Supplemental Guide:
Chemical Pathology

ACGME

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Milestones Supplemental Guide

This document provides additional guidance and examples for the Chemical Pathology 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 develop competence in clinical consultation for ordering providers to appropriately and expertly guide clinical care and patient management	
Milestones	**Examples**
Level 1 *Recognizes the role of the consultant in chemical pathology*	● Identifies the added value of medical director interpretation to hemoglobinopathy evaluation beyond simple numerical reporting
Level 2 *Identifies relevant information from the electronic health record (EHR) and other sources needed for consultation of routine clinical scenarios*	● Assembles prior red blood cell indices, serum iron status, and family history to provide context for current test results in the setting of hemoglobinopathy
Level 3 *Prepares consultative reports, recommendations, and action plans for routine clinical scenarios*	● Writes a full hemoglobinopathy interpretation of sickle cell trait with recommendations for family or additional personal testing
Level 4 *Provides consultative reports, recommendations, and action plans for complex clinical scenarios*	● Constructs recommendations for additional testing, including molecular evaluation, for complex heterozygosity in hemoglobinopathies
Level 5 *Teaches others how to approach consultation for simple and complex clinical scenarios*	● Publishes instructional materials for the understanding of hemoglobin genes and testing methodologies
Assessment Models or Tools	● College of American Pathologists (CAP) proficiency educational materials/tests ● Direct observation ● Multisource evaluation ● Ordering provider feedback ● Rotation evaluation
Curriculum Mapping	●
Notes or Resources	● Bain BJ. *Haemoglobinopathy Diagnosis*. 2nd Edition. Hoboken, HJ: John Wiley & Sons, Inc; 2005. ● Keren DF. *Protein Electrophoresis in Clinical Diagnosis*. Chicago, IL: American Society for Clinical Pathology Press; 2012.

	● Mais DD. *Practical Clinical Pathology*. Chicago, IL: American Society for Clinical Pathology Press; 2014. ● Rifai N. *Tietz Textbook of Clinical Chemistry and Molecular Diagnostics*. 6th ed. St. Louis, MO: Elsevier Saunders; 2012. ● Schmidt RL, Panlener J, Hussong JW. An analysis of clinical consultation activities in clinical pathology: who requests to help and why. *Am J Clin Pathol*. 2014;142(3):286-291. https://academic.oup.com/ajcp/article/142/3/286/1760569. 2020.

Patient Care 2: Test Interpretation **Overall Intent:** To develop expertise in chemistry test interpretation for simple and complex clinical scenarios	
Milestones	**Examples**
Level 1 *Recognizes differences in methodologies and performance characteristics of chemistry tests*	● Recognizes differences in analytical sensitivity and specificity between immunoassay and mass spectrometry for drugs of abuse ● Understands reference value differences for lactate dehydrogenase depending on test methodology
Level 2 *Recognizes aberrant and/or discrepant results of chemistry tests*	● Identifies the result pattern of a serum specimen contaminated with intravenous saline ● Identifies the result pattern of an ethylenediaminetetraacetic acid (EDTA) plasma specimen mistakenly used for chemistry analysis ● Recognizes the effect of urine adulterants in drug abuse testing
Level 3 *Interprets routine chemistry tests with understanding of patient context and with regards to test methodology*	● Recognizes that the lack of drug metabolites may indicate medication diversion ● Evaluates for the presence of 6-monoacetylmorphine in distinguishing heroin abuse versus therapeutic opioids
Level 4 *Demonstrates expertise of test interpretation for the diagnosis and/or monitoring of complex clinical scenarios*	● Interprets sex hormone test results for patients undergoing gender transition ● Interprets mixed acid-base disorders with blood gas analysis in the intensive care unit (ICU) setting
Level 5 *Teaches others a strategy to approach the interpretation of chemistry tests for complex clinical scenarios*	● Publishes instructional materials for the selection and interpretation of tests used for pain management monitoring and detection of drugs of abuse ● Teaches nurses about point of care glucose result interpretation and the effect of poor peripheral blood circulation
Assessment Models or Tools	● CAP educational materials ● Direct observation ● Multisource evaluation ● Ordering provider feedback ● Rotation evaluation
Curriculum Mapping	●

Notes or Resources	● Keren DF. *Protein Electrophoresis in Clinical Diagnosis*. Chicago, IL: American Society for Clinical Pathology Press; 2012. ● Mais DD. *Practical Clinical Pathology*. Chicago, IL: American Society for Clinical Pathology Press; 2014. ● Rifai N. *Tietz Textbook of Clinical Chemistry and Molecular Diagnostics*. 6th ed. St. Louis, MO: Elsevier Saunders; 2012.

Patient Care 3: Test Development and Validation **Overall Intent:** To gain expertise in building an appropriate laboratory test menu	
Milestones	**Examples**
Level 1 *Identifies the need for a new test or modification of an existing test* *Recognizes outside resources for referred testing*	● Recognizes which laboratory assays are subject to biotin interference ● Recognizes when to extend the reportable range of tumor markers
Level 2 *Selects the methodology for a new test or modification of an existing test* *Evaluates the need for referred testing*	● Recognizes when to validate carcinoembryonic antigen (CEA) testing for pancreatic cyst fluid ● Assesses whether in-house porphyrin testing is adequate for a patient with sun-sensitive blistering
Level 3 *Identifies requirements for test verification of a Food and Drug Administration (FDA)-approved test* *Evaluates outside resources for accreditation and Clinical Laboratory Improvement Amendments (CLIA) licensure*	● Develops a plan for verifying the performance of a fifth-generation troponin assay ● Confirms Clinical Laboratory Improvement Amendments (CLIA)-licensure of new laboratory providing a solid tumor next-generation sequencing panel
Level 4 *Identifies requirements for test validation of a laboratory developed test* *Demonstrates expertise in the selection of referred tests*	● Re-baselines existing patients for method changes of tumor markers ● Selects appropriate confirmatory test for positive heparin-induced thrombocytopenia antibodies
Level 5 *Creates a new laboratory developed test that can be accredited* *Optimizes a test menu based on trends of referred testing*	● Establishes a pediatric reference interval for liver enzyme testing ● Develops mass spectrometry method for measuring triazole antifungals ● Conducts analysis (cost, volume, service) of send-out versus in-house clinical laboratory testing for fecal calprotectin

Assessment Models or Tools	● CAP educational materials ● Direct observation ● Multisource evaluation ● Ordering provider feedback ● Rotation evaluation
Curriculum Mapping	●
Notes or Resources	● Clinical and Laboratory Standards Institute (CLSI) guidelines ● CAP Accreditation Checklists ● Kratz A, et al. General laboratory section 3. In: Spitalnik SL, Arinsburg S, Jhang J. *Clinical Pathology Board Review*. Philadelphia, PA: Elsevier Saunders; 2015. ● Lurie P. Framework for regulatory oversight of laboratory developed tests; draft guidance for industry, food and drug administration staff, and clinical laboratories; availability. *Federal Register*. 2014; 79(192):59776-9. https://www.govinfo.gov/content/pkg/FR-2014-10-03/pdf/2014-23596.pdf. 2020. ● Rifai N. *Tietz Textbook of Clinical Chemistry and Molecular Diagnostics*. 6th ed. St. Louis, MO: Elsevier Saunders; 2012. ● Weiss RL. The long and winding regulatory road for laboratory-developed tests. *AJCP*. 2012;138(1):20-26. https://academic.oup.com/ajcp/article/138/1/20/1765938. 2020.

Patient Care 4: Laboratory-Related User Interface **Overall Intent:** To improve the user interface experience for ordering providers in order to achieve more appropriate test selection and result interpretation	
Milestones	**Examples**
Level 1 *Identifies the laboratory test order user interface* *Identifies the laboratory test reporting structure*	● Viewing actual order interface from a provider's perspective in a mock patient context ● Identifies how Vitamin D analytes appear in order interface when "Vitamin D" is queried ● Views how results appear for a comprehensive metabolic panel in a mock patient for desktop versus mobile-based interfaces
Level 2 *Describes best practices in test ordering* *Describes clinical laboratory rationale for test reporting structure*	● Reviews latest testing guidelines for Vitamin D screening in patients with osteoporosis ● Identifies that confirmatory test results must immediately follow human immunodeficiency virus (HIV) screening results
Level 3 *Prepares a best practice alert or guidance for test ordering* *Predicts gaps, problems, and impediments for optimized test report display in the laboratory user interface*	● Prepares a best practice alert for appropriate hemoglobin A1c testing frequency that also shows most recent result ● Determines that results review does not display all components of a gastrointestinal polymerase chain reaction panel ● Recognizes that uncommon hemoglobin variant diagnosis may be missed if result field is not originally built in the test
Level 4 *Implements a best practice alert or hard stop for test ordering* *Troubleshoots the test report format and structure in the laboratory user interface*	● Directs information technology (IT) to rename Vitamin D test so that most appropriate Vitamin D analyte is listed first in order interface ● Revises procedure to obligate providers to look at interpretative comment for hemoglobin variants without built results fields
Level 5 *Optimizes the pre-analytic laboratory user interface and structure* *Optimizes the post-analytic laboratory user interface and structure*	● Discusses Vitamin D test order volumes with primary care physician(s) following test name changes ● Surveys ordering provider satisfaction with revised gastrointestinal polymerase chain reaction panel results display in EHR
Assessment Models or Tools	● CAP Accreditation Checklists

	● Direct observation ● Multisource evaluation ● Ordering provider and patient feedback ● Rotation evaluation
Curriculum Mapping	●
Notes or Resources	● Anker JS, Edwards A, Nosal S, et al. Effects of workload, work complexity, and repeated alerts on alert fatigue in a clinical decision support system. *BMC Med Inform Decis Mak*. 2017;17(36). https://bmcmedinformdecismak.biomedcentral.com/articles/10.1186/s12911-017-0430-8. 2020. ● CAP Accreditation Checklists ● Procop GW, Keating C, Stagno P, et al. Reducing duplicate testing: a comparison of two clinical decision support tools. *AJCP*. 2015;143(5):623-626. https://academic.oup.com/ajcp/article/143/5/623/1760774. 2020. ● Procop GW, Weathers AL, Reddy AJ. Operational aspects of a clinical decision support program. *Clin Lab Med*. 2019;39(2):215-229. https://www.sciencedirect.com/science/article/pii/S0272271219300022?via%3Dihub. 2020. ● Sinard JH, Powell SZ, Karcher DS. Pathology training in informatics. *Arch Path Lab Med*. 2014:138(4):505-511. https://www.archivesofpathology.org/doi/10.5858/arpa.2013-0328-RA?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. 2020. ● Walker JM. Implementing an Electronic Health Record System (Health Informatics). London, UK: Springer-Verlag London; 2005.

Medical Knowledge 1: Test Results in Normal and Abnormal Physiology **Overall Intent:** To understand how test results reflect underlying physiology and pathophysiology	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of normal physiology and biochemistry*	● Understands that serum biomarkers reflect a low level of cellular turnover ● Understands the difference in composition between plasma and serum
Level 2 *Demonstrates knowledge of how tests evaluate normal biological processes*	● Understands how the size of the biochemical analyte or molecule informs selection of testing methodology
Level 3 *Demonstrates knowledge of how pathophysiology alters test results*	● Explains why conjugated bilirubin is elevated in biliary atresia ● Understand how hypothyroidism feedback leads to elevation of thyroid stimulating hormone levels ● Understands the kinetics of serum human chorionic gonadotropin decrease following successful treatment of choriocarcinoma
Level 4 *Integrates test findings and other clinical information to identify pathophysiology*	● Understand the effect of disease prevalence on positive and negative predictive value ● Understands how elevated monoclonal immunoglobulins interfere with indirect serum sodium measurements
Level 5 *Demonstrates knowledge of how test findings are affected by the interaction of multiple conditions*	● Interprets organic acid and amino acid analyses ● Suggests a strategy to distinguish in-vitro from in-vivo hemolysis ● Recommends appropriate testing follow up for infant with suspected elevated delta-bilirubin
Assessment Models or Tools	● Direct observation ● Multisource evaluation ● Rotation evaluation
Curriculum Mapping	●
Notes or Resources	● Clinical and Laboratory Standards Institute (CLSI). Assessment of the Diagnostic Accuracy of Laboratory Tests Using Receiver Operating Characteristic Curves; Approved Guideline - Second Edition. https://clsi.org/media/1425/ep24a2_sample.pdf. 2020. ● Wu AHD. Self-Assessment in Clinical Laboratory Science II. Washington, DC: AACC Press; 2008.

	● Mais DD. *Practical Clinical Pathology*. Chicago, IL: American Society for Clinical Pathology Press; 2014. ● Rifai N. *Tietz Textbook of Clinical Chemistry and Molecular Diagnostics*. 6th ed. St. Louis, MO: Elsevier Saunders; 2012.

Medical Knowledge 2: 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 *Use baseline level of medical knowledge to inform decision-making process*	● Navigates EHR, laboratory information system (LIS), manufacturer's literature and scientific/medical literature to locate necessary information and assess validity of information for a clinical pathology case
Level 2 *Discriminates relevance of information*	● Understands that pediatric height in EHR is often outdated or unavailable and therefore should not be used in the estimated glomerular filtration rate calculation ● Understands that cardiac surgery in the immediate post-operative setting will limit the utility of troponin testing
Level 3 *Independently synthesizes information to inform clinical decision making for routine clinical scenarios*	● Employs Americans with Disabilities Act (ADA) consensus guidelines for diagnosis of diabetes mellitus ● Understands and can describe scientific basis for current screening recommendations for prostate cancer ● Recognizes the presence of a therapeutic antibody on the serum protein electrophoresis of a myeloma patient based on review of medications and published characteristics of current therapies
Level 4 *Independently synthesizes information to inform clinical decision making for complex clinical scenarios*	● Interprets a maternal fetal screen in a hyper-multiple pregnancy after fetal reduction ● Works through differential diagnosis of methemoglobinemia in a cyanotic infant
Level 5 *Creates a strategy to approach clinical reasoning for complex and ambiguous cases*	● Describes the impact of methylenetetrahydrofolate reductase variants on azathioprine effects ● Critiques prenatal cell free DNA screening reports and makes recommendations for improvements ● Designs a study to characterize a new diagnostic entity
Assessment Models or Tools	● Case Logs ● Clinical management conferences ● Direct observation ● Multisource evaluation ● Presentations

	● Review of daily case reports
Curriculum Mapping	●
Notes or Resources	● Brandler TC, Laser J, Williamson AK, Louie J, Esposito MJ. Team-based learning in a pathology residency training program. *AJCP*. 2014;142(1):23-28. https://academic.oup.com/ajcp/article/142/1/23/1760842. 2020. ● 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 ● Dumas D, Torre DM, Durning SJ. Using Relational Reasoning Strategies to Help Improve Clinical Reasoning Practice. *Acad Med*. 2018;93(5):709-714. https://journals.lww.com/academicmedicine/fulltext/2018/05000/Using_Relational_Reasoning_Strategies_to_Help.29.aspx. 2020. ● 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. ● Manesh R, Dhaliwal G. Digital tools to enhance clinical reasoning. *Med Clin North Am*. 2018;102(3):559-565. https://www.ncbi.nlm.nih.gov/pubmed/29650076. 2020. ● Parikh RB et al. Addressing bias in artificial intelligence in health care. *JAMA*. 2019;322(24):2377. https://jamanetwork.com/journals/jama/article-abstract/2756196. 2020. ● Saber Tehrani AS, Lee H, Mathews SC, et al. 25-Year summary of US malpractice claims for diagnostic errors 1986-2010: an analysis from the National Practitioner Data Bank. *BMJ Qual Saf*. 2013;22(8):672-680. https://qualitysafety.bmj.com/content/22/8/672.long. 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*	● Understands impact of specimen identification errors in clinical care
Demonstrates knowledge of how to report patient safety events	● Understand how to use institution's online patient safety reporting portal
Demonstrates knowledge of basic QI methodologies and metrics	● Understands the rationale for following laboratory key performance indicators
Level 2 *Identifies system factors that lead to patient safety events*	● Identifies that incorrect specimen collection tube is stocked in an offsite draw station
Reports patient safety events through institutional reporting systems (simulated or actual)	● Identifies the impact of vendor reagent recalls
Describes departmental and institutional QI initiatives	● Understands the rationale behind the handling of irreplaceable specimens
Level 3 *Participates in analysis of patient safety events (simulated or actual)*	● Assists with notifying clinicians in the event of a reagent recall
Participates in disclosure of patient safety events to clinicians and/or patients and families, as appropriate (simulated or actual)	● Approves a break in protocol and waiver use for the handling of irreplaceable specimens ● Prepares for a morbidity and mortality presentation, including root cause analysis
Participates in departmental and institutional QI initiatives	● Performs a root cause analysis following a breakdown of critical value hand-offs
Level 4 *Conducts analysis of patient safety events and offers error prevention strategies (simulated or actual)*	● Collaborates with emergency department to review and improve specimen collection practices

Discloses patient safety events to clinicians and/or patients and families, as appropriate (simulated or actual) *Demonstrates the skills required to identify, develop, implement, and analyze a QI project*	● Works with phlebotomy teams to improve the efficiency of stat and time critical specimen collection ● Investigates increased number of critically low point-of-care glucoses from labor and delivery and proposes a QI project in collaboration with labor and delivery nurses
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*	● Establishes a committee for test utilization at a system or community level ● Leads the action items prepared from a morbidity and mortality (M and M) conference, including patient and provider notifications ● Delivering a case-based grand rounds on patient safety events to the department
Assessment Models or Tools	● Chart or other system documentation by fellow ● Direct observation at bedside or in meetings ● Documentation of QI or patient safety project processes or outcomes ● E-module multiple choice tests ● Multisource evaluations ● Portfolio ● Reflection ● Simulation
Curriculum Mapping	●
Notes or Resources	● Doering TA, Plapp F, Crawford JM. Establishing an evidence base for critical laboratory value thresholds. *AJCP*. 2014;142(5):617-628. https://academic.oup.com/ajcp/article/142/5/617/1760784. 2020. ● Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2020. ● Institutional guidelines for patient safety events and reporting ● Wagar EA, Phipps R, Del Guidice R, et al. Inpatient preanalytic process improvements. *Arch Path Lab Med*. 2013;137(12):1753-1760.

	https://www.archivesofpathology.org/doi/10.5858/arpa.2012-0458-OA?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. 2020. ● Wilson ML. Decreasing inappropriate laboratory test utilization: controlling costs and improving quality of care. *AJCP*. 2015;143(5):614-616. https://academic.oup.com/ajcp/article/143/5/614/1760692. 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 the members of the interprofessional team, including phlebotomists, medical assistants, specimen processing personnel, medical laboratory scientists, other residents or fellows, other physicians, and nurses, and understands their roles in transitions of care and hand-offs ● Documents a therapeutic antibody for use in future testing interpretation
Identifies key elements for safe and effective transitions of care and hand-offs	● Recognizes when additional work-up is needed for test interference
Demonstrates knowledge of population and community health needs and disparities	● Identifies components of social determinants of health and how they impact the delivery of patient care ● Is aware of reporting mechanism and mitigation programs for toxic lead levels involving the laboratory, pediatricians, and state department of health
Level 2 *Coordinates care of patients/specimens in routine cases effectively using interprofessional teams*	● Arranges for proper collection of cryoglobulin specimen ● Communicates to attending when additional work-up is needed for test interference
Performs safe and effective transitions of care/hand-offs in routine situations	● Knows which patients are at high risk for specific health outcomes related to health literacy concerns, cost of testing or therapy, LGBTQ status, etc.
Identifies pathology's role in population and community health needs and inequities for the local population	● Recognizes the need for gender transitioning reference values ● Knows specific recommendations for alpha-thalassemia testing in the prenatal population
Level 3 *Coordinates care of patients/specimens in complex cases effectively using interprofessional teams*	● At interdisciplinary multiple myeloma conference, engages in appropriate discussion of patient care testing options and impact of monoclonal antibody therapy
Performs safe and effective transitions of care/hand-offs in complex situations	● Evaluates point of care and main laboratory comparisons

Identifies opportunities for pathology to participate in community and population health	● Interprets hemoglobin variants and is aware of the frequency of Hb Constant-Spring in southeast Asians
Level 4 *Models effective coordination of patient-centered care among different disciplines and specialties*	● Demonstrating to residents and junior team members how to communicate the need for additional molecular testing of suspected hemoglobinopathy ● Proactively communicates with primary care provider to ensure appropriate testing for monoclonal gammopathy
Models and advocates for safe and effective transitions of care/hand-offs within and across health care delivery systems	● Resolves discrepancies between point of care and main laboratory test results
Recommends and/or participates in changing and adapting practice to provide for the needs of communities and populations	● Adjusts laboratory test formulary to align with needs of community and population
Level 5 *Analyzes the process of care coordination and leads in the design and implementation of improvements*	● Works with key stakeholders to analyze care coordination and laboratory services in a system setting
Improves quality of transitions of care within and across health care delivery systems to optimize patient outcomes	● Works with a QI mentor to identify better hand-offs between technologist shifts ● Designs a social determinants of health curriculum to help others learn to identify local resources and barriers to care and laboratory testing
Leads innovations and advocates for populations and communities with health care inequities	● Sets up a clinic with a local church to initiate lipid and A1c screenings
Assessment Models or Tools	● Case management quality metrics and goals mined from EHRs, laboratory informatics systems ● Direct observation ● Faculty review of fellow case reports ● Interdisciplinary rounds for high-risk patients/cases ● Lectures/workshops on social determinants of health or population health with identification of local resources ● Multisource feedback

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. ● CDC. Population Health Training in Place Program (PH-TIPP). https://www.cdc.gov/pophealthtraining/whatis.html. 2020. ● College of American Pathologists. Competency Model for Pathologists. https://learn.cap.org/content/cap/pdfs/Competency_Model.pdf. 2020. ● Greenblatt MB, Nowak JA, Quade CC, Tanasijevic M, Lindeman N, Jarolim P. Impact of a prospective review program for reference laboratory testing requests. *AJCP*. 2015;143(5):627-634. https://academic.oup.com/ajcp/article/143/5/627/1760818. 2020. ● Kaplan KJ. In pursuit of patient-centered care. http://tissuepathology.com/2016/03/29/in-pursuit-of-patient-centered-care/#axzz5e7nSsAns. 2020. ● Katayev A, Fleming JK, Luo D, Fisher AH, Sharp TM. Reference intervals data mining: no longer a probability paper method. *AJCP*. 2015;143(1):134-142. https://academic.oup.com/ajcp/article/143/1/134/1761867. 2020. ● Little RL, Rohlfing C, Sachs DB. The National Glycohemoglobin Standardization Program: over 20 years of improving hemoglobin A1c measurement. *Clinical Chemistry*. 2019;65(7):839-848. https://academic.oup.com/clinchem/article/65/7/839/5608082. 2020. ● Santana MJ, Manalili K, Jolley RJ, Zelinsky S, Quan H, Lu M. How to practice person-centered care: A conceptual framework. *Health Expect*. 2018;21(2):429-440. https://onlinelibrary.wiley.com/doi/full/10.1111/hex.12640. 2020.

Systems-Based Practice 3: Physician Role in Health Care System **Overall Intent:** To understand the physician 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)* *Describes basic health payment systems (e.g., government, private, public, uninsured care) and practice models*	● Recognizes differences between multiple payment systems ● Recognizes different practice models ● Compares and contrasts types of health benefit plans ● Recognizes the appropriate billing codes for tests offered ● Describes how critical values are determined
Level 2 *Describes how components of a complex health care system are interrelated, and how this impacts patient care* *Documents testing detail and explains the impact of documentation on billing and reimbursement*	● Understands preauthorization for certain laboratory tests ● Understands the hierarchy for reflex testing approval ● Describes the benefits of instrument harmonization in a health care system ● Understands how reference ranges are selected and validated ● Understands how appropriate current procedural terminology or other coding ensures correct reimbursement
Level 3 *Discusses how individual practice affects the broader system (e.g., test use, turnaround time)* *Engages with clinicians and/or patients in shared decision making, such as use of preauthorization for complex testing*	● Uses test volume data to evaluate for improvements in the test menu ● Recognizes the utility of lactate testing for the early identification of sepsis ● Designs algorithm for reflex extractable nuclear antigen panel for positive antinuclear antibodies tests to facilitate rheumatology referral process ● Works with billing team to implement preauthorization process for a new test ● Builds therapeutic ranges and understands how these may vary from site-site
Level 4 *Manages various components of the complex health care system to provide efficient and effective patient care and transition of care*	● Participates in a laboratory formulary committee to improve system-wide test utilization ● Evaluates testing platforms to implement system-wide harmonization

Practices and advocates for cost effective patient care with consideration of the limitations of each patient's payment model	● Designs a complex algorithm to identify patients at risk for sepsis
Level 5 *Advocates for or leads systems change that enhances high-value, efficient, and effective patient care and transition of care* *Participates in health policy advocacy activities*	● Performs a Lean analysis of laboratory practices to identify and modify areas of improvement to make laboratory testing more efficient ● Implements system-wide changes or new practices in pre-authorization, algorithmic testing, or testing platforms ● Leads or creates a laboratory formulary committee to improve system-wide test utilization
Assessment Models or Tools	● Direct observation ● Multisource evaluation ● QI project ● Test utilization audit
Curriculum Mapping	●
Notes or Resources	● Agency for Healthcare Research and Quality. Measuring the Quality of Physician Care. https://www.ahrq.gov/talkingquality/measures/setting/physician/index.html. 2020. ● AHRQ. Major Physician Measurement Sets. https://www.ahrq.gov/talkingquality/measures/setting/physician/measurement-sets.html. 2020. ● American Board of Internal Medicine. QI/PI Activities. https://www.abim.org/maintenance-of-certification/earning-points/qi-pi-activities.aspx. 2020. ● Branda JA, Dighe AS, Dzik W, et al. The practice of clinical pathology: a quantitative description of laboratory director activities at a large academic medical center. *AJCP*. 2014;142(2):144-149. https://academic.oup.com/ajcp/article/142/2/144/1766212. 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*	● Attends departmental quality assurance /quality control meetings, M and M conferences and accreditation/regulatory summation meetings ● Is aware of Centers for Medicare & Medicaid Services (CMS)/ CLIA regulations
Discusses the need for quality control and proficiency testing	● Discusses the need for alternative proficiency testing when commercial material is unavailable
Level 2 *Demonstrates knowledge of the components of laboratory accreditation and regulatory compliance (Clinical Laboratory Improvement Amendments and others), either through training or experience*	● Can explain the difference between assay verification and validation in context of CLIA regulations ● Completes team member inspector training for CAP accreditation ● Performs literature review of newly proposed clinical test ● As part of a method development project selects appropriate quality control and proficiency testing material
Interprets quality data and charts and trends, including proficiency testing results, with supervision	● Interprets Levy-Jennings curves on clinical chemistry rotation ● Interprets daily instrument quality control and proficiency test reports
Level 3 *Identifies the differences between accreditation and regulatory compliance; discusses the process for achieving accreditation and maintaining regulatory compliance*	● Completes team leader inspector training for CAP accreditation ● Completes application to add a new test to an existing CLIA certificate
Demonstrates knowledge of the components of a laboratory quality management plan	● Designs a validation plan for implementing a laboratory developed test
Discusses implications of proficiency testing failures	● Reviews chemistry-specific proficiency testing evaluation forms of CAP Surveys, identifying additional actions to take based on the results

Level 4 *Participates in an internal or external laboratory inspection* *Reviews the quality management plan to identify areas for improvement* *Analyzes proficiency testing failures and recommends a course of action, with oversight*	● Performs a self-inspection using the Chemistry and Toxicology and All Common CAP checklists. ● Reviews results of analytical measurement range validations for chemical pathology tests prior to inspection and assesses the acceptability of low and high concentrations spanning the analytical measurement range ● Prepares a compliant method validation summary of a chemical pathology test prior to implementation ● Writes out a detailed standard operating procedure for a new procedure including all caveats, indications, and clinical validation assessment ● Assists in developing a strategy for handling quality control or proficiency testing failures
Level 5 *Serves as a resource for accreditation at the regional or national level* *Creates and follows a comprehensive quality management plan* *Independently formulates a response for proficiency testing failures*	● Serves on a committee for a regional or national accreditation agency ● Oversees acceptance of testing by a regulatory agency responsible for lab accreditation ● Oversees laboratory quality management as part of duties as a medical director
Assessment Models or Tools	● Assignment of duties for departmental or hospital quality assurance/quality control committees ● Direct observation ● Documentation of inspector training and participation in resident portfolio ● Multisource evaluation ● Planning and completion of QI projects ● Presentation at M and M conferences ● Rotation evaluations
Curriculum Mapping	●
Notes or Resources	● College of American Pathologists. Inspector Training Options. https://www.cap.org/laboratory-improvement/accreditation/inspector-training. 2020.

	● Electronic Code of Federal Regulations. https://www.ecfr.gov/cgi-bin/text-idx?SID=1248e3189da5e5f936e55315402bc38b&node=pt42.5.493&rgn=div5#se42.5.493_11. 2020. ● Oral B, Cullen RM, Diaz DL, Hod EA, Kratz A. Downtime procedures for the 21st century: using a full integrated health record for uninterrupted electronic reporting of laboratory results during laboratory information system downtimes. *AJCP*. 2015;143(1):100-104. https://academic.oup.com/ajcp/article/143/1/100/1761530. 2020.

Systems-Based Practice 5: Utilization **Overall Intent:** To promote efficient use of laboratory resources to improve patient outcomes via behavioral changes within the laboratory and the health care system	
Milestones	**Examples**
Level 1 *Identifies general chemical pathology work practices and workflow*	● Recognizes that urgent clinical need and turnaround, test volume, cost, and complexity should contribute to the composition of the clinical test catalog ● Recognizes that tests can be ordered via electronic, paper requisition, verbal, add-on, approval only, and reflex methods ● Recognizes how urgent (STAT), high-complexity, and temperature requirements affect laboratory resources and workflow ● Recognizes that referred tests have a higher incremental cost than tests performed in-house
Level 2 *Explains rationale for optimizing utilization*	● Identifies that ICUs and operating rooms (ORs) generate the most orders for STAT ionized calcium tests ● Solicits feedback from ordering providers how they use serum transferrin results compared to total iron-binding capacity for medical decision making ● Uses laboratory information system to identify rate of extractable nuclear antigens ordered without antinuclear antibodies orders
Level 3 *Identifies opportunities to optimize utilization of pathology resources*	● Recognizes that ionized calcium is already measured on the point of care blood gas analyzers in the ICUs and ORs ● Recognizes that testing for iron deficiency anemia often is ordered as a panel order set that includes serum iron, serum transferrin, total iron-binding capacity, and percent iron saturation ● Recognizes that false-positive extractable nuclear antigens results can be reduced if antinuclear antibodies is tested first
Level 4 *Initiates efforts to optimize utilization*	● Designs an alert that provides recent ionized calcium results, including those from blood gas panels, when STAT ionized calcium is desired ● Investigates removal of serum transferrin test from serum iron panel order sets ● Formulates an algorithm where extractable nuclear antigens is reflexively ordered only when antinuclear antibodies is positive ● Creates succinct, informative descriptions in the order interface for drugs of abuse testing

	● Reviews expensive genetic referred test requests ordered for inpatients, contacts ordering physician to discuss testing whenever impact on hospitalization seems minimal
Level 5 *Completes a utilization review and implements change*	● Compares volumes of STAT ionized calcium orders from ICUs and ORs pre- and post-implementation of order entry alert ● Measures serum transferrin order volume after removal from serum iron panel order sets and solicits feedback from ordering providers regarding its absence ● Determines impact of increased antinuclear antibodies test volumes on laboratory resources and volume
Assessment Models or Tools	● Direct observation ● Multisource evaluation ● Presentations ● Rotation evaluations ● Test utilization audit
Curriculum Mapping	●
Notes or Resources	● Baird G. The laboratory test utilization management toolbox. Biochem Med (Zagreb). 2014;24(2):223-234. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4083574/. 2020. ● Choosing Wisely. American Society for Clinical Pathology. http://www.choosingwisely.org/societies/american-society-for-clinical-pathology/. 2020. ● Rubinstein M, Hirsch R, Bandyopadhyay K. Effectiveness of practices to support appropriate laboratory test utilization. AJCP. 2018;149(3):197-221. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6016712/. 2020.

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 chemical 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*	● Locates and critically reviews literature regarding Hb A1c testing in sickle cell trait patients ● Reviews the literature regarding reference values for pediatric blood gas tests ● Identifies the need for an Institutional Review Board (IRB) when collecting cases for a possible research project ● Completes Collaborative Institutional Training Initiative training
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 (demographics, Institutional Review Board, human subjects), including how research is evaluated, explained to patients, and applied to patient care*	● Recommends routine high-performance liquid chromatography methodology for Hb A1c measurement in sickle cell trait patients ● Assists in drafting an IRB protocol
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*	● Recommends Hb A1c immunoassay methodology for sickle cell disease patients without transfusion therapy ● Recommends serum fructosamine as a diabetes biomarker in sickle cell disease patients with chronic transfusion therapy ● Drafts an IRB protocol with minimal oversight ● Submits a first author abstract for a national meeting
Level 4 *Critically appraises and applies evidence to guide care, even in the face of conflicting data*	● Submits a paper (original research or review) for peer-reviewed publication in an indexed journal

Proactively and consistently applies knowledge of the basic principles of research such as informed consent and research protocols to clinical practice	● Recommends correlating home blood glucose logs with Hb A1c in sickle cell disease patients given shorter red blood cell half-life and interference by transfusion
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*	● Delivers a grand rounds talk to family medicine colleagues regarding the selection of diabetes biomarkers in unique patient populations ● Submits a research grant proposal (local or national)
Assessment Models or Tools	● Collaborative Institutional Training Initiative Assessment ● Direct observation ● IRB approval ● Multisource evaluation ● Presentation ● Research publications or grant proposal
Curriculum Mapping	●
Notes or Resources	● Institutional and international best practice guidelines ● Institutional IRB guidelines ● Marchevsky AM, Wick MR. Evidence-based pathology: systematic literature reviews as the basis for guidelines and best practices. *Arch Pathol Lab Med*. 2015;139(3):394-399. https://www.archivesofpathology.org/doi/10.5858/arpa.2014-0106-RA?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. 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. ● Online literature sources: PubMed, Ovid, Medline, etc. ● 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 with the intent to improve care; reflect on all domains of practice, personal interactions, and behaviors, and their impact on others; develop clear objectives and goals for improvement	
Milestones	**Examples**
Level 1 *Accepts responsibility for personal and professional development by establishing goals*	● Is aware that self-improvement is a continuous process ● Uses feedback from faculty oversight review to identify gaps in knowledge for self-improvement
Identifies the gap(s) between expectations and actual performance	● Begins to seek ways to determine where improvements are needed and makes some specific goals that are reasonable to execute and achieve
Actively seeks opportunities to improve	● Performs literature searches, attends educational sessions or enrolls in online educational courses when gaps in knowledge or performance are identified
Level 2 *Demonstrates openness to receiving performance data and feedback in order to inform goals*	● Independently identifies performance gaps in diagnostic skills and daily work ● Reviews work-up of suspected aberrant test results and discusses with the laboratory director or attending
Analyzes and reflects on the factors which contribute to gap(s) between expectations and actual performance	● Reviews calls received from physicians, nurses and other care providers regarding laboratory tests and discusses with the laboratory director or attending ● Actively solicits feedback from multiple sources regarding performance
Designs and implements a learning plan, with assistance	● Uses feedback with a goal of improving communication skills
Level 3 *Seeks performance data and feedback with humility*	● Uses feedback to create a performance improvement plan with regards to communicating with other health care providers ● Receives feedback in an appreciative and non-defensive manner, then modifies behavior
Institutes behavioral change(s) to narrow the gap(s) between expectations and actual performance	● Develops active listening skills
Independently creates and implements a learning plan	● Develops SMART (Specific, Measurable, Attainable, Relevant, and Time-bound) goals

Level 4 *Actively and consistently seeks performance data and feedback with humility* *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*	● Routinely solicits input to construct a specific learning plan for each rotation ● Implements active listening skills when discussing workflow issues with laboratory staff ● Consistently identifies gaps and chooses areas for further development ● Participates in ongoing professional development activities
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 the team ● Encourages team members to consider how their behavior affects others ● Provides professional development lectures or other educational materials ● Critiques the strengths of and gaps in each rotation to implement changes
Assessment Models or Tools	● Direct observation ● Multisource evaluation ● Review of learning plan ● Rotation evaluations ● Simulation
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. ● 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. ● 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. ● Patterson K, Grenny J, McMillan R, Switzler A. Crucial Conversations: Tools for Talking When Stakes are High. 2nd ed. New York, NY: McGraw-Hill; 2013.

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*	● Identifies institutional referral sources for compromised health care providers ● Recognizes the need to notify all relevant clinical personnel in a timely fashion when corrected reports are issued ● Is aware of HIPAA (Health Insurance Portability and Accountability Act), and describe its role in protecting patient privacy ● Understands the components of informed consent ● Understands the concept of risk management plans ● Protects patient confidentiality
Describes when and how to appropriately report professionalism lapses, including strategies for addressing common barriers; identifies and describes potential triggers for professionalism lapses	● Is aware of institutional policies regarding harassment and unprofessional behavior ● Understands that drug or alcohol abuse may impact professional behavior
Level 2 *Analyzes straightforward situations using ethical principles*	● Demonstrates honesty and professional behavior routinely ● Acknowledge a lapse in ethical behavior without becoming defensive, making excuses, or blaming others ● Recognizes and responds effectively to the emotions of others ● Obtains informed consent in clear and compassionate ways
Demonstrates insight into professional behavior in routine situations; takes responsibility for own professionalism lapses	● Apologizes for lapses in ethical behavior and makes amends ● Articulates strategies for preventing future lapses ● Monitors and responds to fatigue and stress in self
Level 3 *Recognizes the need and uses relevant resources to seek help in managing and resolving complex ethical situations*	● Analyzes how the clinical situation evokes strong emotions or creates conflicts ● Navigates a clinical situation when the fellow is not at personal best
Demonstrates professional behavior in complex or stressful situations	● Recognizes own limitations and seeks resources to resolve complex ethical situations ● Monitors and responds to fatigue or stress in team members

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 considers the perspectives of others ● Models respect for patients and others ● Serves as a member of an IRB or ethics committee ● Recognizes the vulnerability of laboratory data
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*	● Leads a system-wide IRB or ethics committee ● Establishes a privacy agreement with an outside vendor ● Develops educational programs in the institution or system for personal improvement in behavior and establishes metrics at a systems level ● Serves on a counseling or interventional committee or group for professional lapses
Assessment Models or Tools	● Direct observation ● Multisource evaluation ● Oral or written self-reflection ● Simulation
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. ● Otte KK, Zehe SC, Wood AJ, Hernandez JS, Karon BS. Legal aspects of laboratory medicine and pathology for residents and fellows: a curriculum for pathology training programs. *Arch Path Lab Med*. 2010;134(7):1029-1032. https://www.archivesofpathology.org/doi/10.1043/2009-0251-OA.1?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. 2020.

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 clinical and educational work hour logs ● Timely attendance at conferences ● Responds promptly to requests to complete preliminary diagnostic reports
Level 2 *Takes ownership and performs tasks and responsibilities in a timely manner with attention to detail*	● Completes diagnostic reports in a timely manner, recognizes when there will be trouble completing that task, and knows the deadline for completing diagnostic reports ● Completes and documents safety modules, procedure review, and licensing requirements
Level 3 *Recognizes situations that may impact own ability to complete tasks and responsibilities in a timely manner and describes the impact on team*	● Appropriately notifies resident on service during transition of care or hand-offs ● Completes tasks in time-critical situations and anticipates barriers to completion ● Reviews evaluation and portfolio to develop 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 and addresses issues that could impede residents on service from completing tasks ● Communicates with program director to resolve a systems barrier ● Takes responsibility for potential adverse outcomes from mishandled specimen and professionally discusses with the interprofessional team
Level 5 *Takes ownership of system outcomes* *Designs new strategies to ensure that the needs of patients, teams, and systems are met*	● Streamlines a reflex testing algorithm in collaboration with ordering providers ● Leads a committee to address time-critical accreditation issue
Assessment Models or Tools	● Compliance with deadlines and timelines ● Direct observation ● Multisource evaluations ● Quality metrics ● Self-evaluations and reflective tools ● Simulation

Curriculum Mapping	●
Notes or Resources	● ASA. Guidelines for the Ethical Practice of Anesthesiology. https://www.asahq.org/standards-and-guidelines/guidelines-for-the-ethical-practice-of-anesthesiology. 2020. ● Expectations of fellowship program regarding accountability and professionalism ● Institutional code of conduct ● Wells C. Physician accountability. AMA J Ethics. 2007;9(7):471-520. https://journalofethics.ama-assn.org/issue/physician-accountability. 2020.

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*	● Accepts constructive feedback with positive response
Recognizes status of personal and professional well-being, with assistance	● Identifies institutional self-care resources
Level 2 *Independently recognizes limitations in the knowledge/skills/ behaviors of self or team and seeks help when needed*	● Identifies sources of personal/team stress or lack of clinical knowledge and independently seeks help
Independently recognizes status of personal and professional well-being and seeks help when needed	● Displays emotional self-awareness and uses self-care resources as appropriate
Level 3 *Proposes and implements a plan to remediate or improve the knowledge/ skills/behaviors of self or team, with assistance*	● With supervision, develops a personal learning or action plan to address gaps in knowledge/skills/behaviors of self or team
Proposes and implements a plan to optimize personal and professional well-being, with assistance	● With supervision, develops a self-care plan to address stress and burnout
Level 4 *Independently develops and implements a plan to remediate or improve the knowledge/skills/ behaviors of self or team*	● Independently develops personal learning or action plans for continued personal and professional growth of self or team
Independently develops and implements a plan to optimize personal and professional well-being	● Independently develops personal learning or action plans to limit stress and burnout for self or team

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 patients or colleagues in self-awareness ● Establishes health management plans to limit stress and burnout ● Professionally conducts difficult conversations with colleagues
Assessment Models or Tools	● Direct observation ● Group interview or discussions for team activities ● Individual interview ● Institutional online training modules ● Multisource evaluation ● Participation in institutional well-being programs ● Self-assessment and personal learning plan
Curriculum Mapping	●
Notes or Resources	● ACGME. Tools and Resources. https://www.acgme.org/What-We-Do/Initiatives/Physician-Well-Being/Resources. 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. *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 use language and behaviors to form constructive relationships, to identify and minimize communication barriers, 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*	● Presents a respectful and collegial demeanor in discussions with other members of the care team ● Ensures written reports and other communications are accurate, easily understood, and complete
Identifies common barriers to effective communication (e.g., language, disability) while accurately communicating own role within the health care system	● Avoids medical jargon in verbal and written communications ● Recognizes the need to clearly explain laboratory-based decisions including test cancellation or rejection to non-laboratory personnel with the appropriate level of detail
Level 2 *Establishes a relationship in straightforward encounters using active listening and clear language*	● Develops professional relationship with other members of the care team, using active listening, attention to affect, and questions that explore the optimal approach to daily tasks
Identifies complex barriers to effective communication (e.g., health literacy, cultural)	● Selects the appropriate level of medical and laboratory terminology when communicating test results or critical values and when responding to questions from care providers
Level 3 *Sensitively and compassionately delivers medical information, with supervision*	● Ensures, with guidance, that the appropriate medical personnel are contacted and all questions are fully and respectfully answered in the setting of laboratory error or delay
When prompted, reflects on personal biases while attempting to minimize communication barriers	● Discusses with the ordering physician the cancellation of an inappropriately ordered test in a collegial and detailed manner
Level 4 *Independently, sensitively, and compassionately delivers medical information and acknowledges uncertainty and conflict*	● Independently contacts appropriate medical personnel and answers all questions fully and respectfully in the setting of laboratory error or delay
Independently recognizes personal biases while attempting to proactively minimize communication barriers	● Participates in a root cause analysis without becoming defensive

Level 5 *Mentors others in the sensitive and compassionate delivery of medical information* *Models self-awareness while teaching a contextual approach to minimize communication barriers*	● Serves as team leader in the work-up of a suspected specimen misidentification ● Develops a laboratory procedure to standardize the work-up of suspected specimen misidentification ● Develops procedure to track lost calls and call answer rate
Assessment Models or Tools	● Direct observation ● Kalamazoo Essential Elements Communication Checklist (Adapted) ● Multisource evaluation ● Self-assessment including self-reflection exercises ● Skills needed to Set the state, Elicit information, Give information, Understand the patient, and End the encounter (SEGUE) ● Standardized patients or 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. ● 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. ● Makoul G. Essential elements of communication in medical encounters: the Kalamazoo consensus statement. *Acad Med*. 2001;76(4):390-393. https://journals.lww.com/academicmedicine/Fulltext/2001/04000/Essential_Elements_of_Communication_in_Medical.21.aspx#pdf-link. 2020. ● Makoul G. The SEGUE Framework for teaching and assessing communication skills. *Patient Educ Couns*. 2001;45(1):23-34. https://www.sciencedirect.com/science/article/abs/pii/S0738399101001367?via%3Dihub. 2020.

	● Porter ME, Kaplan RS. How to pay for healthcare. *Harvard Business Review*. 2016. https://hbr.org/2016/07/how-to-pay-for-health-care. 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 in routine and complex situations	
Milestones	**Examples**
Level 1 *Uses language that values all members of the health care team*	● Shows respect through words and actions in handling possibly inappropriate requests ● Listens to and considers others' points of view, is nonjudgmental and actively engaged, and demonstrates humility
Describes the use of constructive feedback	● Recognizes ineffective communication whenever email subject is misaligned with email body ● Recognizes that email is a discoverable form of communication
Level 2 *Communicates information effectively with all health care team members*	● Actively confirms patient identification when communicating with health care team ● Communicates in an organized and timely manner during consultations
Solicits feedback on performance as a member of the health care team	● Seeks feedback at sign-out ● Judiciously uses "reply all" when communicating via email ● Ensures subject line of email conveys topic
Level 3 *Uses active listening to adapt communication style to fit team needs*	● Succinctly provides critical values in emergency situations ● Demonstrates awareness of care situation and adjusts communication style appropriately
Integrates feedback from team members to improve communication	● Provides constructive feedback to members of the medical team ● Demonstrate the practice of "praise in public" and "criticize in private"
Level 4 *Coordinates recommendations from different members of the health care team to optimize patient care*	● Offers suggestions to resolve conflicts among health care team members
Communicates feedback and constructive criticism to superiors	● Raises concerns or provides opinions and feedback to superiors on the team ● Adapts communication strategies when handling complex situations ● Devotes time for discussions with more junior team members

Level 5 *Models flexible communication strategies that value input from all health care team members, resolving conflict when needed* *Facilitates regular health care team-based feedback in complex situations*	● Resolves system-wide conflicts in any situation ● Leads consensus building among endocrinologists for appropriate testing
Assessment Models or Tools	● Chart review ● Direct observation ● Multisource evaluation ● Review of electronic communications ● Review of telecommunications metrics ● 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. ● Hickner J, Thompson PJ, Wilkinson T, et al. Primary care physicians' challenges in ordering clinical laboratory tests and interpreting results. *JABFM*. 2014;27(2):268-274. https://www.jabfm.org/content/27/2/268.long. 2020. ● Nakhleh RE, Myers JL, Allen TC, et al. Consensus statement on effective communication of urgent diagnoses and significant, unexpected diagnoses in surgical pathology and cytopathology from the College of American Pathologists and Association of Directors of Anatomic and Surgical Pathology. *Arch Pathol Lab Med*. 2012;136(2):148-154.

	https://www.archivesofpathology.org/doi/10.5858/arpa.2011-0400-SA?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. 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 when it is unacceptable to include protected health information in various forms of communication ● Utilizes the laboratory test catalog
Identifies institutional and departmental structure for communication of issues	● Attends relevant interdepartmental meetings
Level 2 *Selects forms of communication based on context and urgency of the situation*	● Identifies method for sharing urgent results ● Recognizes that a communication breakdown has happened and respectfully brings the breakdown to the attention of the laboratory manager or director
Respectfully communicates concerns about the system	● Calls a patient with direct access testing to discuss concerning results ● Communication LIS and EHR discrepancies to laboratory director
Level 3 *Communicates while ensuring security of personal health information, with supervision*	● Communicates opportunities for improvement in the LIS/EHR interface ● Knows when to direct concerns locally, departmentally, or institutionally
Uses institutional structure to effectively communicate clear and constructive suggestions to improve the system	● Drafts the announcement of a new test offering for the laboratory newsletter to clinical staff ● Prepares the agenda for a laboratory meeting ● Talks to multiple individuals across the system regarding test menu and indications
Level 4 *Independently communicates while ensuring security of personal health information*	● Talks directly to a colleague about breakdowns in communication ● Participates in task force to update policies for patient portals
Initiates conversations on difficult subjects with appropriate stakeholders to improve the system	● Improves methods for communicating system-wide service schedules ● Conducts a laboratory meeting to discuss practice changes ● Participates in a performance review

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)*	● Prepares and presents critical value change recommendations to medical staff board for approval ● Establishes a working group of individual lab directors to implement uniformity ● Facilitates system-wide harmonization of test report format and content ● Meets regularly with medical directors, laboratory chiefs and C-suite individuals ● Leads initiative to improve the LIS/EHR interface
Assessment Models or Tools	● Chart review ● Direct observation ● Multisource evaluation ● Review of electronic communications
Curriculum Mapping	●
Notes or Resources	● Bierman JA, Hufmeyer KK, Liss DT, Weaver AC, Heiman HL. Promoting responsible electronic documentation: validity evidence for a checklist to assess progress notes in the electronic health record. *Teach Learn Med.* 2017;29(4):420-432. https://www.tandfonline.com/doi/full/10.1080/10401334.2017.1303385. 2020. ● Flatman R, Férard G, Dybkaer R; IFCC IUPAC Joint Committee on Nomenclature, Properties and Units (C-NPU). Understanding the 'Silver Book' - An important reference for standardised nomenclature in clinical laboratory sciences. *Clin Chim Acta*. 2017;467:4-7. https://www.sciencedirect.com/science/article/abs/pii/S0009898116302807?via%3Dihub. 2020. ● 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. ● Starmer AJ, et al. I-pass, a mnemonic to standardize verbal handoffs. *Pediatrics*. 2012;129(2):201-204. https://pediatrics.aappublications.org/content/129/2/201?sso=1&sso_redirect_count=1&nfstatus=401&nftoken=00000000-0000-0000-0000-000000000000&nfstatusdescription=ERROR%3a+No+local+token. 2020. ● Weise M, Bielsky MC, De Smet K. Biosimilars: what clinicians should know. *Blood*. 2012;120(26):5111-5117. https://ashpublications.org/blood/article-lookup/doi/10.1182/blood-2012-04-425744. 2020.

	● Weiss RL, Hassell LA, Parks ER. Progress toward improved leadership and management training in pathology. *Arch Path Lab Med*. 2014;138(4):492-497. https://www.archivesofpathology.org/doi/10.5858/arpa.2013-0288-RA?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. 2020.

In an effort to aid programs in the transition to using the new version of the Milestones, the original Milestones 1.0 have been mapped to the new Milestones 2.0. Below, it is indicated where the subcompetencies are similar between versions. These are not necessarily exact matches but are areas that include the same or similar elements. 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: Interpretation, Reporting, and Diagnosis	PC2: Test Interpretation
MK1: Diagnostic Knowledge	No match
MK2: Teaching	No match
MK3: Fundamental and Diagnostic Knowledge	No match
No match	PC3: Test Development and Validation
No match	PC4: Laboratory-Related User Interface
No match	MK1: Test Results in Normal and Abnormal Physiology
No match	MK2: Clinical Reasoning
SBP1: Regulatory	SBP4: Accreditation, Compliance, and Quality
SBP2: Health Care Teams	SBP2: Systems Navigation for Patient-Centered Care ICS2: Interprofessional and Team Communication
SBP3: Lab Management: Resource Utilization (personnel and finance)	SBP5: Utilization SBP3: Physician Role in Health Care System
PBLI1: Evidence-based Utilization	PBL1: 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 and Conscientiousness PROF3: Self-Awareness and 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	ICS1: Patient-and Family-Centered Communication ICS2: Interprofessional and Team Communication
ICS2: Personnel Management and Conflict Resolution	ICS2: Interprofessional and Team Communication
No match	ICS3: Communication with Health Care Systems

Available Milestones Resources

Clinical Competency Committee Guidebook, updated 2020 - https://www.acgme.org/Portals/0/ACGMEClinicalCompetencyCommitteeGuidebook.pdf?ver=2020-04-16-121941-380

Clinical Competency Committee Guidebook Executive Summaries, New 2020 - https://www.acgme.org/What-We-Do/Accreditation/Milestones/Resources - Guidebooks - Clinical Competency Committee Guidebook Executive Summaries

Milestones Guidebook, updated 2020 - https://www.acgme.org/Portals/0/MilestonesGuidebook.pdf?ver=2020-06-11-100958-330

Milestones Guidebook for Residents and Fellows, updated 2020 - https://www.acgme.org/Portals/0/PDFs/Milestones/MilestonesGuidebookforResidentsFellows.pdf?ver=2020-05-08-150234-750

Milestones for Residents and Fellows PowerPoint, new 2020 -https://www.acgme.org/Residents-and-Fellows/The-ACGME-for-Residents-and-Fellows

Milestones for Residents and Fellows Flyer, new 2020 https://www.acgme.org/Portals/0/PDFs/Milestones/ResidentFlyer.pdf

Implementation Guidebook, new 2020 - https://www.acgme.org/Portals/0/Milestones%20Implementation%202020.pdf?ver=2020-05-20-152402-013

Assessment Guidebook, new 2020 - https://www.acgme.org/Portals/0/PDFs/Milestones/Guidebooks/AssessmentGuidebook.pdf?ver=2020-11-18-155141-527

Milestones National Report, updated each Fall - https://www.acgme.org/Portals/0/PDFs/Milestones/2019MilestonesNationalReportFinal.pdf?ver=2019-09-30-110837-587 (2019)

Milestones Bibliography, updated twice each year - https://www.acgme.org/Portals/0/PDFs/Milestones/MilestonesBibliography.pdf?ver=2020-08-19-153536-447

Developing Faculty Competencies in Assessment courses - https://www.acgme.org/Meetings-and-Educational-Activities/Other-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://dl.acgme.org/pages/assessment

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