

Introduction to Medical Laboratory Information Systems

Introduction to Medical Laboratory Information Systems (LIS)
Designed for students, new staff, or anyone needing a concise overview.

1. What Is a Laboratory Information System?

Aspect	Description
Definition	A software platform that manages the end-to-end workflow of a clinical laboratory: order entry, specimen tracking, testing, result reporting, and data storage.
Core Purpose	Improve accuracy, speed, and traceability of laboratory processes while supporting regulatory compliance and data analytics.
Typical Users	Laboratory technologists, pathologists, clinicians, IT staff, quality assurance personnel, and health information managers.

2. Key Functional Modules

Module	Primary Functions	Typical Outputs
Order Entry / Interface	Receives test requests from EMR, CPOE, or manual entry; validates orders against patient demographics and test catalog.	Order tickets, electronic requisitions.
Specimen Management	Generates barcodes, logs collection time, tracks transport, and records receipt.	Specimen accession numbers, chain-of-custody logs.
Result Entry & Verification	Captures instrument data (auto-interface) or manual entry; provides rules-based verification, flagging, and sign-off.	Verified results, critical alerts.
Reporting & Distribution	Formats reports per test, adds interpretive comments, sends to EMR, physician portals, or prints.	Lab reports, HL7 messages, PDFs.
Quality Control (QC) & Assurance	Stores QC data, runs Levey-Jennings charts, triggers corrective actions.	QC trend reports, audit trails.
Inventory & Supply Management	Tracks reagents, consumables, calibrators; generates re-order alerts.	Stock reports, expiry alerts.

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Module	Primary Functions	Typical Outputs
Billing & Charge Capture	Maps performed tests to billing codes (ICD-9, LOINC) and interfaces with hospital finance.	Charge entries, claim files.
Analytics & Business Intelligence	Aggregates data for turnaround time (TAT) monitoring, test utilization, and performance dashboards.	KPI dashboards, statistical reports.

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3. Typical Workflow (Step-by-Step)

1. **Test Order Initiation** – Clinician orders a test via EMR/CPOE.
2. **Order Transmission** – Order is sent to LIS (HL7 ORM/ORU).
3. **Specimen Collection** – Phlebotomist collects sample; barcode printed and affixed.
4. **Specimen Accession** – Sample arrives at lab; LIS assigns accession number, logs receipt.
5. **Pre-analytical Processing** – Sorting, centrifugation, aliquoting; LIS updates status.
6. **Instrument Interface** – Automated analyzers send raw data to LIS (HL7 ORU).
7. **Result Verification** – Technologist reviews, applies rules, signs off.
8. **Result Reporting** – Verified results flow back to EMR and are available to clinicians.
9. **Post-analytical Activities** – QC review, billing, archiving, and data export for research.

(A flow diagram can be added in presentations to visualize the steps.)

4. Standards & Interoperability

Standard	Role in LIS
HL7 v2.x / v3	Messaging for orders, results, and acknowledgments.
FHIR (Fast Healthcare Interoperability Resources)	Modern RESTful API for real-time data exchange.

**LOINC (Logical Observation Identifiers Names and