



كلية العلوم قسم الانظمة الطبية الذكية

Lec 1 & 2

Introduction to Electronic Health Records (EHR)

Subject: Electronic Health Records

Level: fourth

Lecturer: Asst. Lecturer Qusai AL-Durrah



Understanding EHRs – What and Why?

Electronic Health Records represent a fundamental shift in how healthcare data is captured, stored, and utilized. This transformation touches every aspect of modern medical practice, from individual patient encounters to population health management.

Today, we'll explore the foundational concepts that make EHRs essential to intelligent medical systems.

What is an Electronic Health Record (EHR)?



An EHR is a **comprehensive digital record** of a patient's health history and care, designed to follow patients throughout their healthcare journey.

Key Components

- Diagnoses and treatment plans
- Medications and immunizations
- Laboratory and imaging results
- Vital signs and lifestyle data
- Clinical notes and observations

Crucially, EHRs are designed to be **shared across multiple healthcare providers and settings**, enabling coordinated care.

EHR vs EMR vs PHR: Key Differences

EMR (Electronic Medical Record)

An electronic record of health related information on an individual that can be created, gathered, managed and consulted by authorized clinicians and staff within one healthcare organization

Scope: Organization-specific

EHR (Electronic Health Record)

An electronic record of health related information that can be created, managed and consulted by authorized clinicians and staff across more than one healthcare organization

Scope: Universal, multi Organization

PHR (Personal Health Record)

An electronic record of an individual's health-related information that may be drawn from multiple sources and is managed, shared, and controlled by the individual

Scope: Patient-managed

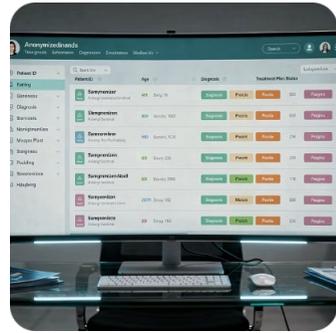
The distinction lies in interoperability and scope – EHRs provide the universal, connected view essential for modern healthcare delivery.

From Fragmented to Connected Care

The evolution from paper-based records to integrated digital systems represents one of healthcare's most significant technological advances.



Core Features of EHR Systems



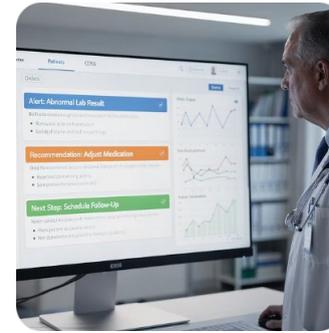
Health Information & Data

Comprehensive storage of clinical notes, lab results, medications, allergies, and imaging studies



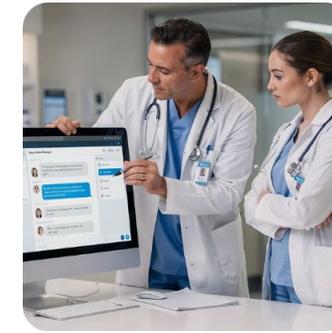
Results & Order Management

Electronic ordering of tests, prescriptions, and referrals with automated result tracking



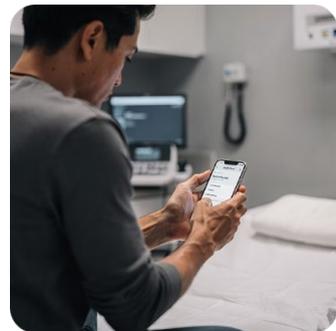
Decision Support Tools

Real-time alerts, clinical reminders, and evidence-based guidelines at point of care



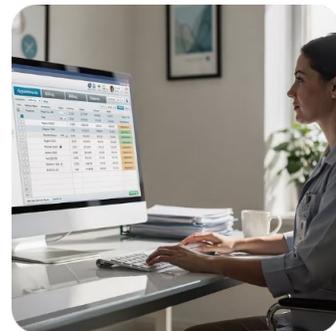
Electronic Communication

Secure messaging between providers, care teams, and patients for coordinated care



Patient Support Portals

Online access for patients to view records, schedule appointments, and communicate with providers



Administrative Processes

Streamlined billing, scheduling, reporting, and regulatory compliance management

Deep Dive: Health Information and Data

Comprehensive Data Storage

EHR systems serve as the central repository for all patient health information, creating a complete clinical picture.

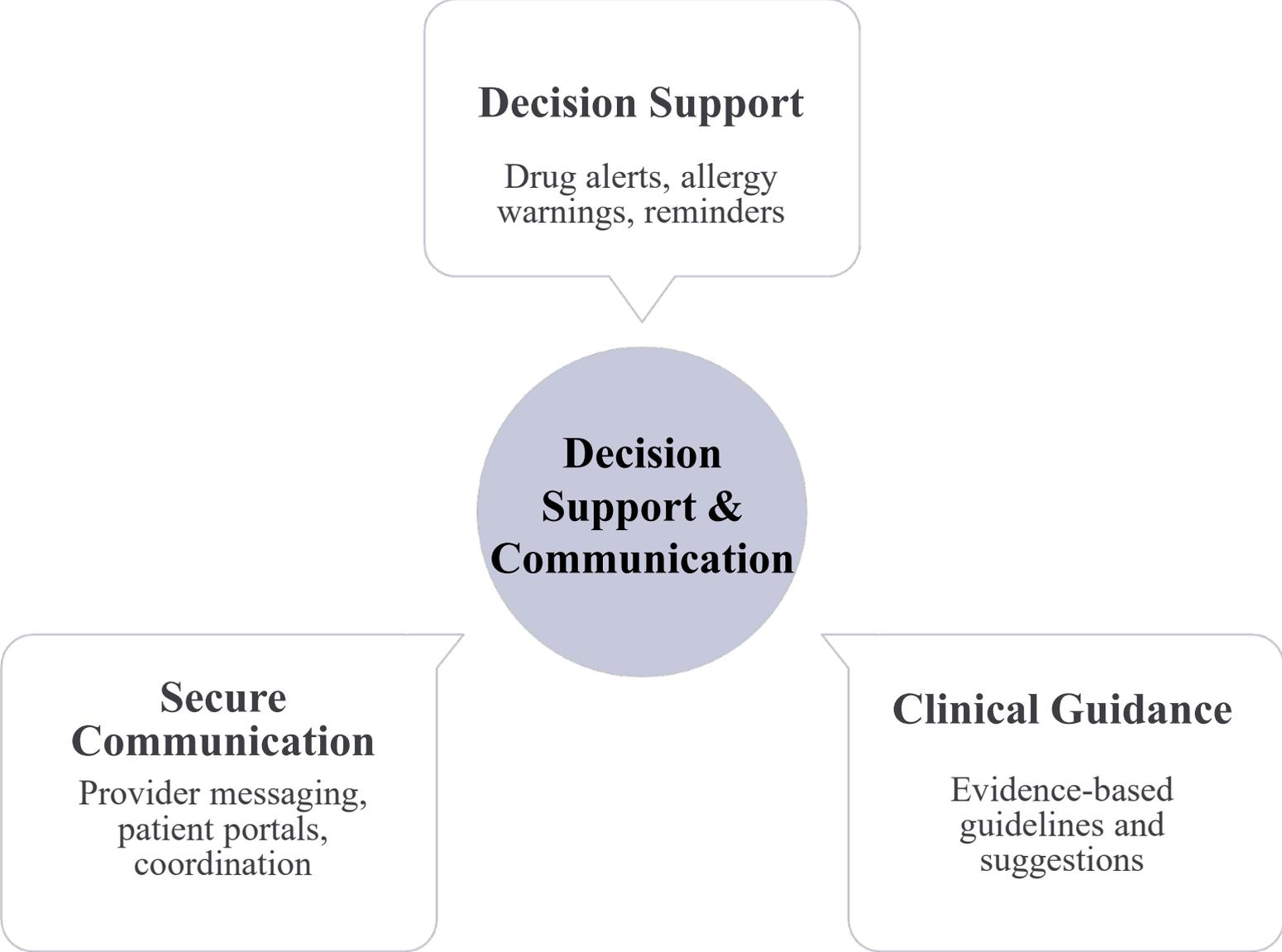
What's Stored

- Clinical notes from every encounter
- Complete medication histories
- Allergy and adverse reaction records
- Laboratory and pathology results
- Diagnostic imaging and reports
- Vital signs trends over time

Clinical Impact

This comprehensive data enables **informed clinical decisions**, reduces duplicate testing, minimizes medical errors, and supports real-time updates accessible to authorized care team members.

Decision Support & Communication



These interrelated features work together to enhance patient safety and care coordination. Automated alerts catch potential errors before they reach patients, while secure communication ensures all care team members stay informed and aligned.

Decision support tools have been shown to reduce medication errors by up to 55% while improving adherence to clinical guidelines.

Types of EHR Systems in Use Today



On-Premise Systems

Hosted on the providers own servers, offering complete control over data and infrastructure. Requires significant IT investment and maintenance.

Best for: Large health systems with robust IT departments



Cloud-Based Systems

Hosted by third-party vendors, accessible from anywhere with internet connectivity. Offers scalability, automatic updates, and reduced upfront costs.

Best for: Small to medium practices, multi-location organizations



Specialty EHRs

Tailored solutions for specific medical fields like cardiology, oncology, or behavioral health with specialized workflows and templates.

Best for: Specialty practices with unique documentation needs



Patient Portals & PHRs

Consumer-facing platforms that empower patients to access their records, schedule appointments, and actively participate in their care.

Best for: Enhancing patient engagement and satisfaction



The Benefits of EHRs on Care

Beyond digitizing records, EHRs fundamentally transform how care is delivered, improving outcomes for providers, patients, and healthcare organizations.

Why Healthcare Providers Adopt EHRs

Healthcare providers experience transformative benefits when implementing EHR systems. The shift from paper-based workflows eliminates time-consuming manual processes.

Operational Improvements

- Elimination of paper charts and filing systems
- Automated prescription and order management
- Reduced transcription and documentation time
- Faster access to patient information

Clinical Quality

- Significant reduction in medication errors
- Improved diagnostic accuracy
- Better adherence to evidence-based guidelines

Financial Impact

Studies show practices can save **\$50,000+ annually** through improved billing accuracy and reduced chart storage costs.

Benefits for Patients



Faster Access to Information

Immediate availability of health records at any authorized facility, eliminating delays in emergency situations and reducing redundant tests.



Increased Care Participation

Patient portals enable active engagement through access to test results, educational materials, and direct communication with care teams.



Coordinated Care

All providers see the same comprehensive health picture, reducing miscommunication and ensuring treatments work together effectively.



Higher Satisfaction

Reduced wait times, fewer repeated questions, and more personalized care lead to measurably improved patient satisfaction scores.

Research shows patients with portal access demonstrate better health outcomes and higher treatment adherence rates.

Real-World Impact: EHR Success Stories

55%

Medication Error Reduction

Leading hospitals report up to 55% decrease in medication errors after EHR implementation with decision support

30%

Improved Scheduling Efficiency

Clinics using integrated EHR scheduling see 30% reduction in no-shows and better appointment utilization

3X

Patient Engagement Growth

Patient portal adoption leads to 3x higher engagement rates in preventive care and chronic disease management

"After implementing our EHR system, we've seen dramatic improvements in care coordination and patient outcomes. The ability to share information instantly across our network has been transformative."

—*Chief Medical Officer, Regional Health System*



Empowering Care Through Data

The true power of EHRs lies in how they facilitate meaningful interactions between patients and providers, transforming data into actionable insights and improved outcomes.

Challenges and Considerations

Critical Decision Factors

Implementing an EHR system requires careful consideration of multiple factors that will impact your organization for years to come.

System Selection

- **Interoperability:** Can it exchange data with other systems?
- **Customizability:** Does it adapt to your workflows?
- **Scalability:** Will it grow with your organization?
- **Security:** Does it meet all compliance requirements?

Implementation Hurdles

- Staff training and adoption resistance
- Workflow disruption during transition
- Data migration from legacy systems
- Initial productivity decline

Compliance Requirements

HIPAA: Privacy and security rules

HITECH: Meaningful use standards

State regulations:
Additional data protection laws

Financial Considerations

Initial costs: \$15K-\$70K per provider

Ongoing fees: Maintenance and updates

Training investment: Time and resources

Success Factors

Leadership buy-in: Top-down support

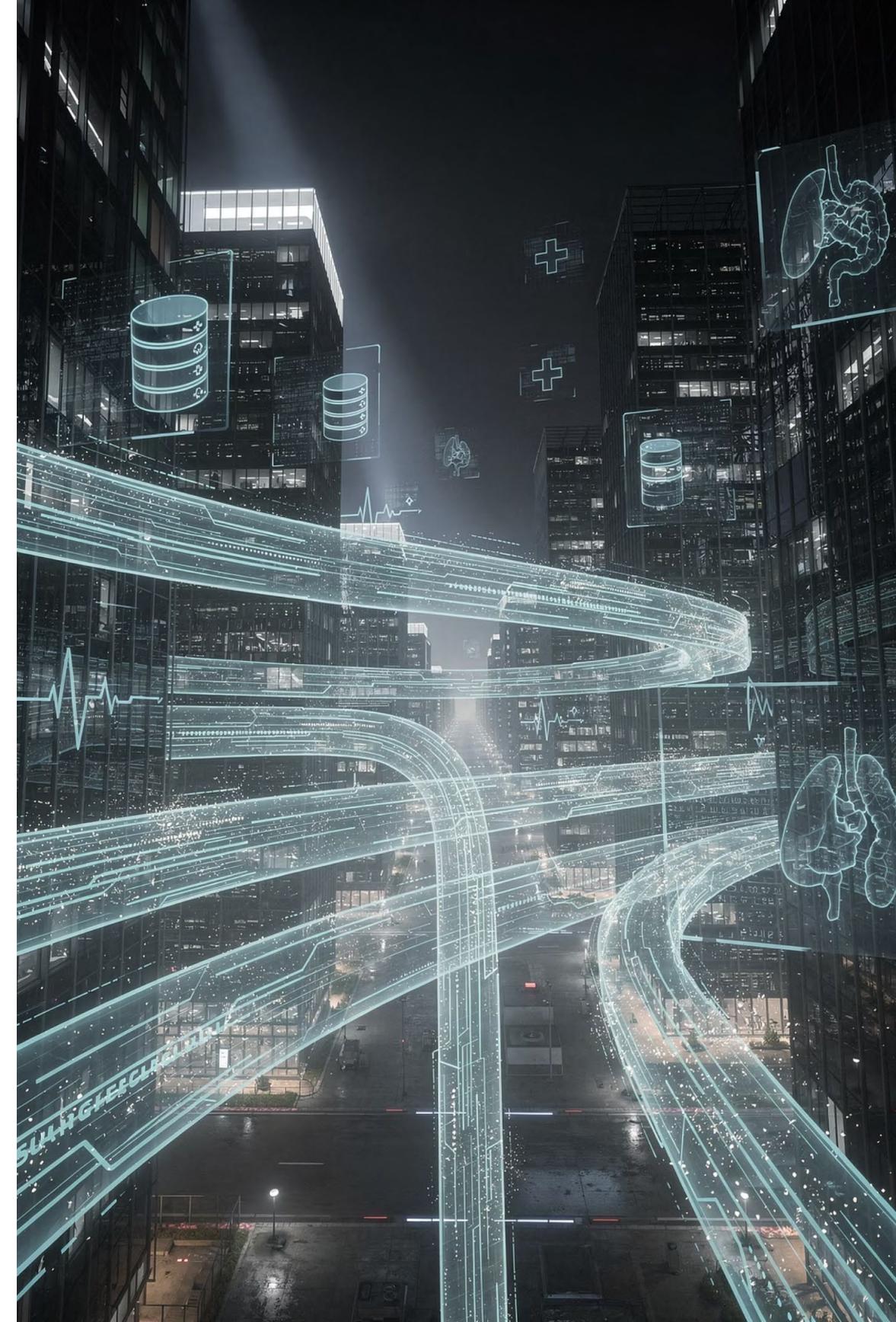
User involvement: Include end-users early

Adequate training: Comprehensive education

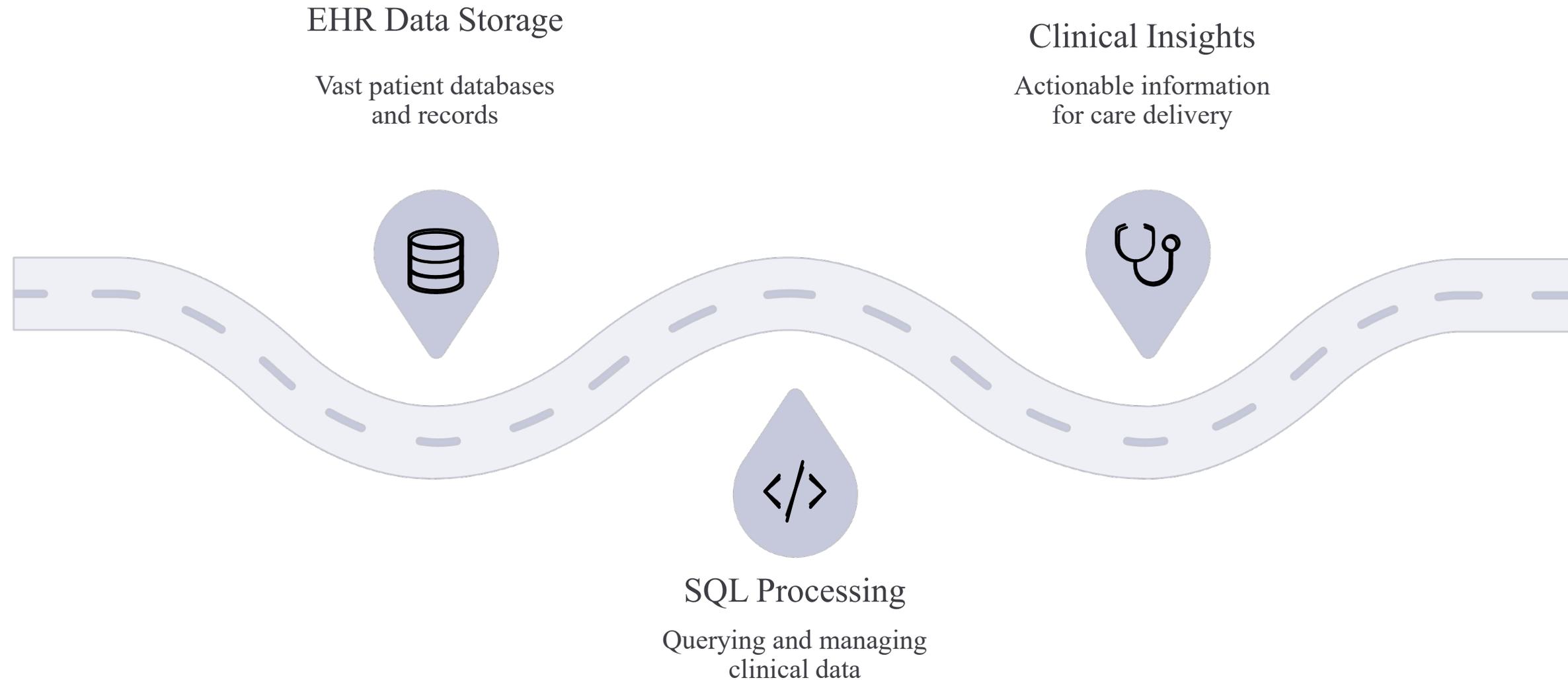
Linking Theory to Practice

Introduction to SQL with SSMS

Now that we understand what EHRs are and why they matter, lets explore the technical foundation that makes them work: database management through SQL.



Why SQL Matters in EHR Systems



Electronic Health Record systems rely on robust database infrastructure to store, retrieve, and manage the enormous volume of patient data generated daily. **SQL (Structured Query Language)** serves as the universal language for interacting with these databases.

Understanding SQL is essential for anyone working with health informatics, as it enables you to extract meaningful insights, generate reports, ensure data quality, and support clinical decision-making through data analysis.

What is SQL Server Management Studio (SSMS)?

The Industry Standard

SSMS is Microsoft's integrated environment for managing SQL Server databases, widely adopted in healthcare IT for EHR data management.

It provides a comprehensive suite of tools for database administration, development, and analysis.

Core Capabilities

- Create and manage database structures
- Write and execute SQL queries
- Design tables and relationships visually
- Monitor performance and optimize queries
- Manage security and user permissions
- Automate routine database tasks

Why Healthcare Uses SSMS

Healthcare organizations choose SSMS for its **reliability, security features, and seamless integration** with major EHR platforms like Epic, Cerner, and Meditech.



Key Components of SSMS

1

Object Explorer

Navigate through database objects including tables, views, stored procedures, and functions. Essential for understanding database structure.

2

Query Editor

Write, edit, and execute SQL queries with syntax highlighting, IntelliSense code completion, and result visualization tools.

3

Template Explorer

Access pre-built query templates for common operations, accelerating development and ensuring best practices.

4

Visual Database Tools

Design tables, relationships, and schemas using intuitive visual interfaces without writing code manually.

Practical Overview: Basic SQL Operations in SSMS

01

Connect to SQL Server

Establish connection to your database instance using server name, authentication method, and credentials

02

Create Database Structure

Design and create databases, tables, and define data types for patient information storage

03

Insert Patient Data

Add new patient records, medical encounters, lab results, and other clinical data

04

Query and Retrieve

Write SELECT statements to find specific patients, analyze trends, and generate reports

05

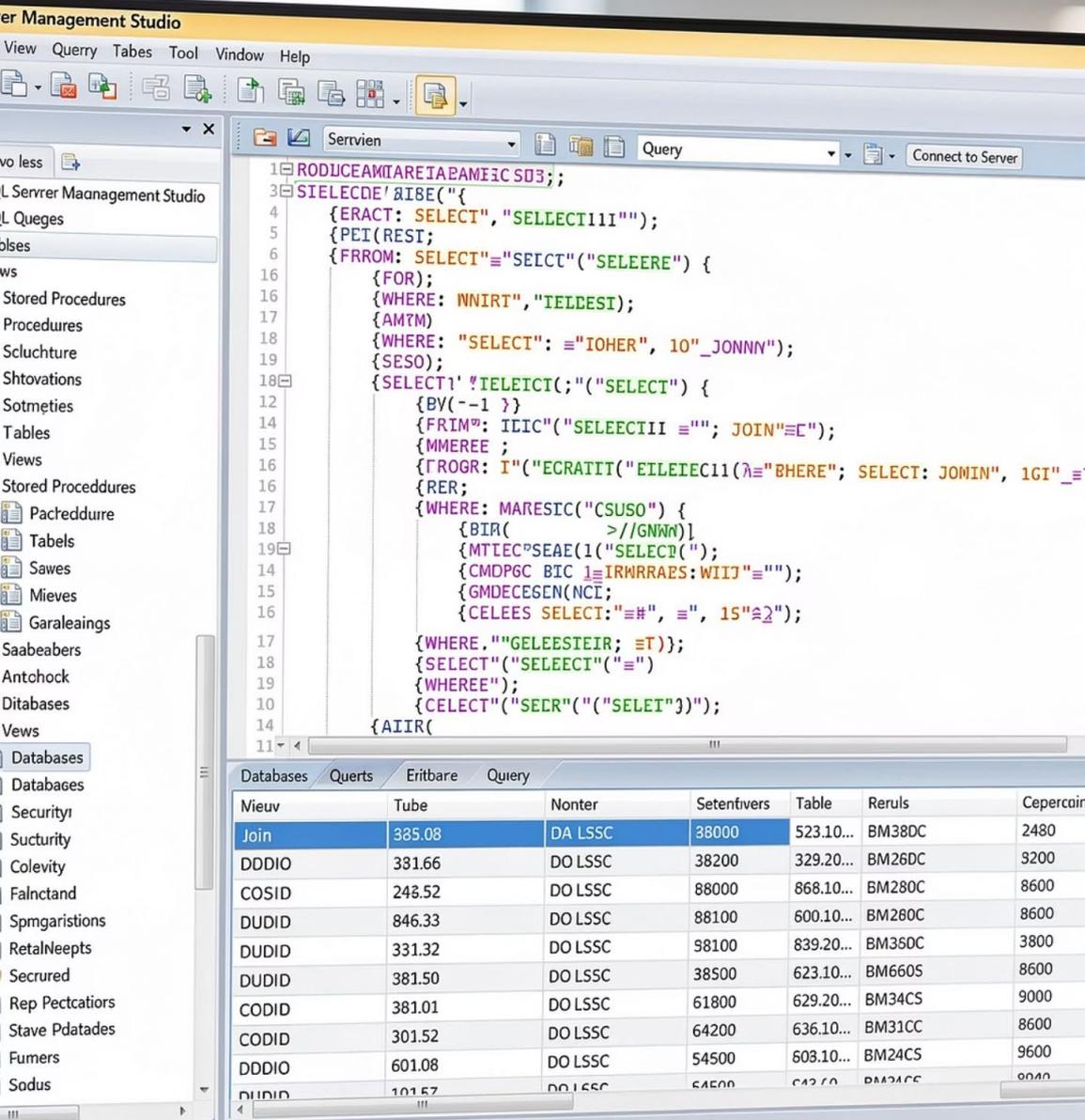
View and Export Results

Examine query results in grid format, export to various formats, and verify data accuracy

In your practical session, you'll work through each of these steps hands-on using a sample EHR database.

Your Gateway to EHR Data

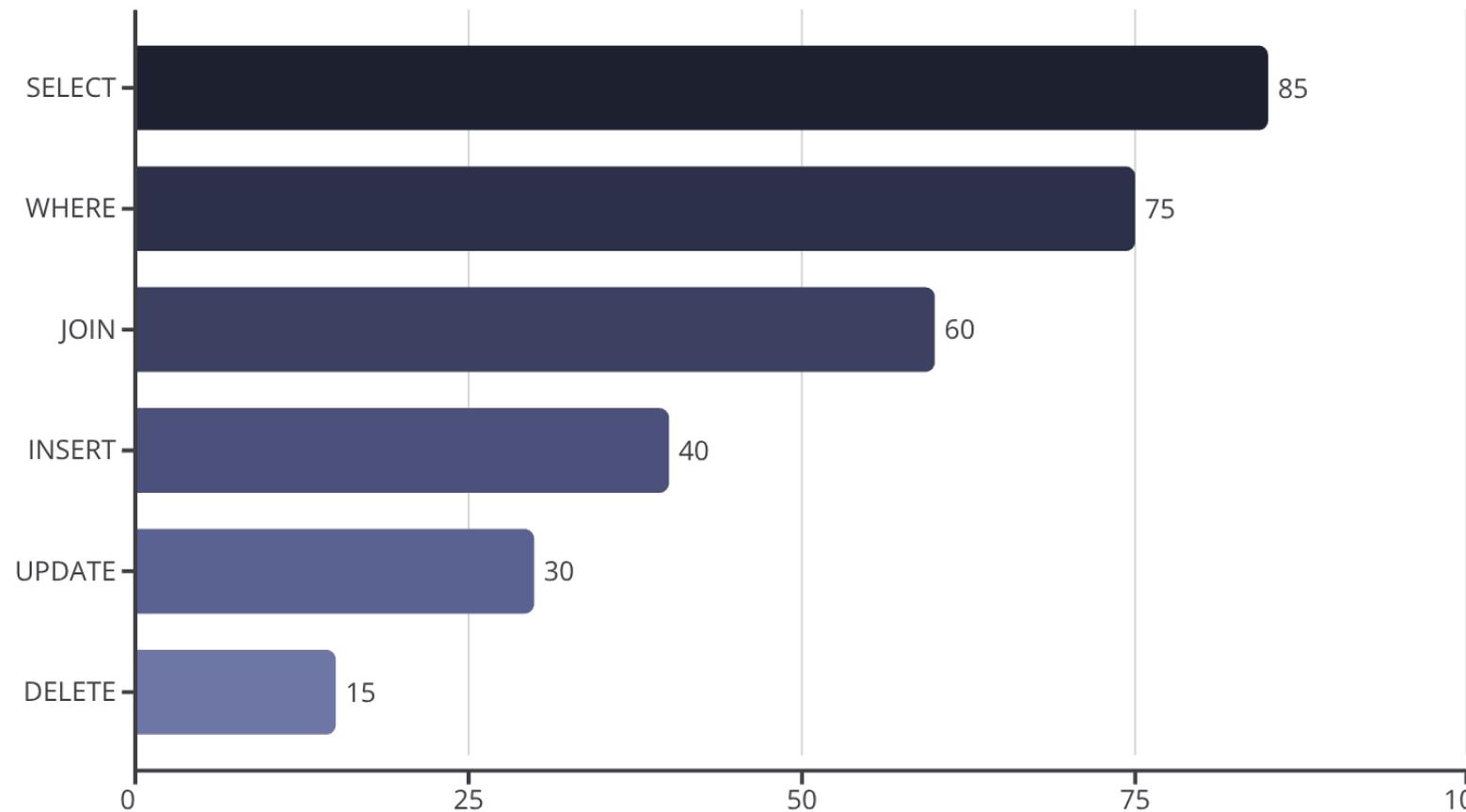
SSMS provides the tools you need to unlock insights hidden within millions of patient records.



The screenshot displays the Microsoft SQL Server Enterprise Manager (SSMS) interface. The top menu bar includes 'View', 'Query', 'Tables', 'Tool', 'Window', and 'Help'. The main window is titled 'Servien' and shows a query editor with a complex SQL query. The query is a multi-line statement with various clauses and subqueries. Below the query editor, a results grid is visible, showing data from a query. The grid has columns for 'Mieuw', 'Tube', 'Nonter', 'Setentivers', 'Table', 'Reruls', and 'Cepercoir'. The data is organized into rows, with the first row highlighted in blue.

Mieuw	Tube	Nonter	Setentivers	Table	Reruls	Cepercoir
Join	385.08	DA LSSC	38000	523.10...	BM38DC	2480
DDDIO	381.66	DO LSSC	38200	329.20...	BM26DC	9200
COSID	248.52	DO LSSC	88000	868.10...	BM280C	8600
DUDID	846.33	DO LSSC	88100	600.10...	BM280C	8600
DUDID	331.32	DO LSSC	98100	839.20...	BM360C	3800
DUDID	381.50	DO LSSC	38500	623.10...	BM660S	8600
CODID	381.01	DO LSSC	61800	629.20...	BM34CS	9000
CODID	301.52	DO LSSC	64200	636.10...	BM31CC	8600
DDDIO	601.08	DO LSSC	54500	603.10...	BM24CS	9600
DUDID	101.57	DO LSSC	64500	642.10...	BM24CS	9000

Cheat Sheet Preview: Essential SQL Commands for EHR Data



Command Reference

SELECT: Retrieve patient records, lab results, and any data from tables

```
SELECT * FROM Patients WHERE Age > 65
```

INSERT: Add new patient information or clinical data

```
INSERT INTO Patients VALUES ('John', 'Doe')
```

UPDATE: Modify existing records when information changes

```
UPDATE Patients SET Phone = '555-1234'
```

DELETE: Remove outdated or incorrect records

```
DELETE FROM Appointments WHERE Date < '2020-01-01'
```

WHERE: Filter data based on specific conditions

```
WHERE DiagnosisCode = 'E11.9'
```

Preparing for the Practical Session

1

Database Connection

Learn to connect SSMS to our sample EHR database and navigate its structure

2

Exploratory Queries

Write queries to explore patient demographics, find specific diagnoses, and examine medication lists

3

Lab Results Analysis

Query laboratory data to identify abnormal results and track patient trends over time

4

Data Relationships

Understand how tables connect through primary and foreign keys to represent complex medical relationships

5

Report Generation

Create meaningful reports combining data from multiple tables for clinical decision support

Summary: From EHR Concepts to Data Mastery



EHR Concepts

Comprehensive digital records and system types

Clinical Benefits

Improved care quality and reduced errors

Technical Foundation

SQL databases, SSMS tools, query capabilities

Key Takeaways

- **EHRs transform healthcare** through comprehensive, interoperable digital records that follow patients across care settings
- **Core features** including decision support, results management, and communication tools directly improve patient outcomes
- **Multiple stakeholders benefit** – providers gain efficiency, patients receive better coordinated care, and organizations achieve better financial performance
- **SQL and SSMS skills** are essential for unlocking the full potential of EHR data and supporting intelligent medical systems

By mastering both the conceptual framework and technical tools, you'll be equipped to work effectively with modern healthcare information systems.

Next Steps: Get Ready to Dive Into SQL with SSMS!

Install & Configure

Download and install SSMS, then connect to the practice database using the provided credentials

Use Your Cheat Sheet

Follow the SQL cheat sheet to write your first queries and explore the sample EHR database structure

Explore Data-Driven Insights

Discover how data queries drive clinical decisions, population health, and intelligent medical systems

Thank

you



Google Classroom

