

Applied Health Informatics Certificate Program

Electronic Health Records (EHRs) & Health IT Systems Mini-Textbook
Reference Text

1. Introduction: Healthcare as an Information System

Healthcare is fundamentally an information management process.

Every patient encounter generates information that must be collected, communicated, interpreted, stored, and acted upon. Clinicians make decisions based on information.

Administrators allocate resources based on information. Researchers generate evidence from information. Public health agencies monitor populations using information.

When information is incomplete, delayed, inaccessible, or inaccurate, patient care suffers.

Traditionally, healthcare information was documented using paper records. While paper systems remain important in many settings, they often present significant challenges:

- Records may be lost or damaged
- Information may be difficult to retrieve
- Data cannot easily be shared across facilities
- Reporting is labor-intensive
- Large-scale analysis is difficult

Electronic Health Records (EHRs) were developed to address many of these challenges by providing a digital environment for capturing, managing, and using healthcare information. However, an EHR is more than a digital chart.

An EHR is a system that supports healthcare delivery through documentation, communication, coordination, reporting, quality improvement, research, and decision-making.

2. What Is an Electronic Health Record?

An Electronic Health Record (EHR) is a digital version of a patient's health information that can be created, accessed, updated, and used by authorized healthcare providers.

An EHR typically contains:

- Patient demographics
- Clinical documentation
- Diagnoses
- Medications
- Laboratory results
- Imaging reports
- Treatment plans
- Follow-up information
- Discharge summaries

The primary purpose of an EHR is to ensure that the right information is available to the right person at the right time.

The value of an EHR is not the software itself. The value lies in how effectively information supports healthcare delivery.

3. Healthcare Workflows and the Patient Journey

To understand EHRs, it is important to first understand healthcare workflows. Providing healthcare in a typical hospital involves a series of interdependent activities that include patients, clinicians, laboratories, pharmacies, administrators, and health systems.

Consider a typical patient journey.

Registration: The patient arrives and demographic information is collected.

Examples include:

- Name & Age
- Contact information
- Unique patient identifier

Clinical Assessment: A clinician evaluates the patient and documents:

- Symptoms
- Medical history
- Physical examination findings
- Initial diagnoses

Diagnostic Testing: Laboratory and imaging studies may be ordered.

Examples:

- Blood tests
- Pathology reports
- Radiology studies

Treatment: Treatment plans are developed and documented.

Examples:

- Medications
- Procedures
- Chemotherapy
- Follow-up plans

Reporting and Follow-Up: Healthcare organizations use patient information to:

- Monitor outcomes
- Generate reports
- Support quality improvement
- Meet regulatory requirements

At each step, information is generated, exchanged, and reused.

EHR systems help ensure that information moves efficiently through these processes.

4. Core Components of an EHR

Most EHR systems contain several key functional areas.

Patient Registration: Supports patient identification and demographic management.

Clinical Documentation

Captures:

- Histories
- Assessments
- Diagnoses
- Treatment plans

Structured documentation improves consistency and usability.

Laboratory Integration: Allows clinicians to review laboratory results within the patient record.

Benefits include:

- Faster access to information
- Reduced transcription errors
- Improved clinical decision-making

Pharmacy Management

Supports:

- Medication prescribing
- Dispensing
- Medication tracking
- Medication safety

Reporting and Analytics

Supports:

- Operational reporting
- Quality improvement
- Research
- Public health reporting

5. Understanding EHR Architecture

Healthcare professionals do not need to become software engineers to understand EHR systems.

However, informatics professionals should understand the basic architecture that supports digital healthcare.

Most EHR systems include four major layers.

User Layer: The screens and interfaces used by healthcare workers.

Application Layer: The software logic that supports clinical workflows and business processes.

Examples:

- Scheduling
- Documentation
- Order entry

Data Layer: The databases where information is stored.

Integration Layer: The mechanisms that allow different systems to exchange information.

Examples:

- Laboratory systems
- Pharmacy systems
- Imaging systems
- National reporting platforms

Understanding these layers helps informaticians identify opportunities for optimization and integration.

6. OpenMRS and Open-Source EHRs

Many healthcare organizations use commercial EHR platforms.

OpenMRS is one of the most widely used open-source EHR platforms globally and has been implemented in numerous LMIC settings.

OpenMRS supports:

- Patient registration
- Clinical encounters
- Documentation
- Laboratory management
- Disease programs
- Reporting

OpenMRS has been used extensively in HIV, tuberculosis, maternal health, and oncology programs.

Why OpenMRS?

The goal of this course is not to become an OpenMRS administrator.

OpenMRS serves as a practical learning environment that allows learners to:

- Experience an EHR firsthand
- Understand clinical workflows
- Practice documentation concepts

- Explore healthcare information management

The concepts learned through OpenMRS can be applied to many other EHR platforms.

7. The Reality of EHRs in LMIC Settings

Digital health implementation looks very different across healthcare environments.

Many LMIC healthcare facilities operate under significant resource constraints.

Common challenges include:

- Limited computer availability
- Shared devices
- Unreliable electricity
- Limited internet connectivity
- Workforce shortages
- Limited technical support

As a result, many facilities operate hybrid systems that combine paper and electronic processes.

Examples include:

- Paper charts with digital laboratory systems
- Paper clinical notes with electronic pharmacy systems
- Spreadsheet-based patient tracking

Successful digital transformation does not always require full digitization.

The most effective systems are often those that fit the local environment and address real operational needs.

8. Thinking Like an Informatics Professional

One of the goals of this course is to help learners think beyond software.

Different stakeholders view EHR systems differently.

Clinician Perspective: Can I deliver safe and efficient patient care?

Administrator Perspective: Can I monitor performance and allocate resources effectively?

Research Perspective: Can I use the data to answer important questions?

Public Health Perspective: Can I understand trends affecting populations?

Informatics Perspective: Can the right information reach the right person at the right time?

Informatics professionals often serve as translators between these perspectives.

9. The EHR Implementation Lifecycle

Implementing an EHR involves more than installing software.

Successful implementations typically follow several phases.

Planning: Define goals and identify stakeholders.

Design and Configuration: Adapt the system to support local workflows.

Training: Prepare users to work effectively within the system.

Go-Live: Deploy the system in clinical settings.

Optimization: Continuously improve workflows and system performance.

Implementation is an ongoing process rather than a one-time event.

10. Why EHR Implementations Succeed or Fail

Many EHR failures are not technology failures.

They are workflow, process, and change-management failures.

Common reasons for failure include:

- Poor workflow alignment
- Insufficient training
- Limited stakeholder engagement
- Lack of leadership support
- Unrealistic expectations
- Infrastructure limitations

Technology rarely solves problems on its own.

Successful implementation requires people, processes, and technology to work together.

11. EHRs and Oncology Care

Oncology care generates large volumes of complex information over long periods of time.

Examples include:

- Pathology reports
- Tumor staging
- Treatment protocols
- Chemotherapy cycles
- Toxicity monitoring
- Follow-up visits

EHR systems can support:

- Cancer registry reporting
- Tumor board preparation
- Care coordination
- Outcome tracking
- Research

Improving oncology documentation remains one of the most important opportunities for informatics-driven health system strengthening.

13. Capstone Project Opportunities

Potential projects include:

- Improving oncology documentation completeness
- Designing an EHR implementation roadmap
- Improving referral tracking
- Optimizing clinical documentation workflows
- Developing reporting dashboards

These projects allow learners to apply EHR concepts to real-world healthcare challenges.

14. Chapter Summary

Electronic Health Records are foundational components of modern healthcare systems.

Key concepts from this chapter include:

- Healthcare is fundamentally an information management process.
- EHRs support healthcare workflows, communication, reporting, and decision-making.
- Understanding workflows is essential to understanding EHRs.
- OpenMRS provides a practical environment for learning EHR concepts.
- Hybrid systems remain common in LMIC settings.
- Successful EHR implementation depends on people, processes, and technology.
- Oncology care presents unique opportunities for informatics improvement.
- Informatics professionals help ensure that information becomes actionable and supports better healthcare outcomes.

The goal of an EHR is not simply to digitize records. The goal is to improve the availability, quality, and use of information to support safer, more coordinated, and more effective healthcare.