the use of a consultation and lists available resources useful in consultation*	● Uses test catalog to recommend appropriate specimens for anaerobe testing ● Uses PubMed to access most recent literature for *Coxiella burnetii* testing ● Discusses with program director the fellow's impact on clinical care through consultation
Level 2 *For simple consultations, delineates the clinical question, obtains additional clinical information, accesses available resources, recommends next steps, and documents it, with assistance*	● Calls clinical care provider to obtain rationale for work-up of a mixed abdominal fluid culture ● Consults with technologist regarding the reporting of a single set of blood cultures positive for a *Dermabacter* species
Level 3 *For complex consultations, delineates the clinical question, obtains additional clinical information, applies relevant resources, and recommends next steps with assistance; manages simple consultations independently*	● Calls clinical care provider regarding an apparent false positive malaria antigen test ● Calls antimicrobial stewardship team for add-on requests of a multidrug resistant gram-negative rod
Level 4 *Manages complex consultations independently*	● Makes decisions on the appropriateness of broad-range polymerase chain reaction (PCR) based on chart review of clinical history, culture/histopathology results, and discussions with healthcare team and adds a note in the electronic health record (EHR) ● Appends an additional interpretation to explain human immunodeficiency virus (HIV)-viral load trend
Level 5 *Recognized as an expert in providing comprehensive consultations*	● Receives directed consults from clinical care providers ● Contributes to institutional guidelines for sexually transmitted infection (STI) testing
Assessment Models or Tools	● Direct observation ● Multisource evaluation ● Portfolio review
Curriculum Mapping	●
Notes or Resources	● College of American Pathologists (CAP) Today. The what and why of diagnostic management teams. https://www.captodayonline.com/diagnostic-management-teams/. 2020. ● Marques MB, Anastasi J, Ashwood E, et al. The clinical pathologist as a consultant. *Am J Clin Pathol*. 2011;135(1):11-12. https://academic.oup.com/ajcp/article/135/1/11/1765622. 2020. ● McMullen AR, Anderson NW, Burnham CA, Education Committee of the Academy of Clinical Laboratory Physicians and Scientists. Pathology consultation on Influenza

	diagnosis. *Am J Clin Pathol*. 2016;145(4):440-448. https://academic.oup.com/ajcp/article/145/4/440/2195467. 2020. ● Verna R, Velazquez AB, Laposata M. Reducing diagnostic errors worldwide through diagnostic management teams. *Ann Lab Med*. 2019;39(2):121-124. http://www.annlabmed.org/journal/view.html?volume=39&number=2&spage=121. 2020.

Patient Care 2: Test Performance and Organism Identification **Overall Intent:** To perform, troubleshoot, and teach common and complex microbiology tests	
Milestones	**Examples**
Level 1 *Observes and assists in the performance of common microbiology tests*	● Observes catalase and oxidase testing during bench rotations ● Subcultures plates ● Reads Gram stains from colonies
Level 2 *Performs common microbiology tests and observes and assists in the performance of uncommon (i.e., esoteric) microbiology tests*	● Performs catalase and oxidase testing during bench rotations ● Performs antimicrobial susceptibility testing ● Spots matrix-assisted laser desorption/ionization-time of flight mass spectrometer (MALDI-TOF MS) targets
Level 3 *Supervises and troubleshoots microbiology tests in all clinical scenarios*	● Identifies trailing effect on antimicrobial susceptibility panel ● Supervises other learners in microbiology in unknown work-ups or delta checks
Level 4 *Teaches the features of microbiology testing, including the use, strengths, and limitations of the various methods of testing*	● Demonstrates/discusses interesting or problem cases with infectious disease fellows or other learners at laboratory rounds ● Discusses a false positive malaria antigen test with clinicians ● Discusses limits of quantitation and limits of detection of molecular tests with infectious disease fellows or other learners
Level 5 *Independently chooses the optimal test based on an analysis of test characteristics and patient population variables for any clinical scenario*	● Selects best point of care methodology for influenza testing ● Develops algorithm for respiratory virus testing
Assessment Models or Tools	● Competency checklist ● Completion of unknowns ● Direct observation ● Multisource evaluation ● Portfolio review
Curriculum Mapping	●
Notes or Resources	● Centers for Disease Control and Prevention. Guidelines & Guidance Library. https://www.cdc.gov/infectioncontrol/guidelines/index.html. 2020.

Patient Care 3: Test Interpretation and Reporting **Overall Intent:** To interpret common and complex microbiology tests and effectively report the results	
Milestones	**Examples**
Level 1 *Identifies common pre-analytic, analytic, and post-analytic issues that can affect results and interpretation of testing*	● Describes reasons for specimen rejection criteria ● Understands why urine over 30 mL is rejected for gonorrhea/chlamydia testing ● Gets involved in reporting a positive blood culture result on a discharged patient
Level 2 *Interprets and reports common microbiology tests with guidance*	● Does the second reading for manual test results ● Interprets Gram stain from blood culture
Level 3 *Independently interprets and reports common microbiology tests, and interprets and reports complex microbiology tests with guidance*	● Reads primary Gram stains of sputum specimens for acceptability and interpretation of inflammatory cells and organism morphology ● Does preliminary read and reporting of blood parasite smears
Level 4 *Independently interprets and reports microbiology tests in all clinical scenarios*	● Interprets antibiotic test results and identifies multidrug resistant *Pseudomonas aeruginosa* and communicates to the infectious disease or infection prevention team ● Interprets complex fourth-generation HIV testing results
Level 5 *Develops procedures for test performance, interpretation, and reporting*	● Writes procedure for yeast susceptibility testing ● Develops procedures for interpretation and reporting of Lyme disease
Assessment Models or Tools	● Assessment of procedure knowledge ● Direct observation ● Multisource evaluation ● Portfolio review ● Review by faculty of specific procedure developed ● Unknown session
Curriculum Mapping	●
Notes or Resources	● Centers for Disease Control and Prevention. Guidelines and Guidance Library. https://www.cdc.gov/infectioncontrol/guidelines/index.html. 2020. ● Clinical and Laboratory Standards Institute (CLSI). Documents (M35, M48, MM17). https://clsi.org/standards/products/microbiology/documents/. 2020. ● Infectious Diseases Society of America (IDSA). IDSA Practice Guidelines. https://www.idsociety.org/practiceguidelines#/name_na_str/ASC/0/+/. 2020. ● Jorgensen JH, Pfaller MA. *Manual of Clinical Microbiology*. 11th ed. Washington, DC: American Society for Microbiology (ASM); 2015. ● Leber AL. *Clinical Microbiology Procedures Handbook*. 4th ed. Washington, DC: ASM; 2015.

Medical Knowledge 1: Fundamental and Diagnostic Knowledge **Overall Intent:** To be proficient in microorganism identification, susceptibility testing, and resistance mechanisms	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of microorganisms of all groups that are commonly encountered and their role in disease*	● Describes commonly encountered microorganisms from the major taxonomic groups and the diseases they cause
Demonstrates knowledge of common antibacterial agents	● Lists common antibacterial agents and discusses their mechanisms of action
Demonstrates knowledge of common resistance mechanisms in bacteria	● Discusses the mechanisms of resistance to antibacterial agents
Level 2 *Demonstrates knowledge of the methods required for detection/identification of commonly encountered microorganisms*	● Shows/teaches other learners the major methods used for the detection of commonly encountered microorganisms
Demonstrates knowledge of guidelines regarding selection of antibacterial agents for testing	● Describes the use of the Clinical & Laboratory Standards Institute (CLSI) M100 document
Demonstrates knowledge in how to detect phenotypic and genotypic antimicrobial resistance mechanisms for bacteria	● Provides a tutorial on rounds on the detection of resistance mechanisms in bacteria
Level 3 *Demonstrates knowledge of the methods required for detection/identification of novel pathogens and less commonly encountered microorganisms*	● Gives a tutorial to other learners on advanced detection methods
Demonstrates knowledge of antimicrobial agents for all groups of organisms	● Lists common antiviral, antifungal, and antiparasitic agents and their mechanisms of action
Demonstrates knowledge of resistance mechanisms for all pathogens	● Discusses the mechanisms of resistance to antiviral, antifungal, and antiparasitic agents
Level 4 *Teaches the features of microorganism detection/identification for all groups of organisms*	● Reviews optimal detection methods with rotating residents or other learners for all types of pathogens

Demonstrates knowledge of guidelines regarding selection of all agents for testing	● Describes guidelines for the selection of antiviral, antifungal, and antiparasitic agents
Demonstrates knowledge in how to detect phenotypic and genotypic antimicrobial resistance mechanisms for all pathogens	● Provides a tutorial on rounds on detection of antiviral resistance mechanisms ● Describes the factors that need to be considered to set a clinical antimicrobial breakpoint
Level 5 *Consistently uses the literature or other means to investigate difficult to identify or novel pathogens*	● Performs a literature review when investigating the etiology of challenging infections
Demonstrates knowledge of pharmacokinetics and pharmacodynamics and clinical use of antimicrobials	● Describes what data are required to revise a clinical antimicrobial breakpoint
Contributes to the literature and/or guideline development regarding resistance detection	● Volunteers for and actively contributes to a CLSI committee
Assessment Models or Tools	● Antimicrobial stewardship committee participation ● Direct observation ● Journal Club ● Multisource evaluation ● Portfolio review
Curriculum Mapping	●
Notes or Resources	● CLSI. Login Page. http://em100.edaptivedocs.net/Login.aspx?_ga=2.166274238.1667693071.1575752274-529674231.1575645304. 2020. ● Johnson EM. Antifungal susceptibility testing and resistance. In: Kibbler CC, Barton R, Gow NAR, Howell S, MacCallum DM, Manuel RJ. *Oxford Textbook of Medical Mycology*. Oxford, UK; 2018. ● Jorgensen JH, Ferraro MJ. Antimicrobial susceptibility testing: a review of general principles and contemporary practices. *Clin Infect Dis*. 2009;49(11)1749-1755. https://academic.oup.com/cid/article/49/11/1749/344384. 2020. ● Miller JM, Binnicker MJ, Campbell S, et al. A guide to utilization of the microbiology laboratory for diagnosis of infectious diseases: 2018 updated by the Infectious Diseases Society of America and the American Society for Microbiology. *Clin Infect Dis*. 2018;67(6):e1-e94. https://academic.oup.com/cid/article/67/6/e1/5046039. 2020.

	● Procop GW, Church DL, Hall GS, et al. *Koneman's Color Atlas & Textbook of Diagnostic Microbiology*. Philadelphia, PA: Wolters Kluwer; 2017.

Medical Knowledge 2: Test Methodology **Overall Intent:** To demonstrate knowledge of test platforms, methods, and integration into testing algorithms	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of basic test platforms and methodology*	● Discusses with program director the purpose of various media for growth of bacteria, fungi, and mycobacteria ● Describes how MALDI-TOF MS functions and the procedures for each organism group ● Describes mycobacteria broth culture instrumentation
Level 2 *Demonstrates knowledge of complex test platforms and methodology*	● Describes differences between broth microdilution, disk diffusion, and other microbiology susceptibility testing methods ● Lists three indicators of possible false positive reactions in a nucleic acid amplification test
Level 3 *Demonstrates knowledge of the use and methods of outsourced microbiology tests*	● Reviews select send-out tests ● Coordinates submission of botulism samples to the public health laboratory
Level 4 *Demonstrates knowledge of the integration of different test methodology and platforms (e.g., testing algorithms)*	● Describes the tests and order of performance in the reverse algorithm for syphilis testing ● Describes the tests and order of performance for initial diagnosis of HIV
Level 5 *Identifies optimal methodology for novel test development*	● Investigates the utility of serology versus PCR for the detection of Powassan virus in endemic settings
Assessment Models or Tools	● Direct observation ● Journal Club ● Multisource evaluation ● Portfolio review
Curriculum Mapping	●
Notes or Resources	● CDC. Sexually Transmitted Diseases Treatment Guidelines, 2015. https://www.cdc.gov/std/tg2015/tg-2015-print.pdf. 2020.

Medical Knowledge 3: Test Development and Validation/Verification **Overall Intent:** To demonstrate knowledge of requirements for validation/verification of simple and complex tests	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of the necessity of test validation/verification*	● Discusses the importance of test validation/verification ● Lists potential adverse outcomes from poorly validated/verified tests
Level 2 *Demonstrates knowledge of the essentials of test development and test validation/verification*	● Defines clinical and analytical sensitivity, specificity, limits of detection, and limits of quantitation ● Defines positive and negative predictive values and understands the impact of prevalence on these values
Level 3 *Identifies requirements for test verification of a Food and Drug Administration (FDA)-approved test*	● Discusses the need for demonstrating accuracy, precision, and reportable range for a new test ● Drafts a verification plan for Food and Drug Administration (FDA)-approved herpes simplex virus (HSV) PCR
Level 4 *Identifies requirements for test validation of a laboratory-developed test*	● Drafts a validation plan for a laboratory-developed BK viral load test
Level 5 *Designs and implements a new laboratory-developed test*	● Develops a PCR test for Powassan virus
Assessment Models or Tools	● Direct observation ● Journal Club ● Multisource evaluation ● Objective written examination ● Portfolio review ● Simulation
Curriculum Mapping	●
Notes or Resources	● CLSI. MM17: Validation and Verification of Multiplex Nucleic Acid Assays, 2nd ed. https://clsi.org/standards/products/molecular-diagnostics/documents/mm17/. 2020.

Medical Knowledge 4: Clinical Reasoning **Overall Intent:** To approach a diagnostic work-up in an informed and logical manner using appropriate resources to guide decisions	
Milestones	**Examples**
Level 1 *Demonstrates a basic framework for clinical reasoning* *Identifies resources to inform clinical reasoning*	● Navigates the EHR, laboratory information system (LIS), internet, and literature to locate necessary information and assess the validity of the test request
Level 2 *Demonstrates clinical reasoning to determine relevant information* *Selects relevant resources based on various scenarios to inform decisions*	● Extracts pertinent clinical findings from the patient's medical record and distinguishes between relevant and extraneous data to inform culture work-up and follow-up testing ● Is aware of and uses appropriate algorithms, consensus guidelines, and published literature
Level 3 *Synthesizes information to inform clinical reasoning, with assistance* *Seeks and integrates evidence-based information to inform diagnostic decision making in complex cases, with assistance*	● Employs CLSI guidelines to report appropriate susceptibility testing for cerebrospinal fluid cultures ● Understands and describes the scientific basis for current screening recommendations for Human papillomavirus (HPV) ● Uses the published literature and recommendations to correctly direct the work-up of a patient who traveled to a Zika-endemic area
Level 4 *Independently synthesizes information to inform clinical reasoning in complex cases* *Independently seeks out, analyzes, and applies relevant original research to diagnostic decision making in complex clinical cases*	● Uses histopathologic, culture, and molecular data to interpret next generation sequencing testing requests and results ● Uses clinical, laboratory, and epidemiologic data to guide work-up of a patient with infectious encephalitis
Level 5 *Demonstrates intuitive approach to clinical reasoning for complex cases* *Contributes to the literature or knowledge base that informs diagnostic decision making*	● Sought by attending faculty members and/or clinicians for expertise
Assessment Models or Tools	● Case Logs ● Direct observation ● Multisource evaluations ● Portfolio review ● Presentations at multidisciplinary rounds

Curriculum Mapping	●
Notes or Resources	● Clinical reasoning relies on appropriate foundational knowledge that requires the trainee to apply that knowledge in a thoughtful, deliberate and logical fashion to clinical cases to inform clinical care ● Iobst WF, Trowbride R, Philibert I. Teaching and assessing critical reasoning through the use of entrustment. *J Grad Med Educ*. 2013;5(3):517-518. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3771188/. 2020.

Systems-Based Practice 1: Patient Safety and Quality Improvement (QI) **Overall Intent:** To engage in the analysis and management of patient safety events, including relevant communication with patients, families, and health care professionals; to conduct a QI project	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of common patient safety events*	● Identifies common patient safety events including sentinel events and near-misses
Demonstrates knowledge of how to report patient safety events	● Describes how to enter a report into the institutional-specific electronic reporting tool
Demonstrates knowledge of basic QI methodologies and metrics	● Describes root cause analysis and Plan-Do-Study-Act (PDSA) cycle
Level 2 *Identifies system factors that lead to patient safety events*	● Identifies that a trash can being placed next to specimen accession area may result in specimens being discarded inadvertently
Reports patient safety events through institutional reporting systems (simulated or actual)	● Is aware of improvement initiatives within their scope of practice
Describes departmental and institutional QI initiatives	● Enters a report into the institutional-specific electronic reporting tool
Level 3 *Participates in analysis of patient safety events (simulated or actual)*	● Reviews a patient safety event and communicates with provider about such an event
Participates in disclosure of patient safety events to clinicians and/or patients and families (simulated or actual)	● Recognizes a mislabeled specimen and follows up with appropriate laboratory and clinical personnel
Participates in departmental and institutional QI initiatives	● Participates in a study of blood culture contamination rates
Level 4 *Conducts analysis of patient safety events and offers error prevention strategies (simulated or actual)*	● Collaborates with the infection control team to analyze and identify the increase of central line-associated blood stream infection
Discloses patient safety events to clinicians and/or patients and families, as appropriate (simulated or actual)	● Contacts the clinical provider to report a lost cerebrospinal fluid specimen

Demonstrates the skills required to identify, develop, implement, and analyze a QI project	● Provides in-service to phlebotomists regarding blood culture contamination rates
Level 5 *Actively engages teams and processes to modify systems to prevent patient safety events* *Role models or mentors others in the disclosure of patient safety events* *Creates, implements, and assesses QI initiatives at the institutional or community level*	● Leads a project to assess and implement a blood diversion device to reduce blood culture contamination rates
Assessment Models or Tools	● Chart or other system documentation by fellow ● Direct observation in meetings or in the laboratory ● Documentation of QI or patient safety project processes or outcomes ● E-module multiple choice tests ● Portfolio ● Reflection ● Simulation
Curriculum Mapping	●
Notes or Resources	● Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2020.

Systems-Based Practice 2: Systems Navigation for Patient-Centered Care **Overall Intent:** To effectively navigate the health care system, including the interdisciplinary team and other care providers, to adapt care to a specific patient population to ensure high-quality patient outcomes	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of case coordination* *Identifies key elements for safe and effective transitions of care and hand-offs* *Demonstrates knowledge of population and community health needs and disparities*	● Identifies the members of the interprofessional team including laboratory technologists, other specialty physicians, nurses, and consultants, and describes their roles ● Identifies components of social determinants of health and how they impact the delivery of patient care
Level 2 *Coordinates care of patients/specimens in routine cases effectively using interprofessional teams* *Performs safe and effective transitions of care/hand-offs in routine situations* *Identifies pathology's role in population and community health needs and inequities for the local population*	● Contacts interprofessional team members to discuss resource needs for specimens of limited quantity ● Communicates with on-call microbiologist about an incoming specimen for malaria ● Knows which patients are at high risk for specific health outcomes related to health literacy concerns, cost of testing or therapy, LGBTQ status, etc.
Level 3 *Coordinates care of patients/specimens in complex cases effectively using interprofessional teams* *Performs safe and effective transitions of care/hand-offs in complex situations* *Identifies opportunities for pathology to participate in community and population health*	● At interdisciplinary case conferences, engages in appropriate discussion of antimicrobial susceptibility testing options and impact on therapy for complex cases ● Appreciates the need for and uses clinic or local resources, such as when coordinating microorganism identification from an outside hospital ● Notifies the health department about an increase in the number of cases of *Legionella pneumophila*
Level 4 *Models effective coordination of patient-centered care among different disciplines and specialties*	● Educates students and team members regarding the engagement of appropriate interprofessional team members, as needed for each patient and/or case

Models and advocates for safe and effective transitions of care/hand-offs within and across health care delivery systems *Recommends and/or participates in changing and adapting practice to provide for the needs of communities and populations*	● Performs quality reviews and correlations between direct Gram stain and culture results ● Identifies patient populations at high risk for poor health care outcomes related to diabetic foot infections due to health disparities and inequities in screening and implements strategies to improve care
Level 5 *Analyzes the process of care coordination and leads in the design and implementation of improvements* *Improves quality of transitions of care within and across health care delivery systems to optimize patient outcomes* *Leads innovations and advocates for populations and communities with health care inequities*	● Works with ambulatory site team members to analyze laboratory services and optimize the test menu in that setting ● Works with a QI mentor to identify better hand-off tools for on-call microbiology services ● Effectively uses resources, such as telehealth and telepathology for proactive outreach to prevent diagnostic errors in Gram stain interpretation at regional hospitals ● Becomes certified in LEAN/Six Sigma ● Participates in high-level institutional safety oversight committee
Assessment Models or Tools	● Direct observation (including discussion during rounds, case work-up and case presentations) ● Interdisciplinary rounds for high-risk patients/cases ● Lectures/workshops on social determinants of health or population health with identification of local resources ● Multisource feedback from the interprofessional team ● Portfolio review ● Review of sign-out tools, use and review of checklists between pathology services
Curriculum Mapping	●
Notes or Resources	● Aller RD. Pathology's contributions to disease surveillance: sending our data to public health officials and encouraging our clinical colleagues to do so. *Archives of Path Lab Med*. 2009;133(6):926-932. https://www.archivesofpathology.org/doi/10.1043/1543-2165-133.6.926?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. 2020. ● CAP. Competency Model for Pathologists. https://learn.cap.org/content/cap/pdfs/Competency_Model.pdf. 2020. ● CDC. Population Health Training in Place Program (PH-TIPP). https://www.cdc.gov/pophealthtraining/whatis.html. 2020.

	● Kaplan KJ. In pursuit of patient-centered care. http://tissuepathology.com/2016/03/29/in-pursuit-of-patient-centered-care/#axzz5e7nSsAns. 2020.

Systems-Based Practice 3: Physician Role in Health Care System **Overall Intent:** To understand the physician's role in the complex health care system and how to optimize the system to improve patient care and the health system's performance	
Milestones	**Examples**
Level 1 *Identifies key components of the complex health care system (e.g., hospital, skilled nursing facility, finance, personnel, technology)*	● Names systems and providers involved in test ordering and payment
Describes basic health payment systems (e.g., government, private, public, uninsured care) and practice models	● Recognizes that there are different payment systems, such as Medicare, Medicaid, Veterans Affairs (VA), and commercial third-party payers
Level 2 *Describes how components of a complex health care system are interrelated, and how this impacts patient care*	● Understands the impact of health plans on testing options and reimbursement; demonstrates knowledge that is theoretical, but is not yet able to apply this knowledge to the care of patients without some direct attending input and/or prompting
Documents testing detail and explains the impact of documentation on billing and reimbursement	● Documents appropriate code for interpretation of malaria or blood smear that affords accurate billing
Level 3 *Discusses how individual practice affects the broader system (e.g., test utilization, turnaround time)*	● Evaluates utilization review queue and consults with clinicians regarding inappropriate testing and triage
Engages with clinicians and/or patients in shared decision making, such as use of preauthorization for complex testing	● Consults with clinicians regarding 16S testing on formalin fixed paraffin-embedded tissue
Level 4 *Manages various components of the complex health care system to provide efficient and effective patient care and transitions of care*	● Works collaboratively with surgical nursing or anatomic pathology personnel to ensure tissue specimens from the operating room are also submitted for culture ● Understands difference between billing/reimbursement for inpatient versus outpatient and in-house versus reference laboratory testing
Practices and advocates for cost effective patient care with consideration of the limitations of each patient's payment model	● Develops optimal use of 1,3-beta-D-glucan testing in various patient populations
Level 5 *Advocates for or leads systems change that enhances high-value, efficient, and effective patient care and transitions of care*	● Implements point of care testing for respiratory viruses for all hospitals in a network

Participates in health policy advocacy activities	● Lobbies for policies concerning strategies to combat antimicrobial resistance
Assessment Models or Tools	● Direct observation ● Portfolio review ● QI project ● Review of testing usage audit
Curriculum Mapping	●
Notes or Resources	● Agency for Healthcare Research and Quality. Major Physician Measurement Sets. https://www.ahrq.gov/talkingquality/measures/setting/physician/measurement-sets.html. 2020. ● AHRQ. Measuring the Quality of Physician Care. https://www.ahrq.gov/talkingquality/measures/setting/physician/index.html. 2020. ● The Commonwealth Fund. Health Reform Resource Center. http://www.commonwealthfund.org/interactives-and-data/health-reform-resource-center#/f:@facasubcategoriesfacet63677=[Individual%20and%20Employer%20Responsibility. 2020. ● The Commonwealth Fund. Health System Data Center. http://datacenter.commonwealthfund.org/?_ga=2.110888517.1505146611.1495417431-1811932185.1495417431#ind=1/sc=1. 2020. ● Dzau VJ, McClellan M, Burke S, et al. Vital directions for health and health care: priorities from a National Academy of Medicine Initiative. *NAM Perspectives*. Discussion Paper, National Academy of Medicine, Washington, DC. https://nam.edu/vital-directions-for-health-health-care-priorities-from-a-national-academy-of-medicine-initiative/. 2020. ● The Kaiser Family Foundation. www.kff.org. 2020. ● The Kaiser Family Foundation: Topic: health reform. https://www.kff.org/topic/health-reform/. 2020.

Systems-Based Practice 4: Accreditation, Compliance, and Quality **Overall Intent:** To gain in-depth knowledge of the components of laboratory accreditation, regulatory compliance, and quality management	
Milestones	**Examples**
Level 1 *Demonstrates knowledge that laboratories must be accredited* *Discusses the need for quality control and proficiency testing*	● Attends departmental quality assurance/quality control meetings, morbidity and mortality (M and M) conferences and accreditation/regulatory summation meetings
Level 2 *Demonstrates knowledge of the components of laboratory accreditation and regulatory compliance (e.g., Clinical Laboratory Improvement Amendments and others), either through training or experience* *Interprets quality data and charts and trends, including proficiency testing results, with assistance*	● Demonstrate knowledge of the College of American Pathologists (CAP) checklist as a part of laboratory accreditation processes ● Interprets standard curves for viral load testing ● Interprets daily instrument quality control and proficiency test reports ● Monitors positivity rates of *Chlamydia trachomatis* nucleic acid amplification tests for environmental contamination
Level 3 *Identifies the differences between accreditation and regulatory compliance; discusses the process for achieving accreditation and maintaining regulatory compliance* *Demonstrates knowledge of the components of a laboratory quality management plan* *Discusses implications of proficiency testing failures*	● Completes inspector training for CAP to understand process for achieving/maintaining regulatory/accreditation compliance ● Begins to actively participate in regular laboratory quality management duties ● Monitors blood culture contamination rates ● Reviews patient charts to understand if proficiency testing failures could have impacted patient care
Level 4 *Participates in an internal or external laboratory inspection* *Reviews the quality management plan to identify areas for improvement*	● Performs mock or self-inspection using a CAP checklist ● Assists in developing a strategy for handling quality control or proficiency testing failures

Performs analysis and review of proficiency testing failures and recommends a course of action, with oversight	
Level 5 *Serves as a resource for accreditation at the regional or national level* *Creates and follows a comprehensive quality management plan* *Formulates a response for proficiency testing failures*	● Serves on a committee for a regional or national accreditation agency ● Oversees laboratory quality management as part of duties as a section director ● Writes a proficiency testing failure investigation report
Assessment Models or Tools	● Assignment of duties for departmental or hospital quality assurance/quality control committees ● Documentation of inspector training and participation in fellow portfolio ● Presentation at M and M conferences ● QI projects ● Review of reports ● Rotation evaluations
Curriculum Mapping	●
Notes or Resources	● American Society for Clinical Pathology. Laboratory Management University. https://store.ascp.org/productlisting/productdetail?productId=52290189%20%20. 2020. ● CAP. Inspector Training Options. https://www.cap.org/laboratory-improvement/accreditation/inspector-training. 2020.

Systems-Based Practice 5: Utilization **Overall Intent:** To understand the microbiologist's role in test implementation and utilization	
Milestones	**Examples**
Level 1 *Identifies general microbiology work practices and workflow (e.g., specialized molecular testing, serology, and pre-analytics)*	● Rotates on benches ● Becomes familiar with the test menu and specimen turnaround times
Level 2 *Explains rationale for optimizing utilization*	● Analyzes the literature for optimal practice guidelines ● Reviews hepatitis C virus serology logs to detect repeat testing
Level 3 *Identifies opportunities to optimize utilization of pathology resources*	● Performs internal audit to detect inappropriate specimen submission for *C. difficile* testing ● Contacts clinician regarding inappropriate requests for susceptibility testing
Level 4 *Initiates efforts to optimize utilization*	● Compiles retrospective data on *Histoplasma* urinary antigen orders on patients with solitary pulmonary nodules ● Works with the order entry system to implement best practice alerts for appropriate testing of *C. difficile*
Level 5 *Completes a utilization review and implements change*	● Publishes the results of intervention of completed utilization review ● Leads an effort to modify or eliminate an ineffective test from test menu ● Presents project intervention at international meeting or podium presentation
Assessment Models or Tools	● Direct observation ● Measure impact of intervention ● Portfolio review ● Review of utilization review logs ● Scholarly activity (e.g., abstracts, conference presentations)
Curriculum Mapping	●
Notes or Resources	● American College of Physicians. High Value Care. https://www.acponline.org/clinical-information/high-value-care. 2020.

Systems-Based Practice 6: Infection Prevention, Antimicrobial Stewardship, and Public Health **Overall Intent:** To gain in-depth knowledge of and experience in infection prevention, antimicrobial stewardship, and public health	
Milestones	**Examples**
Level 1 *Identifies the role of the microbiology laboratory in infection prevention* *Identifies the role of the microbiology laboratory in antimicrobial stewardship* *Identifies the role and requirements of the microbiology laboratory in public health*	● Explains the role of the microbiology laboratory in infection prevention, antimicrobial stewardship, and public health
Level 2 *Attends infection prevention meetings and discusses initiatives to enhance infection prevention* *Attends antimicrobial stewardship meetings and discusses the antimicrobial stewardship initiatives* *Explains select agents and other agents of reportable diseases and means of their control, laboratory safety, and destruction*	● Explain the steps necessary to document the destruction of *Brucella* species ● Reviews and discusses the American Society for Microbiology laboratory response network documents
Level 3 *Analyzes data and coordinates initiatives to support hospital infection prevention committee, with guidance* *Analyzes susceptibility data and coordinates initiatives to support antimicrobial stewardship, with guidance* *Employs resources to interface with public health officials/ departments, with guidance*	● Compiles data for an outbreak investigation in the transplant unit ● Reviews carbapenem resistance in the intensive care unit (ICU) ● Discusses a possible case of botulism with public health department
Level 4 *Independently analyzes data and coordinates initiatives to support hospital infection prevention committee*	● Initiates intervention for improved quality of hand hygiene for control of norovirus outbreak

Independently analyzes susceptibility data and coordinates initiatives to support antimicrobial stewardship *Independently interfaces with public health officials/ departments*	● Works with antimicrobial stewardship to remove Ciprofloxacin reporting from urine cultures ● Coordinates collection and transport of appropriate specimens to the public health facility for testing in a suspected infant botulism case
Level 5 *Leads an infection prevention initiative* *Independently analyzes susceptibility data and creates an antibiogram* *Leads a collaboration with public health to complete a project*	● Detects an increase in methicillin-resistant Staphylococcus aureus (MRSA) in the neonatal intensive care unit, gathers and analyzes data, and works with a multidisciplinary team to implement an intervention ● Works with public health agency to identify the epidemiology of HIV by zip code
Assessment Models or Tools	● Direct observation ● Measure impact of intervention ● Multisource evaluation ● Portfolio ● Scholarly activity (e.g., abstracts, conference presentations)
Curriculum Mapping	●
Notes or Resources	●

Practice-Based Learning and Improvement 1: Evidence-Based Practice and Scholarship **Overall Intent:** To incorporate evidence into clinical practice and is involved in contributing to the body of knowledge in pathology	
Milestones	**Examples**
Level 1 *Demonstrates how to access and select applicable evidence* *Is aware of the need for patient privacy, autonomy, and consent as applied to clinical research*	● Recognizes that molecular testing is useful in the work-up of Whipple's disease or herpes encephalitis ● Identifies the need for an Institutional Review Board (IRB) when collecting cases for a possible research project
Level 2 *Identifies and applies the best available evidence to guide diagnostic work-up of simple cases* *Develops knowledge of the basic principles of research (e.g., demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care*	● Reviews guidelines and suggests algorithms for syphilis testing ● Drafts an IRB protocol with attending oversight
Level 3 *Identifies and applies the best available evidence to guide diagnostic work-up of complex cases* *Applies knowledge of the basic principles of research such as informed consent and research protocols to clinical practice, with supervision*	● Recommend the ordering of 16s sequencing on tissue from culture-negative endocarditis ● Drafts an IRB protocol with minimal oversight ● Submits an abstract for a national meeting
Level 4 *Critically appraises and applies evidence to guide care, even in the face of conflicting data* *Proactively and consistently applies knowledge of the basic principles of research such as informed consent and research protocols to clinical practice*	● Appropriately researches the primary literature and clinical information to explain discrepant molecular findings ● Submits a paper for publication

Level 5 *Teaches others to critically appraise and apply evidence for complex cases; and/or participates in the development of guidelines* *Suggests improvements to research regulations and/or substantially contributes to the primary literature through basic, translational, or clinical research*	● Moderates a discussion with clinicians over disparate molecular findings with HIV genotyping to recommend an alternative test method based on review of the primary literature ● Submits a grant proposal
Assessment Models or Tools	● Direct observation ● Formal presentation at a regional, national, or international meeting ● Portfolio review ● Review of IRB submission or grant proposals
Curriculum Mapping	●
Notes or Resources	● Institutional IRB guidelines ● Mandal J, Acharya S, Parija SC. Ethics in human research. *Trop Parasitol*. 2011;1(1):2-3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3593469/. 2020. ● Masic I, Miokovic M, Muhamedagic B. Evidence based medicine - new approaches and challenges. 2008;16(4):219-225. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3789163/. 2020. ● National Institutes of Health. Write Your Application. https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/write-your-application.htm. 2020. ● U.S. Department of Health & Human Services. The Belmont Report. https://www.hhs.gov/ohrp/regulations-and-policy/belmont-report/read-the-belmont-report/index.html. 2020. ● U.S. National Library of Medicine. PubMed Tutorial. https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html. 2020. ● Various journal submission guidelines

Practice-Based Learning and Improvement 2: Reflective Practice and Commitment to Personal Growth **Overall Intent:** To seek clinical performance information to improve care; reflects on all domains of practice, personal interactions, and behaviors, and their impact on technologists, colleagues and patients (if applicable) (reflective mindfulness); develop clear objectives and goals for improvement in some form of a learning plan	
Milestones	**Examples**
Level 1 *Accepts responsibility for personal and professional development by establishing goals* *Identifies the gap(s) between expectations and actual performance* *Actively seeks opportunities to improve*	● Discusses learning goals and opportunities for personal improvement with program director ● Makes specific goals that are reasonable to execute and achieve
Level 2 *Demonstrates openness to receiving performance data and feedback in order to inform goals* *Analyzes and reflects on the factors which contribute to gap(s) between expectations and actual performance* *Designs and implements a learning plan, with assistance*	● Increasingly identifies performance gaps in terms of diagnostic skills and daily work; uses feedback from others ● Seeks a mentor and asks the mentor about performance and opportunities for improvement ● Uses feedback with a goal of improving communication skills with technologists, peers/colleagues, and staff members
Level 3 *Seeks performance data and feedback with humility* *Institutes behavioral change(s) to narrow the gap(s) between expectations and actual performance* *Independently creates and implements a learning plan*	● Meets regularly with mentor ● Takes input from technologists, peers/colleagues, and supervisors to gain complex insight into personal strengths and opportunities for improvement ● Incorporates feedback and is appreciative and not defensive ● Refines goals such that attaining them is reasonable and measurable
Level 4 *Actively and consistently seeks performance data and feedback with humility*	● Actively reviews plans with mentor and seeks feedback

Critically evaluates the effectiveness of behavioral changes in narrowing the gap(s) between expectations and actual performance *Uses performance data to measure the effectiveness of the learning plan and improves it when necessary*	● Consistently identifies ongoing gaps and chooses areas for further development
Level 5 *Models seeking performance data and accepting feedback with humility* *Coaches others in reflective practice* *Facilitates the design and implementing learning plans for others*	● Actively discusses learning goals with supervisors and colleagues ● Serves as a mentor to other learners ● Encourages other learners on the team to consider how their behavior affects the rest of the team
Assessment Models or Tools	● Direct observation ● Feedback from mentor ● Multisource evaluation ● Portfolio review ● Review of goals and accomplishments ● Review of learning plan ● Self-assessment
Curriculum Mapping	●
Notes or Resources	● Burke AE, Benson B, Englander R, Carraccio C, Hicks PJ. Domain of competence: practice-based learning and improvement. *Acad Pediatr.* 2014;14: S38-S54. https://www.academicpedsjnl.net/article/S1876-2859(13)00333-1/fulltext. 2020. ● Hewson MG, Little ML. Giving feedback in medical education: verification of recommended techniques. *J Gen Intern Med*. 1998;13(2):111-116. https://pdfs.semanticscholar.org/3113/f34ae09505ef92cb59ca804c82af46f3474c.pdf?_ga=2.5963188.62939443.1581441354-545033232.1580407008. 2020. ● Hojat M, Veloski JJ, Gonnella JS. Measurement and correlates of physicians' lifelong learning. *Academic Medicine.* 2009;84(8):1066-1074. https://journals.lww.com/academicmedicine/fulltext/2009/08000/Measurement_and_Correlates_of_Physicians__Lifelong.21.aspx. 2020. ● Koshy K, Limb C, Gundogan B, Whitehurst K, Jafree DJ. Reflective practice in health care and how to reflect effectively. *Int J Surg Oncol*. 2017;2(6):e20. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5673148/. 2020.

	● Lockspeiser TM, Schmitter PA, Lane JL, Hanson JL, Rosenberg AA, Park YS. Assessing residents' written learning goals and goal writing skill: validity evidence for the learning goal scoring rubric. *Academic Medicine*. 2013;88(10):1558-1563. https://journals.lww.com/academicmedicine/fulltext/2013/10000/Assessing_Residents__Written_Learning_Goals_and.39.aspx. 2020. ● Menard L, Ratnapalan S. Reflection in medicine. *Can Fam Physician*. 2013;59(1):105-107. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3555667/. 2020.

Professionalism 1: Professional Behavior and Ethical Principles **Overall Intent:** To recognize and address lapses in ethical and professional behavior, demonstrates ethical and professional behaviors, and use appropriate resources for managing ethical and professional dilemmas	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources, and related topics* *Describes when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses*	● Identifies and describes potential triggers for professionalism lapses ● Recognizes effect of fatigue on professional behavior and communication ● Maintains patient confidentiality and sensitivity to protected health information (PHI) in public spaces ● Discusses the basic principles underlying ethics (beneficence, nonmaleficence, justice, autonomy) and professionalism (professional values and commitments), and how they apply in various situations ● Recognizes appropriate resources for managing and resolving ethical dilemmas
Level 2 *Analyzes straightforward situations using ethical principles* *Demonstrates insight into professional behavior in routine situations; takes responsibility for one's own professionalism lapses*	● Demonstrates professional behavior in routine situations and uses ethical principles to analyze straightforward situations ● Apologizes for the lapse when appropriate and takes steps to make amends, if needed ● Articulates strategies for preventing similar lapses in the future and monitors and responds to fatigue, hunger, stress, etc. in self and team members
Level 3 *Recognizes the need and uses relevant resources to seek help in managing and resolving complex ethical situations* *Demonstrates professional behavior in complex or stressful situations*	● Analyzes complex situations, such as how the clinical situation evokes strong emotions, conflicts (or perceived conflicts) between patients/providers/staff members ● The fellow navigates situations when the standard operating procedure is not clear regarding reporting of bone culture results, or when the matrix-assisted laser desorption/ionization (MALDI) workflow causes congestion and delayed reporting of important results. ● Informing clinical colleagues of the limited utility of testing or the possible fiscal impact of testing
Level 4 *Independently resolves and manages complex ethical situations* *Recognizes situations that may trigger professionalism lapses and intervenes to prevent lapses in self and others*	● Actively seeks to consider the perspectives of others ● Models respect for patients and expects the same from others ● Uses appropriate resources for managing and resolving ethical dilemmas by seeking consultation with the program director or other faculty members, ethics board, peer consultation, or literature as needed

Level 5 *Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution* *Coaches others when their behavior fails to meet professional expectations*	● Acts as a mentor for technologists or residents that have had inappropriate outbursts or lapses in acceptable professional behavior ● Identifies and seeks to address system-wide factors or barriers to promoting a culture of ethical and professional behavior through participation in a work group, committee, or task force
Assessment Models or Tools	● Direct observation ● Mentor and program director observations ● Multisource evaluation ● Oral or written self-reflection (e.g., of a personal or observed lapse, ethical dilemma, or systems-level factors)
Curriculum Mapping	●
Notes or Resources	● American Board of Internal Medicine, ACP-ASIM Foundation, European Federation of Internal Medicine. Medical professionalism in the new millennium: a physician charter. *Ann Intern Med*. 2002;136:243-246. http://abimfoundation.org/wp-content/uploads/2015/12/Medical-Professionalism-in-the-New-Millenium-A-Physician-Charter.pdf. 2020. ● American Medical Association. Ethics. https://www.ama-assn.org/delivering-care/ama-code-medical-ethics. 2020. ● Brissette MD, Johnson K, Raciti PM, et al. Perceptions of unprofessional attitudes and behaviors: implications for faculty role modeling and teaching professionalism during pathology residency. *Arch Pathol Lab Med.* 2017;141:1349-1401. https://www.archivesofpathology.org/doi/10.5858/arpa.2016-0477-CP. 2020. ● Byyny RL, Papadakis MA, Paauw DS. *Medical Professionalism Best Practices*. Menlo Park, CA: Alpha Omega Alpha Medical Society; 2015. https://alphaomegaalpha.org/pdfs/2015MedicalProfessionalism.pdf. 2019. ● Conran RM, Powell SZ, Domen RE, et al. Development of professionalism in graduate medical education: a case-based educational approach from the College of American Pathologists' Graduate Medical Education Committee. 2018;5: 2374289518773493. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6039899/. 2020. ● Domen RE, Johnson K, Conran RM, et al. Professionalism in pathology: a case-based approach as a potential education tool. *Arch Pathol Lab Med*. 2017;141:215-219. https://www.archivesofpathology.org/doi/10.5858/arpa.2016-0217-CP?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. 2020. ● Domen RE, Talbert ML, Johnson K, et al. Assessment and management of professionalism issues in pathology residency training: results from surveys and a

	workshop by the graduate medical education committee of the College of American Pathologists. *Acad Pathol.* 2015; 2:2374289515592887. https://journals.sagepub.com/doi/10.1177/2374289515592887. 2020. ● Levinson W, Ginsburg S, Hafferty FW, Lucey CR. *Understanding Medical Professionalism*. 1st ed. New York, NY: McGraw-Hill Education; 2014.

Professionalism 2: Accountability and Conscientiousness **Overall Intent:** To take responsibility for one's own actions and the impact on patients and other members of the health care team	
Milestones	**Examples**
Level 1 *Responds promptly to instructions, requests, or reminders to complete tasks and responsibilities*	● Responds promptly to reminders from program administrator to complete work hour logs ● Timely attendance at conferences ● Responds promptly to requests to investigate an unusual laboratory result
Level 2 *Takes ownership and performs tasks and responsibilities in a timely manner with attention to detail*	● Adheres to assigned bench schedule and notifies technical staff of planned absences ● Completes and documents safety modules, procedure review, and competency requirements ● Is ready for microbiology rounds with case presentations completed
Level 3 *Recognizes situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team*	● Completes tasks in stressful situations and preempts issues that would impede completion of tasks ● Reviews Case Logs, evaluations, and portfolio and develops a learning plan to address gaps/weakness in knowledge, case exposure, and skills
Level 4 *Anticipates and intervenes in situations that may impact others' ability to complete tasks and responsibilities in a timely manner*	● Identifies issues that could impede laboratory technologists from completing tasks and provides leadership to address those issues ● Communicates with program director if problem requires a systems-based approach and needs to be addressed at a higher administrative level ● Takes responsibility for potential adverse outcomes from a mishandled specimen and professionally discusses with the interprofessional team
Level 5 *Takes ownership of system outcomes, and implements new strategies when necessary*	● Sets up a meeting with the lead technologist to streamline a reflex testing algorithm and follows through with a system-based solution ● Leads team to find solutions to problem
Assessment Models or Tools	● Compliance with deadlines and timelines ● Direct observation ● Multisource evaluations ● Self-evaluations and reflective tools
Curriculum Mapping	●
Notes or Resources	● American Society of Anesthesiologists (ASA). Ethics Resources. https://monitor.pubs.asahq.org/article.aspx?articleid=2623185&_ga=2.195503080.594041218.1580135281-292330288.1579657750. 2020. ● Code of conduct from fellow/resident institutional manual ● Expectations of residency program regarding accountability and professionalism

Professionalism 3: Self-Awareness and Help-Seeking **Overall Intent:** To identify, use, manage, improve, and seek help for personal and professional well-being for self and others	
Milestones	**Examples**
Level 1 *Recognizes limitations in the knowledge/skills/ behaviors of self or team, with assistance* *Recognizes status of personal and professional well-being, with assistance*	● Accepts feedback and exhibits positive responses to criticism ● Accepts feedback to spend more time studying Gram stain morphology and reaches out to technical staff members to identify helpful resources and shadow technologist performing Gram stain interpretations ● Discusses time management with attending to help prioritize research projects
Level 2 *Independently recognizes limitations in the knowledge/skills/ behaviors of self or team and seeks help when needed* *Independently recognizes status of personal and professional well-being and seeks help when needed*	● Identifies possible sources of personal stress or lack of clinical knowledge and independently seeks help ● Seeks the attending microbiologist's feedback/opinion on how best to handle an upcoming discussion with a healthcare provider intent on obtaining an unnecessary diagnostic test ● Identifies deficit in knowledge of antimicrobial spectrums of action and requests resources to use to improve
Level 3 *Proposes and implements a plan to remediate or improve the knowledge/ skills/behaviors of self or team, with assistance* *Proposes and implements a plan to optimize personal and professional well-being, with assistance*	● With supervision, assists in developing a personal learning or action plan to address gaps in knowledge or stress and burnout for self or team ● To address deficits in parasite identification, seeks help from technical staff members and parasitology attendings and develops a strategy to study parasitology morphology texts and review archived clinical specimens ● Discusses, with the fellowship director, the plan to use lunch break for exercise once a week
Level 4 *Independently develops and implements a plan to remediate or improve the knowledge/skills/ behaviors of self or team* *Independently develops and implements a plan to optimize personal and professional well-being*	● Independently develops personal learning or action plans for continued personal and professional growth, and limits stress and burnout for self or team ● To optimize presentation delivery skills, develops a plan to practice giving microbiology lab round presentations to pathology residents the day before presentation to infectious disease staff ● Discusses study plans with residents on microbiology rotations to help improve readiness for board certification

Level 5 *Serves as a resource or consultant for developing a plan to remediate or improve the knowledge/ skills/behaviors* *Coaches others when responses or limitations in knowledge/skills do not meet professional expectations*	● Mentors colleagues in self-awareness and establishes health management plans to limit stress and burnout ● To address deficiencies in resident knowledge in parasitology, presents a high-yield parasitology session to residents on service and create a study set of archived clinical samples for residents to review ● Discusses lapses in professionalism with residents and how it could impact their careers
Assessment Models or Tools	● Direct observation ● Institutional online training modules ● Multisource evaluation ● Self-assessment and personal learning plan ● Self-reflection
Curriculum Mapping	●
Notes or Resources	● This subcompetency is not intended to evaluate a fellow's well-being, but to ensure each fellow has the fundamental knowledge of factors that impact well-being, the mechanisms by which those factors impact well-being, and available resources and tools to improve well-being. ● ACGME. "Well-Being Tools and Resources." https://dl.acgme.org/pages/well-being-tools-resources. Accessed 2022. ● Conran RM, Powell SZ, Domen RE, et al. Development of professionalism in graduate medical education: a case-based educational approach from the College of American Pathologists' Graduate Medical Education Committee. *Acad Pathol*. 2018;5:2374289518773493. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6039899/. 2020. ● Hicks PJ, Schumacher D, Guralnick S, Carraccio C, Burke AE. Domain of competence: personal and professional development. *Acad Pediatr*. 2014;14(2 Suppl):S80-97. https://linkinghub.elsevier.com/retrieve/pii/S1876-2859(13)00332-X. 2020. ● Joseph L, Shaw PF, Smoller BR. Perceptions of stress among pathology residents: survey results and some strategies to reduce them. *Am J Clin Pathol*. 2007;128(6):911-919. https://academic.oup.com/ajcp/article/128/6/911/1764982. 2020. ● Local resources, including Employee Assistance Program

Interpersonal and Communication Skills 1: Patient- and Family-Centered Communication **Overall Intent:** To deliberately use language and behaviors to facilitate constructive relationships among patients and health care providers, to identify communication barriers including self-reflection on personal biases, and to organize and lead communication around shared decision making	
Milestones	**Examples**
Level 1 *Uses language and nonverbal behavior to demonstrate respect and establish rapport* *Identifies common barriers to effective communication (e.g., language, disability) while accurately communicating one's own role within the health care system*	● Self-monitors and controls tone, non-verbal responses, and language and asks questions to invite participation ● Accurately communicates the pathologist's role in the health care system ● Identifies common communication barriers in patient care ● Avoids medical jargon in specimen collection instructions, making sure communication is at the appropriate level to be understood by a layperson
Level 2 *Establishes a relationship in straightforward encounters using active listening and clear language* *Identifies complex barriers to effective communication (e.g., health literacy, cultural)*	● Demonstrates active listening, attention to affect, and questions that explore the optimal approach to daily tasks ● Recognizes health literacy issues and how they impact selection of language to report test results or communicating specimen collection plans ● Understands that certain words or phrases in tests results may have a negative impact
Level 3 *Sensitively and compassionately delivers medical information, with supervision* *When prompted, reflects on personal biases while attempting to minimize communication barriers*	● Demonstrates respect and compassion when reporting test results ● Completes a module on recognizing implicit/unconscious bias
Level 4 *Independently, sensitively, and compassionately delivers medical information and acknowledges uncertainty and conflict* *Independently recognizes personal biases while attempting to proactively minimize communication barriers*	● Is an active member of patient care team in discussion of test results and/or subsequent recommended studies ● Participates in the sharing of test results in face of medical error ● Reporting test results using language that can be understood by individuals at other levels of health literacy
Level 5 *Mentors others in the sensitive and compassionate delivery of medical information*	● Leads the sharing of test results in face of medical error

Models self-awareness while teaching a contextual approach to minimize communication barriers	
Assessment Models or Tools	● Direct observation ● Self-assessment including self-reflection exercises ● Simulation ● Structured case discussions
Curriculum Mapping	●
Notes or Resources	● Dintzis SM. Improving pathologist's communication skills. *AMA J Ethics*. 2016;18(8):802-808. https://journalofethics.ama-assn.org/article/improving-pathologists-communication-skills/2016-08. 2020. ● Dintzis SM, Stetsenko GY, Sitlani CM, et al. Communicating pathology and laboratory errors: anatomic pathologists' and laboratory medical directors' attitudes and experiences. *Am J Clin Pathol*. 2011;135(5):760-765. https://academic.oup.com/ajcp/article/135/5/760/1766306. 2020. ● Harvard University. Project Implicit. https://implicit.harvard.edu/implicit/takeatest.html. 2020. ● Laidlaw A, Hart J. Communication skills: an essential component of medical curricula. Part I: Assessment of clinical communication: AMEE Guide No. 51. *Med Teach*. 2011;33(1):6-8. https://www.tandfonline.com/doi/full/10.3109/0142159X.2011.531170. 2020. ● Symons AB, Swanson A, McGuigan D, Orrange S, Akl EA. A tool for self-assessment of communication skills and professionalism in residents. *BMC Med Educ*. 2009;9:1. https://bmcmededuc.biomedcentral.com/articles/10.1186/1472-6920-9-1. 2020.

Interpersonal and Communication Skills 2: Interprofessional and Team Communication **Overall Intent:** To effectively communicate with the health care team including both inter- and intra-departmental team members, in both straightforward and complex situations	
Milestones	**Examples**
Level 1 *Uses language that values all members of the health care team* *Describes the utility of constructive feedback*	● Shows respect in health care team communications through words and actions such as in requests for clinical consultation ● Uses respectful communication to clerical and technical staff members ● Listens to and considers others' points of view and is nonjudgmental and actively engaged
Level 2 *Communicates information effectively with all health care team members* *Solicits feedback on performance as a member of the health care team*	● Follows up in the laboratory with technologists regarding questions about a work-up ● Demonstrates active listening by fully focusing on the speaker, actively showing verbal and non-verbal signs ● Communicates clearly and concisely in an organized and timely manner during consultant encounters, as well as with the health care team in general ● Seeks feedback from health care team following recommendations
Level 3 *Uses active listening to adapt communication style to fit team needs* *Integrates feedback from team members to improve communication*	● Verifies understanding of discussions on rounds by restating key points before communicating to health care team ● Raises concerns or provides opinions and feedback when needed to others on the team ● Respectfully provides feedback to junior members of the medical team for the purposes of improvement or reinforcement of correct knowledge, skills, and attitudes
Level 4 *Coordinates recommendations from different members of the health care team to optimize patient care* *Communicates feedback and constructive criticism to superiors*	● Summarizes and reports discussions of complex patient results with other members of the health care team ● Raises concerns or provides opinions and feedback to superiors on the team ● Adapts communication strategies in handling complex situations
Level 5 *Models flexible communication strategies that value input from all health care team members, resolving conflict when needed*	● Communicates with all health care team members, resolves conflicts, and provides feedback in any situation ● Organizes a team meeting to discuss and resolve potentially conflicting points of view regarding sending out samples for metagenomic next-generation sequencing testing

Facilitates regular health care team-based feedback in complex situations	● Organizes a process for communicating multidrug resistant organism test results in real time through electronic messaging and validates the process by interactions with clinical teams, infection control, and laboratory staff members
Assessment Models or Tools	● Debriefing sessions with attending ● Direct observation ● Multisource assessment ● Portfolio review ● Simulation
Curriculum Mapping	●
Notes or Resources	● Brissette MD, Johnson K, Raciti PM, et al. Perceptions of unprofessional attitudes and behaviors: implications for faculty role modeling and teaching professionalism during pathology residency. *Arch Pathol Lab Med*. 2017;141:1394-1401. https://www.archivesofpathology.org/doi/10.5858/arpa.2016-0477-CP. 2020. ● Conran RM, Powell SZ, Domen RE, et al. Development of professionalism in graduate medical education: a case-based educational approach from the College of American Pathologists' Graduate Medical Education Committee. 2018;5: 2374289518773493. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6039899/. 2020. ● Green M, Parrott T, Cook G., Improving your communication skills. *BMJ*. 2012;344:e357. https://www.bmj.com/content/344/bmj.e357. 2020. ● Henry SG, Holmboe ES, Frankel RM. Evidence-based competencies for improving communication skills in graduate medical education: a review with suggestions for implementation. *Med Teach*. 2013;35(5):395-403. https://www.tandfonline.com/doi/full/10.3109/0142159X.2013.769677. 2020. ● Roth CG, Eldin KW, Padmanabhan V, Freidman EM. Twelve tips for the introduction of emotional intelligence in medical education. *Med Teach*. 2019;41(7):1-4. https://www.tandfonline.com/doi/full/10.1080/0142159X.2018.1481499. 2020.

Interpersonal and Communication Skills 3: Communication within Health Care Systems **Overall Intent:** To effectively communicate using a variety of methods	
Milestones	**Examples**
Level 1 *Safeguards patient personal health information by communicating through appropriate means as required by institutional policy (e.g., patient safety reports, cell phone/pager usage)* *Identifies institutional and departmental structure for communication of issues*	● Identifies when it is acceptable to include PHI in various forms of communication ● When communicating histopathology slide review interpretations, notices one colleague using a personal email address and brings this to the attention of the microbiology attending to safeguard a potential breach in PHI ● Upon noticing the acid-fast bacilli room pressure sensor indicating a lack of negative pressure, the fellow notifies personnel in the tuberculosis (TB) room and the microbiology supervisor to address this issue and then pages the attending microbiologist ● Enters safety report for tiles coming up off of floor that are a trip hazard
Level 2 *Selects forms of communication based on context and urgency of the situation* *Respectfully communicates concerns about the system*	● Upon consultation with lab personnel for isolation of *Candida auris*, seeks immediate consultation with the attending microbiologist and promptly calls infection prevention ● Sends an encrypted email to notify the microbiology attending and residents on service regarding a patient with potential brucellosis ● Recognizes a communication breakdown has happened between second and third shift and respectfully brings the breakdown to the attention of the lab supervisor and attending microbiologist ● Upon quality assurance review of antibiotic susceptibility reports, notices the wrong antibiotics are being reported for *Burkholderia* species within the *B. cepacia* species complex and notifies the microbiology lab supervisor and attending ● Reports a corrected Gram stain result that led to an unnecessary surgery in the patient safety event reporting system
Level 3 *Communicates while ensuring security of personal health information, with supervision* *Uses institutional structure to effectively communicate clear and constructive suggestions to improve the system*	● Communicates opportunities for improvement in the LIS/EHR interface ● After reviewing new species updates in the MALDI-TOF database, realizes clinicians may not know that *Burkholderia vietnamensis* is in the *B. cepacia* species complex and works with the lab supervisor and information technology (IT) experts to update LIS reporting of the species name along with the complex in parentheses ● Knows when to appropriately escalate concerns locally, departmentally, or institutionally ● Upon review of fungal nomenclature changes, discusses the need to update LIS reporting with the lab manager and microbiology attending; upon consensus, works with the lab manager and IT to implement these changes

	● Upon determining that a yeast seen on a Gram stain from a blood culture is most consistent with *Cryptococcus* spp., seeks rapid confirmation from the attending microbiologist then immediately pages and communicates findings to the health care provider ● Uses the medical record to find a provider to contact for a critical value when the ordering provider cannot be reached
Level 4 *Independently communicates while ensuring security of personal health information* *Initiates conversations on difficult subjects with appropriate stakeholders to improve the system*	● Talks directly to a colleague about breakdowns in communication in order to prevent recurrence ● Although highly involved and interested in a clinical case involving a famous sports athlete with positive joint cultures, restricts discussion of this case to physicians actively providing care ● Participates in a task force to update policy for sharing abnormal results ● Asks attending microbiologist to step out of the hallway into an office to discuss a patient history ● Upon review of the infection prevention policy, realizes the emerging pathogen *Candida auris* has not been added to the list and communicates a need to update the list with infection prevention ● Discusses the need for N95 fit testing with the residency program director and organizes a session during resident orientation
Level 5 *Guides departmental or institutional communication around policies and procedures regarding the security of personal health information* *Facilitates dialogue regarding systems issues among larger community stakeholders (e.g., institution, health care system, field)*	● Participates in a task force established by the hospital QI committee to educate providers on appropriate communication methods to minimize breaches in PHI ● Participates in the institution's IRB office and updates the IRB template to optimize the appropriate use and security of PHI ● Develops an orientation module for incoming residents and fellows on appropriate use of PHI ● Identifies an unacceptable delay in transport time from outlying health care facilities and works with key stakeholders at both institutions to optimize specimen transport ● Works with system hospitals to standardize the microbiology critical value list
Assessment Models or Tools	● Debriefing session with attendings ● Direct observation of communications with providers ● Documentation of participation in meetings ● Multisource evaluation ● Portfolio review
Curriculum Mapping	●

Notes or Resources	● Haig KM, Sutton S, Whittington J. SBAR: a shared mental model for improving communication between clinicians. *Jt Comm J Qual Patient Saf*. 2006;32(3):167-175. https://www.jointcommissionjournal.com/article/S1553-7250(06)32022-3/fulltext. 2020.

In an effort to aid programs in the transition to using the new version of the Milestones, we have mapped the original Milestones 1.0 to the new Milestones 2.0. Below we have indicated where the subcompetencies are similar between versions. These are not necessarily exact matches but are areas that include some of the same elements. Note that not all subcompetencies map between versions. Inclusion or exclusion of any subcompetency does not change the educational value or impact on curriculum or assessment.

Milestones 1.0	Milestones 2.0
PC1: Consultation	PC1: Clinical Consultation
PC2: Testing (Methodology/Performance/Interpretation and Reporting) and Microorganism Identification	PC3: Test Performance and Organism Identification PC3: Test Interpretation and Reporting MK2: Test Methodology
MK1: Fundamental and Diagnostic Knowledge	MK1: Fundamental and Diagnostic Knowledge
MK2: Test Development and Validation/ Verification	MK2: Clinical Reasoning
MK3: Test Development, and Validation/ Verification	MK3: Test Development and Verification
SBP1: Regulatory	SBP4: Accreditation, Compliance, and Quality
SBP2: Health Care Teams	SBP2: Systems Navigation for Patient-Centered Care SBP6: Infection Prevention, Antimicrobial Stewardship, and Public Health ICS2: Interprofessional and Team communication
SBP3: Laboratory Management: Resource Utilization (Personnel and Finance)	SBP3: Physician Role in Health Care System SBP5: Utilization
PBLI1: Evidence-based Utilization	PBLI1: Evidence-Based Practice and Scholarship SBP5: Utilization
PBLI2: Process Improvement and Patient Safety	SBP1: Patient Safety and Quality Improvement (QI)
PROF1: Receiving and Providing Feedback	PBLI2: Reflective Practice and Commitment to Personal Growth
PROF2: Accountability, Honesty, and Integrity	PROF1: Professional Behavior and Ethical Principles PROF2: Accountability & Conscientiousness PROF3: Self-Awareness & Help Seeking
PROF3: Cultural Competency	SBP2: Systems Navigation for Patient-Centered Care ICS1: Patient and Family Centered Communication
ICS1: Communication with Health Care Providers, Families, and Patients (as applicable)	ICS1: Patient and Family Centered Communication ICS2: Interprofessional and Team Communication
ICS2: Personnel Management and Conflict Resolution	ICS2: Interprofessional and Team Communication
	ICS3: Communication within Health Care Systems

Available Milestones Resources

Milestones 2.0: Assessment, Implementation, and Clinical Competency Committees Supplement, 2021 - *https://meridian.allenpress.com/jgme/issue/13/2s*

Milestones Guidebooks: https://www.acgme.org/milestones/resources/

- *Assessment Guidebook*
- *Clinical Competency Committee Guidebook*
- *Clinical Competency Committee Guidebook Executive Summaries*
- *Implementation Guidebook*
- *Milestones Guidebook*

Milestones Guidebook for Residents and Fellows: https://www.acgme.org/residents-and-fellows/the-acgme-for-residents-and-fellows/

- Milestones Guidebook for Residents and Fellows
- Milestones Guidebook for Residents and Fellows Presentation
- Milestones 2.0 Guide Sheet for Residents and Fellows

Milestones Research and Reports: https://www.acgme.org/milestones/research/

- *Milestones National Report*, updated each fall
- *Milestones Predictive Probability Report,* updated each fall
- *Milestones Bibliography*, updated twice each year

Developing Faculty Competencies in Assessment courses - https://www.acgme.org/meetings-and-educational-activities/courses-and-workshops/developing-faculty-competencies-in-assessment/

Assessment Tool: Direct Observation of Clinical Care (DOCC) - https://dl.acgme.org/pages/assessment

Assessment Tool: Teamwork Effectiveness Assessment Module (TEAM) - https://team.acgme.org/

Improving Assessment Using Direct Observation Toolkit - https://dl.acgme.org/pages/acgme-faculty-development-toolkit-improving-assessment-using-direct-observation

Remediation Toolkit - https://dl.acgme.org/courses/acgme-remediation-toolkit

Learn at ACGME has several courses on Assessment and Milestones - https://dl.acgme.org/