

PIER Essential 3 Resource Toolkit



PIER Essentials 1

- Informatics in Pathology Practice
- Information Technology Fundamentals
- Introduction to Data Science
- Data Availability and Security



PIER Essentials 2

- LIS Components & Functions
- Specialized LISs and Middleware
- Interoperability, Messaging Standards, and Regulations
- Digital Imaging
- Basics of the Health Care Information Ecosystem



PIER Essentials 3

- Pathologist Role in LIS and EHR Projects
- LIS Lifecycle
- Information Systems and Laboratory Performance
- Introduction to Data Warehousing and Analytics/Visualization Tools



PIER Essentials 4

- LIS Management & Oversight
- Laboratory Data Analytics for Quality Improvement, Education, and Research
- Laboratory Data for Quality Improvement and Research
- Advanced Digital Imaging

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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 3 Recommended Resources Requiring Advanced Purchase/Login Access

1. Bove LA, Kennedy RD, Houston SM. Project Management. In: Finnell JT, Dixon BE, ed. Clinical informatics study guide: text and review. 1st ed. Springer International Publishing; 2015.
2. Kaplan KJ, Rao LK. Selection and Implementation of New Information Systems. *Surg Pathol Clin*. 2015;8(2):239-253.
3. Pantanowitz L, Tuthill JM, Balis UJ. *Pathology Informatics: Theory & Practice*. Chicago, IL: American Society for Clinical Pathology Press; 2012.
4. 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. Version 1.2.0.0. 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.
5. 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: Pathologist Role in LIS and EHR Projects](#)
- [Topic 2: LIS Lifecycle](#)
- [Topic 3: Information Systems and Laboratory Performance](#)
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Essentials 3 – PIER Resource Options

Topic 1: Pathologist Role in LIS and EHR Projects	
Rationale	The LIS is mission-critical to the management of the day-to-day practice of pathology and functioning of laboratories.
PIER Outcome Statements (OS)	<ul style="list-style-type: none"> ➔ OS1 Explain the role and responsibilities of pathologists in LIS projects. ➔ OS2 Explain the role and responsibilities of pathologists in managing test ordering and lab result display in the EHR. ➔ OS3 Explain the role and responsibilities of pathologists in the design of decision support for lab test orders. OS4 Discuss project management principles as it relates to informatics and lab projects. ➔ OS5 Describe the laboratory team involved with LIS/EHR projects and the leadership role of the pathologist on those teams.
➔ Indicates high priority OS	
Subtopics (Content covered within topic)	<ol style="list-style-type: none"> 1. Pathologist involvement in LIS and EHR projects, including decision support and troubleshooting order and result display issues 2. Basic project management of informatics projects (eg, life cycle of an informatics project) 3. Managing people, processes, and technology 4. Leadership versus management

Recommended Resources

OS	Resource
OS1, OS5	Henricks WH, Wilkerson ML, Castellani WJ, Whitsitt MS, Sinard JH. Pathologists' place in the electronic health record landscape . <i>Arch Pathol Lab Med</i> . 2015;139(3):307-310.
OS2, OS3	Henricks WH, Wilkerson ML, Castellani WJ, Whitsitt MS, Sinard JH. Pathologists as stewards of laboratory information . <i>Arch Pathol Lab Med</i> . 2015;139(3):332-337.
OS4	Bove LA, Kennedy RD, Houston SM. Project Management. In: Finnell JT, Dixon BE, ed. <i>Clinical informatics study guide: text and review</i> . 1st ed. Springer International Publishing; 2015:377-414.

➔ [Additional Learning Resources](#)

Practical Exercises

OS	Exercise
OS1, OS4, OS5	Operational Meeting
OS2, OS3	Report Elements
OS2, OS3	Identify Incorrect/Incomplete Orders

Essentials 3 – PIER Resource Options, Topic 2

Topic 2: LIS Lifecycle

Rationale	Pathologists need to understand the requirements of managing the LIS through its entire life cycle.
PIER Outcome Statements (OS) → Indicates high priority OS	<p>→ OS1 List the key steps in the evaluation, selection, and implementation of a new LIS or module.</p> <p>→ OS2 Describe the testing and training procedures required for an implementation or upgrade of the LIS.</p> <p>→ OS3 Understand the process and requirements for test definition and other information maintenance in the LIS.</p> <p>→ OS4 Distinguish between system upgrades and software patches and explain the need to have current software versions.</p> <p>→ OS5 Discuss the retirement of the LIS, including the data transfer needs from the retired system to its replacement.</p>
Subtopics (Content covered within topic)	<ol style="list-style-type: none"> 1. LIS selection and implementation 2. LIS testing and training 3. LIS system configuration (eg, test creation and maintenance, dictionaries maintenance) 4. LIS upgrades and software patches 5. LIS retirement

Recommended Resources

OS	Resource
OS1, OS2, OS3, OS4, OS5	Pantanowitz L, Tuthill JM, Balis UJ. <i>Pathology Informatics: Theory & Practice</i> . Chicago, IL: American Society for Clinical Pathology Press; 2012. <ul style="list-style-type: none"> • Chapter 5: Laboratory Information System Overview • Chapter 6: LIS Selection and Implementation • Chapter 7: Laboratory Information System Operations • Chapter 12: Leadership, Management & Project Management Skills for the Informaticist
OS1, OS2, OS3	Kaplan KJ, Rao LK. Selection and Implementation of New Information Systems. <i>Surg Pathol Clin</i> . 2015;8(2):239-253.
OS5	Aller RD. CAP Today. Moving to a new LIS? Let the headaches begin. Published November 2008.

→ [Advanced Learning Resources](#)

Practical Exercises

OS	Exercise
OS1, OS2, OS3, OS4	System Analysis
OS1, OS2, OS3, OS4, OS5	LIS Conversion
OS2, OS3	Updating the LIS Dictionary

Essentials 3 – PIER Resource Options, Topic 3

Topic 3: Information Systems and Laboratory Performance

Rationale	Pathologists rely on information to monitor and improve the overall performance of the laboratory.
PIER Outcome Statements (OS) → Indicates high priority OS	<p>OS1 Describe the role of the LIS in facilitating appropriate ordering of tests by clinicians.</p> <p>→ OS2 List and define commonly used automated operational rules in the lab. (eg, autoverification, calculations, reflex testing).</p> <p>→ OS3 Describe how pathology utilizes interim, cumulative, amended, and addendum reports to control the flow of information.</p> <p>→ OS4 Explain the role of the LIS in monitoring the quality of lab performance and error tracking/reduction.</p>
Subtopics (Content covered within topic)	<ol style="list-style-type: none">1. Test utilization in the laboratory2. Operational rules (eg, autoverification)3. Workflow management (eg, tracking)4. Error tracking and reduction5. Quality metrics and monitoring (eg, TAT)

Recommended Resources

OS	Resource
OS1, OS2, OS3, OS4	<p>Pantanowitz L, Tuthill JM, Balis UGJ, eds. Pathology Informatics: Theory and Practice. Chicago, IL: ASCP Press; 2012.</p> <ul style="list-style-type: none">• Chapter 5: Laboratory Information System Overview

→ [Advanced Learning Resources](#)

Practical Exercises

OS	Exercise
OS2, OS3	Specimen Tracking
OS2, OS4	Autoverification Rules and Practices

Essentials 3 – PIER Resource Options, Topic 4

Topic 4: Introduction to Data Warehousing and Analytics/Visualization Tools	
Rationale	Pathologists require more than the LIS to provide data and a platform for analytics to support patient care and system operations.
PIER Outcome Statements (OS) → Indicates high priority OS	<p>→ OS1 Recognize limitations and information gaps resulting from the limitations of the data analysis capability of the LIS.</p> <p>OS2 Define a data warehouse, data lake, and data mart.</p> <p>OS3 List features of commonly used data analytics and visualization tools.</p> <p>→ OS4 Describe how pathology data is analyzed and visualized on dashboards to support efficient laboratory operations and the department or institution's financial performance.</p>
Subtopics (Content covered within topic)	<ol style="list-style-type: none">1. Data analytics capabilities and shortcomings of the LIS2. Data warehousing (eg, data lakes, data marts, and Unified Data Architecture (UDA))3. Data analytics and visualization tools in health care and the lab4. Essentials of dashboarding

Recommended Resources

OS	Resource Citation
OS1, OS2, OS3	Pantanowitz L, Tuthill JM, Balis UGJ, eds. Pathology Informatics: Theory and Practice. Chicago, IL: ASCP; 2012. <ul style="list-style-type: none">• Chapter 3 Databases
OS1, OS2, OS3, OS4	de Baca ME, Spinosa JC, eds. <i>Clinical Informatics Resource Guide</i> . Northfield, IL: College of American Pathologists; 2018. <ul style="list-style-type: none">• Section 8.1 Big Data/Metadata.• Section 8.3 The Value of Big Data in the Laboratory and in Value Based Care

→ [Advanced Learning Resources](#)

Practical Exercises

OS	Exercise
OS1, OS2, OS3, OS4	Natural Language Searches
OS1, OS2, OS3, OS4	Quality Improvement

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. Outcome measurements 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 3 Topic 1 Practical Exercises ([Return to E3T1](#))

Practical Exercise 1: Operational Meeting		Exercise Type: Research
PIER Outcome Statements	OS1, OS4, OS5	
Setup	During one or more rotations the resident should regularly attend the lab's operational meetings and document and analyze issues discussed that involve the LIS and/or EHR. Optional exercises include: <ul style="list-style-type: none">LIS team meetings. Most academic medical centers use major EHR systems and usually have AP- and CP-specific team meetingsEHR NPR (new project request) meetingInterdisciplinary PM / EHR meetings	
Informatic Tools	None	
Resources	Team members in designated meeting.	
Activity Time	Length of a meeting.	
Completion Proof	Report analysis back to that lab's director/rotation director on the meeting activity or decisions.	

Practical Exercise 2: Report Elements		Exercise Type: Research
PIER Outcome Statements	OS2, OS3	
Setup	Resident performs the following activities: <ul style="list-style-type: none">Review pathology reports and identify all required elements.Compare pathology reports in the APLIS with those in the EHR and identify differences and/or problematic features.Describe the process for creating or updating a specimen type (part type) in the LIS.During a rotation, have the resident observe any clinician order a laboratory test and see how they look up and use AP and CP laboratory results in the EHR when rounding.	
Informatic Tools	APLIS and EHR reports	
Resources	Institution's policy and procedures regarding laboratory testing.	
Activity Time	2-3 days	
Completion Proof	Presents case and processes at group resident meeting.	

Practical Exercise 3: Identifying Incorrect/Incomplete Orders**Exercise Type: Research**

PIER Outcome Statements	OS2, OS3
Setup	During rotations, have a resident review at least one problem case that arises in which there is evidence that a laboratory order in CPOE was incorrect or incomplete.
Informatic Tools	
Resources	Patient case presenting an issue (eg, incorrect or incomplete).
Activity Time	1 day.
Completion Proof	Presents case and incorrect processes with corrective action at group resident meeting.

Essentials 3 Topic 2 Practical Exercises ([Return to E3T2](#))**Practical Exercise 1: System Analysis****Exercise Type: Thought-provoking; Hands-on**

PIER Outcome Statements	OS1, OS2, OS3, OS4
Setup	<p>Have the resident carry out a systems analysis project in which the resident writes a two to three page evaluation that:</p> <ul style="list-style-type: none"> • Maps a current process in the LIS and identifies an area of inefficiency (or problem) within this process • Proposes a possible solution and defines its benefits • Identifies barriers to implementing the solution • Evaluates the relative value of the solution accounting for the benefits versus barriers • Identifies the resources required for ongoing maintenance • Defines a validation plan • Identifies whether change control documentation is required
Informatic Tools	
Resources	Access to institution's policies and procedures for validation plan and control documentation.
Activity Time	2-4 days
Completion Proof	Submits documentation on system analysis project.

Practical Exercise 2: LIS Conversion**Exercise Type: Research**

PIER Outcome Statements	OS1, OS2, OS3, OS4, OS5
Setup	<p>Provide access to selected documentation from the most recent LIS conversion for the resident to review. Documents should emphasize at least one workflow item from start to finish, ideally in an area of interest to the resident.</p> <ul style="list-style-type: none"> • Have the resident describe the differences in workflow between one LIS and the other and explain any efficiencies gained from the LIS conversion <p>Have the resident estimate the FTE requirements (eg, LIS staff, lab technologist, specialist, and supervisor) for the chosen workflow item, as well as the data transfer process.</p>
Informatic Tools	
Resources	Access to documentation from the most recent LIS conversion. Examples of documentation include workflow analysis, project management methodology documentation (e.g. Gantt chart), testing plans, validation documentation, and training

records. Additionally, provide the resident documentation regarding the institution's strategy for data transfer upon LIS retirement.

Activity Time 2-3 days

Completion Proof Provide feedback to the resident's analysis of workflow differences. Discuss and compare the resident's FTE estimates versus the actual requirements.

Practical Exercise 3: Updating LIS Dictionary

Exercise Type: Thought-provoking; Hands-on

PIER Outcome Statements OS2, OS3

Setup Have the resident observe the process for creating or updating an element in the LIS dictionary (eg, test definition, container type, specimen type, person/user). Resident then identifies the reason for this LIS dictionary update (eg, is this necessary as a result of an LIS system update?) After observation, directly assist the LIS analyst, or independently aid, in additional dictionary updates.

Informatic Tools Access to LIS

Resources Personnel performing LIS dictionary update.

Activity Time 1 day

Completion Proof Document the process of the dictionary update within the LIS and provide documentation of validation. Present this process to the relevant pathology division.

Essentials 3 Topic 3 Practical Exercises ([Return to E3T3](#))

Practical Exercise 1: Specimen Tracking

Exercise Type: Hands-on

PIER Outcome Statements OS2, OS3

Setup Resident performs the following exercises:

- Access the specimen tracking function in the LIS to identify steps in tracking and/or to locate a specimen's current location (AP and CP).
- Access the histology function in APLIS to determine who prepared the slides for a given case.

Informatic Tools LIS access.

Resources

Activity Time 2-4 hours

Completion Proof Provide screen shots of information.

Practical Exercise 2: Autoverification Rules and Practices

Exercise Type: Research

PIER Outcome Statement OS2, OS4

Setup Resident performs the following exercises:

- Review autoverification practices and criteria for at least one laboratory test; can include review of testing/validation records for the autoverification rules for the test(s).
- Determine whether autoverification rules for a given test reside in the LIS or in middleware.
- Review with the laboratory director the process, rationale, and/or philosophy for how autoverification rules and practices are established in the laboratory.

- Observe process for review and release of test results that have failed autoverification criteria.

Informatic Tools

Resources Laboratory director; institution's policies and procedures for autoverification.

Activity Time 2-5 hours

Completion Proof Short report to the program director on the selected test, autoverification criteria and where the autoverification rule resides.

Essentials 3 Topic 4 Worksheets [\(Return to E3T4\)](#)

Practical Exercise 1: Natural Language Searches

Exercise Type:

PIER Outcome Statements OS1, OS2, OS3, OS4

Setup Have a resident perform a search in the LIS for a specific cohort of cases (eg, with a particular pathologic diagnosis) using "Natural Language Search" if available. Then have the resident do a similar search by ICD or SNOMED CT code (if available) and compare the results.

Informatic Tools

Resources

Activity Time

Completion Proof Presentation of the report findings to the program director.

Practical Exercise 2: Quality Improvement

Exercise Type:

PIER Outcome Statements OS1, OS2, OS3, OS4

Setup Have the resident use data mining techniques/business intelligence tools in the performance of a laboratory quality improvement project.

Informatic Tools Data mining techniques and business intelligent tools

Resources

Activity Time 1-2 days

Completion Proof Resident builds a simple database using a database application (eg, MS-Excel, MS-Access) and shows the database to their program director.

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.

[\(Return to E3T1\)](#)

Topic 1: Pathologist Role in LIS and EHR Projects

None at this time

[\(Return to E3T2\)](#)

Topic 2: LIS Lifecycle

1. Paxton A. CAP Today. [Toolkit lets labs make the case for the right LIS](#). Published August 2013.
2. Pearson S, Balis UJ, Fuller J, et al. [Managing and Validating Laboratory Information Systems](#), 1st Edition. CLSI website. 2006; AUTO-08;26(36).

[\(Return to E3T3\)](#)

Topic 3: Information Systems and Laboratory Performance

1. Krasowski MD, Chudzik D, Dolezal A, et al. [Promoting improved utilization of laboratory testing through changes in an electronic medical record: experience at an academic medical center](#). *BMC Med Inform Decis Mak*. 2015;15:11.
2. Procop GW, Keating C, Stagno P, Kottke-Marchant K, Partin M, Tuttle R, Wyllie R. [Reducing duplicate testing: a comparison of two clinical decision support tools](#). *Am J Clin Pathol*. 2015;143:623-626.

[\(Return to E3T4\)](#)

Topic 4: Introduction to Data Warehousing and Analytics/Visualization Tools

None at this time.