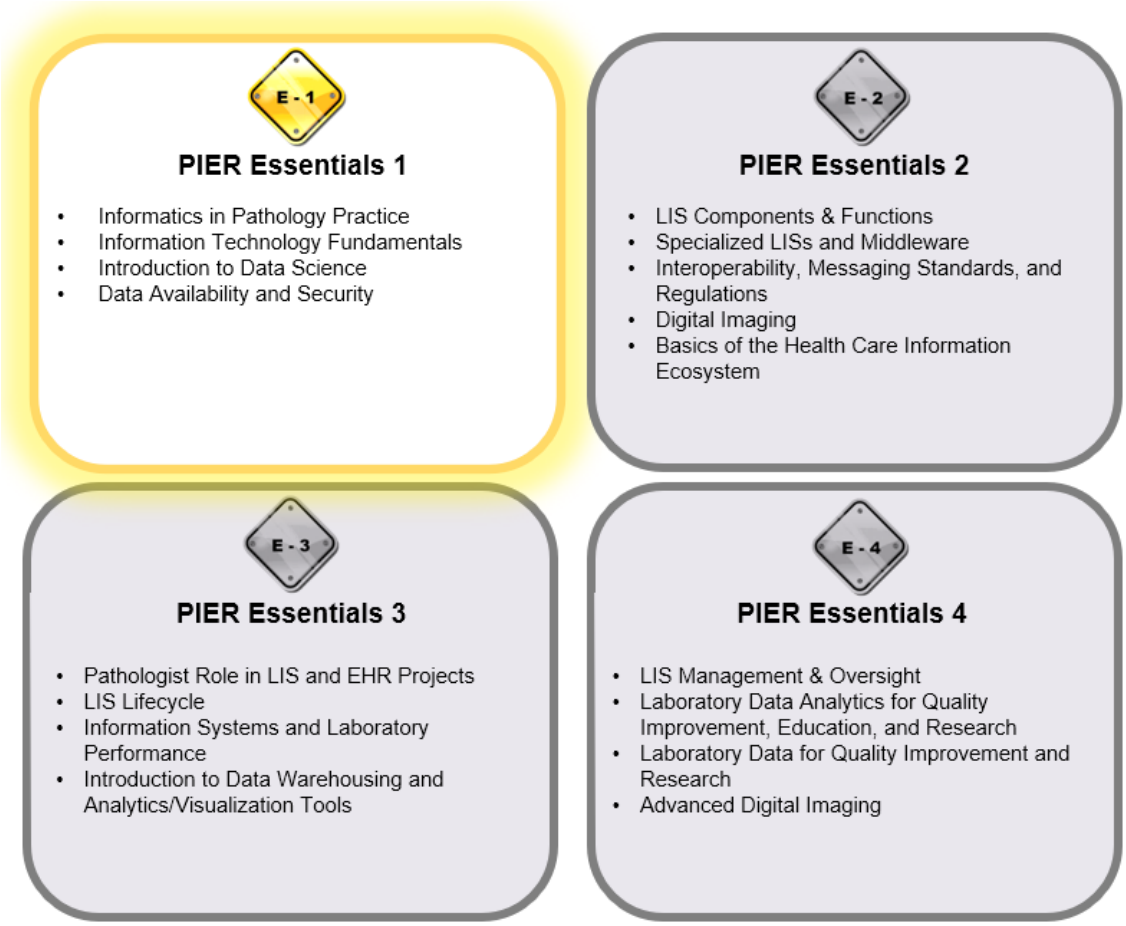
Pathology Informatics Essentials for Residents

PIER Essentials 1 Resource Toolkit



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APC Association of Pathology Chairs

COLLEGE of AMERICAN PATHOLOGISTS

api PATHOLOGY INFORMATICS

Access PIER releases at the Association of Pathology Chairs website.
https://www.apcprods.org/pier

PIER RESOURCE LIBRARY

This section provides information about resources that can be used to teach informatics topics.

College of American Pathologists (CAP) Online Activities

The CAP has developed several online informatics activities about fundamental informatics concepts. See list below. These activities are free. A login is required to access the activities and can be created by clicking on the **LOG IN** button on the CAP website. There is no charge for creating an account.

- Tackling Today's Technology: A Pathologist's Guide to Health IT Basics
- Working With Electronic Health Records: Practical Insights for Pathologists
- Medical Coding Basics
- LIS Fundamentals
- Telepathology and Whole Slide Imaging
- Interfaces and Middleware: LIS Connectivity Options That Can Improve and Streamline Laboratory Operations

Essentials 1 Recommended Resources Requiring Advanced Purchase/Login Access

Below is a list of the recommended resources that may require advance purchase or login access. We recommend that you identify and obtain the resources you plan to use prior to implementing PIER.

1. Pantanowitz L, Tuthill JM, Balis UGJ, eds. Pathology Informatics: Theory and Practice. ASCP Press; 2012.

2. de Baca ME, Spinosa JC, Aller R, Badizadegan K, Blouin AG, Castellani W, Chen P, Gilbertson J, Harrison J, Henricks W, Kennedy M, Knapik C, Pantanowitz L, Reichard RR, Robb J, Stram M. CAP Pathology Resource Guide: Clinical Informatics. Version1.2.0.0. Northfield, IL: College of American Pathologists; 2018.
    a. To Access: https://www.cap.org/member-resources/pathology-resource-guides.
    b. Click on the "Online Versions" link under the "Member-only Benefits" header.

3. The Association for Pathology Informatics website is a good source for material that can be used to teach PIER concepts.
    a. From the main menu, select "Education and Resources" then "PIER Education".
    b. Access to PIER-specific content may require an API membership. API has options for teaching institutional memberships that will give access to all your faculty and residents.

Quick Access Menu

Topic 1:	Informatics in Pathology Practice
Rationale	The practice of pathology relies on the creation, management, accurate, and timely communication of clinical laboratory information.
PIER Outcome Statements (OS) ➔ Indicates high priority OS	➔ **OS1** Explain the relevance of informatics to the practice of pathology and lab medicine. **OS2** Describe the differences between information technology and informatics. **OS3** Define the different subspecialties of health informatics (eg, public health informatics, bioinformatics). ➔ **OS4** Describe the appropriate relationship between pathology informatics and clinical informatics within a health system.
Subtopics (Content covered within topic)	1. Role of informatics in daily practice of pathology 2. Distinction between informatics and information technology (IT) 3. Definitions and roles of informatics subspecialties 4. Practices of and interactions between clinical and pathology informatics

Recommended Resources

OS	Resource
OS1, OS2, OS3	Pantanowitz L, Tuthill JM, Balis UGJ, eds. Pathology Informatics: Theory and Practice. ASCP Press; 2012. • Chapter 1: Pathology Informatics: An Introduction; 1-8.
OS1, OS4	Henricks WH, Wilkerson ML, Castellani WJ, Whitsitt MS, Sinard JH. Pathologists as stewards of laboratory information. *Arch Pathol Lab Med*. 2015;139(3):332-337.

➔ Additional Learning Resources

Practical Exercises

OS	Exercise
OS1, OS2, OS3, OS4	Informatics Laboratory Rotation Log
OS1, OS4	Data Search in EHR vs LIS
OS1	Laboratory Dashboards or Practice Reports

Topic 2:	Information Technology Fundamentals
Rationale	Computers and other IT/communication technology are essential tools that pathologists use in the management of information for laboratory practice and patient care.
PIER Outcome Statements (OS) ➔ Indicates high priority OS	**OS1** Use correct terminology to describe the major types and components of computer hardware and software. **OS2** List the key devices that make up computer networks. ➔ **OS3** Describe the fundamentals of databases and database management systems and how database architecture impacts retrieval of data.
Subtopics (Content covered within topic)	1. Computer hardware and software 2. Networks, including the Internet 3. Database architectures 4. Uses of databases in pathology and medicine

Recommended Resources

OS	Resource
OS1, OS2, OS3	Pantanowitz L, Tuthill JM, Balis UGJ, eds. Pathology Informatics: Theory and Practice. ASCP Press; 2012. • Chapter 2: Computer Fundamentals; 11-33 • Chapter 3: Databases; 35-64 • Chapter 4: Networking; 67-78; 82-84

➔ Advanced Learning Resources

Practical Exercises

OS	Exercise
OS3	Working with LIS Database Dictionaries
OS3	Designing a Simple Database

Essentials 1 – PIER Resource Options, Topic 3

Topic 3:	Introduction to Data Science
Rationale	Data science enables the extraction of knowledge and insights from structured and unstructured pathology data and underlies computational pathology.
PIER Outcome Statements (OS) ➔ Indicates high priority OS	**OS1** Define data science, structured and unstructured data, and list where each is found in pathology. ➔ **OS2** Understand fundamentals of statistical approaches to data analysis. **OS3** Describe the major features of big data. ➔ **OS4** List the types and roles of standards used in pathology. **OS5** Define artificial intelligence and machine learning.
Subtopics (Content covered within topic)	1. Structured versus unstructured data 2. Fundamentals of statistical approaches 3. The "V's" (volume, velocity, variety, veracity, value) of Big Data 4. Data and messaging protocols common in pathology and healthcare 5. Artificial intelligence and machine learning

Recommended Resources

OS	Resource
OS1	Smallcombe M. Structured vs Unstructed Data: 5 Key Differences. Xplenty website. January 28, 2021.
OS2, OS5	Harrison JH, Gilbertson JR, Hanna MG, et al. Introduction to Artificial Intelligence and Machine Learning for Pathologists. *Arch Pathol Lab Med*. 2021; Early Online Release. doi: 10.5858/arpa.2020-0541-C.
OS4	de Baca, ME, Spinosa JC. Section 3: Understanding Laboratory Data Structures and Information Exchange. In: de Baca, ME, Spinosa JC, ed. *Clinical Informatics Resource Guide*. CAP website. Updated 2018. • 3.1 Vocabularies • 3.1.1 LOINC – What is it and why do I need it? • 3.1.2 SNOMED CT – What are the uses for this in my laboratory results? • 3.1.3 What do I need to know about the Dublin Core and Common Data Elements? • 3.1.4 What is UCUM (and why do I care)? Why is UCUM important? • 3.1.5 Are there guides I can use for implementing LOINC and SNOMED CT in my laboratory? • 3.1.6 Insights from Adopters – Alexis Byrne Carter, MD, FCAP • 3.2 Reporting Standards

➔ Advanced Learning Resources

Practical Exercises

OS	Exercise
OS2, OS4	Medicare Pay for Performance and Test Requirements
OS2, OS4	State Public Health Agency Test Reporting

Essentials 1 – PIER Resource Options, Topic 4

Topic 4:	Data Availability and Security
Rationale	Pathologists are ultimately responsible for the access to and safety of pathology data.
PIER Outcome Statements (OS) ➔ Indicates high priority OS	**OS1** Describe the competing demands of data availability and data security within and between health systems. ➔ **OS2** List the regulatory requirements for PHI as it pertains to laboratory and patient data. **OS3** Define high reliability as it pertains to health information systems and access to patient data.
Subtopics (Content covered within topic)	1. Data protection, privacy, and confidentiality 2. Data integrity and availability, including backup, recovery, and high reliability 3. Interoperability 4. Accreditation and regulatory standards (eg, AABB, CAP, CMS/HHS, FDA, HHS, TJC)

Recommended Resources

OS	Resource Citation
OS1, OS2	Health Information and Management Systems Society (HIMSS). Cybersecurity in Healthcare. HIMSS website. 2021.
OS2	U.S. Department of Health and Human Services. Summary of the HIPAA Security Rule. HHS.gov website. July 26, 2013.
OS3	Agency for Healthcare Research and Quality (AHRQ): PSNet. High Reliability. AHRQ website. September 2019.

➔ Advanced Learning Resources

Practical Exercises

OS	Exercise
OS2	Cybersecurity Threats and Violations

Appendix A: Practical Exercises

Appendix A provides a practical exercise worksheet for the topics with specific exercises. Note: Not all topics may have an exercise and topics may combine exercises with two or more topics. Many of the exercises are case based to provide the resident with real life situations where informatics tools are needed to solve a problem or confirm a diagnosis. Proof of completion statements are intended to demonstrate the resident has sufficient knowledge related to the topic content. They are usually a demonstration format (eg, presentation, demonstration of skill, short written report).

Essentials 1 Topic 1 Practical Exercises (Return to E1T1)

Practical Exercise 1: Identifying Informatics in the Laboratory	**Exercise Type: Hands-on**
PIER Outcome Statements	OS1, OS2, OS3, OS4
Setup	During rotations, have the resident keep a log of informatics-related activities and questions that occur during a defined rotation. Provide regular opportunities for residents to meet with a mentor to share these observations and experiences and allow them to ask questions about unfamiliar vocabulary, activities, or observations.
Informatic Tools	None
Resources	None
Activity Time	Length of rotation
Completion Proof	Presents log to mentor for discussion.

Practical Exercise 2: Data Search in EHR vs LIS	**Exercise Type: Hands-on**
PIER Outcome Statements	OS1, OS4
Setup	Perform a “natural language” (text/keyword) search of the LIS for prior cases with similar diagnoses for a current case. Perform a similar search in the EHR and compare the results for consistency. Then perform the search using structured criteria (e.g. date range, case type). Questions to consider: 1. Do free text searches display the same information in the EHR and LIS? Can the entire report be searched, or only parts of it? 2. Do the EHR and LIS have the same options for structured searches? 3. Are there pieces of information present in one system and not the other?
Informatic Tools	EHR and LIS search functions
Resources	Access to EHR (and search tool if separate), access to LIS
Activity Time	Approximately 2 hours
Completion Proof	Presents list of cases and discusses results with mentor.

Practical Exercise 3: Laboratory Dashboards or Practice Reports	Exercise Type: Hands-on
PIER Outcome Statement	OS1
Setup	Explore how your department uses informatics to monitor lab operations (e.g. dashboards or reports of lab turn-around times, specimen processing and/or histology operations and discuss with faculty. Questions to consider: 1. What is the data source of this report? How often is it updated? 2. How is the dashboard or report used in laboratory operations? a. What would happen if it were broken? b. What is the "downtime solution"?
Informatic Tools	Example reports and dashboards from lab divisions
Resources	Access to laboratories
Activity Time	One week or less
Completion Proof	Presents list of reports to mentor for discussion.

Essentials 1 Topic 2 Practical Exercises (Return to E1T2)

Practical Exercise 1: Working with LIS Database Dictionaries	Exercise Type: Research
PIER Outcome Statement	OS3
Setup	Review one or more database dictionaries (eg, staining protocols, pathologists) contained in your LIS.
Informatic Tools	Access to LIS
Resources	Access to selected database (eg, staining protocols).
Activity Time	2 hours
Completion Proof	Provide a screen shot of a database dictionary in your LIS such as the staining protocols dictionary.

Practical Exercise 2: Designing a Simple Database	Exercise Type: Hands-on
PIER Outcome Statement	OS3
Setup	Have the resident demonstrate the ability to use a database application (eg, Shiny from R-Studios, FileMaker, spreadsheet software, database software) to design and build a simple database for a particular purpose (such as a QA project).
Informatic Tools	Shiny from R-Studios, FileMaker, MS-Excel, MS-Access, or hospital proprietary tools.
Resources	Determine the purpose of the database (eg, QA project). The database should focus on a laboratory project such as creating turnaround time data for specimens from a certain time period.
Activity Time	2-4 days
Completion Proof	Builds a simple database based on a need identified and demos the database to their program director, resident group, or other selected individual.

Essentials 1 Topic 3 Practical Exercises (Return to E1T3)

Practical Exercise 1: Medicare Pay For Performance, Test Requirements	**Exercise Type: Research**
PIER Outcome Statements	OS2, OS4
Setup	Describe a Medicare pay for performance standard in terms of the laboratory test information it requires. Then determine: a. What LOINC, UCOM and/or SNOMED CT codes are used for the test? b. Trace the information systems through which the information flows from the laboratory to its final destination to CMS. c. List the main messaging standards for transmission (e.g. HL7/FHIR) between each pair of systems.
Informatic Tools	Access to laboratory information system to trace information flow.
Resources	Messaging standards for transmission between systems. Review resources pertaining to LOINC, UCOM and/or SNOMED CT codes.
Activity Time	1-2 days
Completion Proof	Describes the codes used for a specific test and the messaging standards for transmission between each pair of systems.

Practical Exercise 2: State Public Health Agency Test Reporting	**Exercise Type: Research**
PIER Outcome Statements	OS2, OS4
Setup	What laboratory tests are required to be reported to your state public health agency? Then determine for one of the tests: a. What LOINC, UCOM and/or SNOMED CT codes are used for reporting the test results? b. Trace the information systems through which the information flows to its final destination to the public health agency. c. List the main messaging standards (e.g. HL7/FHIR) for each transmission between systems.
Informatic Tools	Access to laboratory information system to trace information flow.
Resources	Messaging standards for transmission between systems. Review resources pertaining to LOINC, UCOM and/or SNOMED CT codes.
Activity Time	1-2 days
Completion Proof	Describes the codes used for a specific test and the messaging standards for transmission between each pair of systems.

Essentials 1 Topic 4 Practical Exercises (Return to E1T4)

Practical Exercise 1: Cybersecurity Threats and Violations	**Exercise Type: Case Scenario, Research**

PIER Outcome Statement	OS2
Setup	Have the resident review the recommended resources for this outcome statement and develop a list of potential cybersecurity threats and violations of the HIPAA Final Security Rule from the following case scenario: The laboratory has requested to purchase and install a single new middleware server directly in the laboratory to help manage autoverification and quality checking of results coming in from high-throughput chemistry analyzers. The new middleware will be connected to multiple instruments as well as to the LIS, and it will house PHI associated with laboratory orders and results. Laboratory staff state that they have limited space and will need to install the server behind several chemistry analyzers near the instrument heat vents. The server's cables will need to run next to a commonly used walkway in order to reach the nearest available network jack. Laboratory staff want to be able to access the server without a password due to the high volume of work, and the vendor has requested to be able to access the server remotely for support and troubleshooting when needed.
Informatic Tools	None
Resources	None
Activity Time	1-2 days
Completion Proof	Written document in which the resident: • Lists as many potential problems as possible and/or regulatory violations with the proposed installation above according to what he/she read in the recommended resources. • Describes the possible worst case scenario for each problem/violation if it were allowed to be installed in this way, specifically those that could adversely impact the healthcare organization, the laboratory and/or the patient. • Lists potential mitigations for each of the problems identified.

Appendix B: Additional Learning Resources

Appendix B contains resources for those residents who are looking for additional content on a particular topic or want to expand their knowledge related to informatics.

(Return to E1T1)

Topic 1: Informatics in Pathology Practice

Harrison, JH. Management of pathology information systems. In: Laboratory Administration for Pathologists, 2nd Ed. Wagar EA, Cohen MB, Karcher DS, and Siegel GP, Eds. 2019; Northfield, IL: CAP Press.

- Definition of pathology informatics; 93
- Early development and growth of laboratory information systems; 93
- Maturation and adoption; 94

(Return to E1T2)

Topic 2: Information Technology Fundamentals

1. Park SL, Pantanowitz L, Sharma G, Parwani AV. Anatomic pathology laboratory information systems: a review. *Adv Anat Pathol*. 2012 Mar;19(2):81-96.
2. Sinard JH. Practical Pathology Informatics: Demystifying Informatics for the Practicing Anatomic Pathologist. Springer; 2006.
3. Sinard JH, Castellani WJ, Wilkerson ML, Henricks WH. Stand-alone laboratory information systems versus laboratory modules incorporated in the electronic health record. *Arch Pathol Lab Med*. 2015;139(3):311-318.
4. Shortliffe EH, Cimino JJ. Biomedical Informatics: Computer Applications in Health Care and Biomedicine. 4th ed. Springer; 2014

(Return to E1T3)

Topic 3: Introduction to Data Science

1. Milner DA, Meserve EK, Soong TR, Mata DA. *Statistics for Pathologists*. DemosMedical; 2016.
2. Rashidi HH, Tran NK, Betts EV, Howell LP, Green R. Artificial Intelligence and Machine Learning in Pathology: The Present Landscape of Supervised Methods. *Acad Pathol*. 2019 Sep 3;6:2374289519873088.

(Return to E1T4)

Topic 4: Data Availability and Security

1. Carter AB. Considerations for Genomic Data Privacy and Security when Working in the Cloud. *J Mol Diagn*. 2019;21(4):542-552.
2. Health Catalyst. A Framework for High-Reliability Organizations in Healthcare. Published November 30, 2018.
3. Health Insurance Reform: Security Standards; Final Rule. 45 CFR Parts 160, 162 and 164. See Appendix A on page 48 of the PDF document.
4. U.S. Department of Health and Human Services. Cyber Security Guidance Material.