

Electronic Health Record Systems and Clinical Workflow

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MHA 621
Healthcare Informatics

Lecture 4



Intended Learning Objectives

- **By the end of this lecture, you should be able to:**
- 1. Explain the main functions of an EHR.**
 - 2. Describe how an EHR supports the patient journey.**
 - 3. Compare ambulatory and hospital information systems.**
 - 4. Identify common workflow and usability problems.**
 - 5. Recommend practical ways to improve EHR workflow.**

Lecture Road Map

1



1. EHR Foundations and Workflow Integration

2



2. Administrative Workflow and Patient Flow

3



3. Clinical Systems, Architecture, and Departmental Workflows

4



4. EHR Usability and Workflow Optimization

EHR

Patient Summary

Encounters

Medications

Allergies

Lab Results

Immunizations

Documents

Care Plans

Vitals

120/80 mmHg

72 bpm

98 %

14 rpm

Abbreviations Used in This Lecture

CPOE

—
Computerized Provider
Order Entry

EHR

—
Electronic Health Record

EMPI

—
Electronic Master
Patient Index

PACS

—
Picture Archiving and
Communication System



EHR Foundations and Workflow Integration



What Is an Electronic Health Record?

➤ **An EHR is a digital record of a patient's health information.**

- It may contain diagnoses, medicines, allergies, notes, orders, and results.
- It supports both clinical care and administrative work.
- It can follow the patient across visits and care settings.
- It should provide accurate information when the care team needs it.

The EHR as “My Chart”

➤ Patients often think of the EHR as “my chart.”

- An ambulatory EHR may follow a patient for many years.
- It records health, illness, treatment, recovery, and aging.
- Modern EHRs may combine information from several systems.
- The goal is a complete, long-term view of the patient.

Why Workflow Matters

➤ **A workflow is the order of steps used to complete a task.**

- Clinical systems should support how care is actually delivered.
- Poor workflow fit creates delays and extra work.
- Good workflow design improves safety and productivity.
- Workflow should guide system selection and improvement.

Two Connected Sides of the EHR

- **The administrative side manages patient flow and payment.**
- **The clinical side manages care and health information.**
 - Both sides should exchange information smoothly.
 - Poor integration causes repeated entry, delays, and errors.
 - Strong integration improves productivity and revenue work.

Administrative Workflow and Patient Flow



A. The Administrative Management System

1. Patient identification and registration.
2. Appointment scheduling.
3. Check-in and patient tracking.
4. Billing and collections.
5. Operational and financial reporting.

Patient Identification Comes First

➤ Every process begins with the correct patient.

- The system must distinguish one patient from all others.
- Similar names and missing data can cause matching problems.
- Errors can create duplicate or wrongly merged records.
- These errors may harm patients and reduce efficiency.

The Electronic Master Patient Index

➤ An EMPI stores basic identity and demographic information.

- Its purpose is to give each patient one correct identity.
- It links records across sites, specialties, and systems.
- Advanced systems compare many details to find matches.
- An EMPI may also detect possible duplicate records.

Duplicate Records and Patient Safety

- Duplicate records divide one patient's information.
- Wrong merging joins information from different patients.
- Either problem can lead to an incorrect care decision.
- Identity errors may also delay communication and payment.

DUPLICATE RECORDS

REGISTRATION

Same Patient

Patient Record A
MRN: 10045821

Name: Jane Doe
DOB: 07/14/1984
Address: 321 River Rd

ALLERGIES

- Penicillin – Rash
- Latex – Hives

PAST CONDITIONS

- Asthma
- Anemia

SURGICAL HISTORY

- Appendectomy (2012)

Patient Record B
MRN: 10377654

Name: Jane A. Doe
DOB: 07/14/1984
Address: 321 River Rd

CURRENT MEDICATIONS

- Lisinopril 10 mg daily
- Metformin 500 mg BID

LAB RESULTS

- Potassium 5.6 mmol/L (High)
- eGFR 48 mL/min (Low)

Information is incomplete. Risk of unsafe decisions.

Verify Patient Identity

WRONG MERGE

Records from two different patients incorrectly merged into one.

John Smith
MRN: 20033455

DOB: 03/12/1962
Address: 12 Oak St
Phone: 555-123-4567

Jon Smith
MRN: 20033455

DOB: 07/03/1990
Address: 98 Pine Ave
Phone: 555-987-6543

MERGED RECORD (Incorrect)

Blood Type	A+	Conflict	O-
Allergies	No Known Allergies	Conflict	Penicillin – Anaphylaxis
Medications	Atorvastatin 20 mg daily	Conflict	Warfarin 5 mg daily
Recent Visit	Knee Pain (04/10/2025)	Conflict	Follow-up: DVT (04/08/2025)

Conflicting information. Verify before treating.

Warfarin 5mg

1. Patient Registration

➤ Information Collected During Registration

1. Personal and demographic information.
2. Insurance coverage and eligibility information.
3. Emergency contacts.
4. Communication and contact preferences.

➤ Incomplete data may cause delays, denials, and lost revenue.

2. Clinical Scheduling

➤ Clinical scheduling connects appointments to patients.

- Each appointment becomes part of the patient record.
- The system can show appointment history and type.
- Schedules can connect appointments with billing.
- This is more useful than free text in a normal calendar.

What Advanced Scheduling Can Do

- Manage appointment types, waitlists, and repeat visits.
- Provide instructions needed before a visit.
- Coordinate care from several professions.
- Match patients with staff, rooms, and equipment.
- Apply rules to improve flow and appointment access.

Scheduling Complex Services

- Some services need several resources at the same time.
- Endoscopy needs staff, equipment, and sterilization time.
- Chemotherapy may need a fixed sequence and duration.
- Radiology scheduling may consider radiation exposure.
- The system should prevent conflicts and wasted resources.

Advanced Scheduling

Right patient • Right time • Right team • Right resources

May 19 – May 25, 2025

Today



Dashboard



Schedule



Patients



Waitlist



Resources



Care Pathways



Smart Rules



Reports



Messages



Settings

Weekly Schedule

	Mon 5/19	Tue 5/20	Wed 5/21	Thu 5/22	Fri 5/23	Sat 5/24	Sun 5/25
8 AM	8:00 AM New Patient John Miller		8:00 AM New Patient Ava Johnson		8:30 AM Follow-up Isabella Thomas		
9 AM		8:30 AM Follow-up Emily Clark		9:00 AM Telehealth Sophie Moore		9:00 AM Procedure Benjamin Lee	
10 AM	9:30 AM Follow-up Sarah Lee						
11 AM	11:00 AM Procedure Robert Davis	10:00 AM Procedure James Wilson	10:30 AM Follow-up Daniel Martinez	11:30 AM New Patient Olivia White	10:30 AM Telehealth Mia Anderson		
12 PM							
1 PM		1:00 PM Follow-up Michael Brown		1:30 PM Follow-up Ethan Harris	1:00 PM New Patient Liam Jackson		
2 PM	1:30 PM Telehealth Maria Garcia		2:00 PM Procedure William Taylor				
3 PM	3:00 PM New Patient David Kim	3:30 PM Telehealth Lisa Patel			3:30 PM Follow-up Charlotte King		
4 PM				4:00 PM Procedure Noah Martin			
5 PM							

New Patient

Follow-up

Procedure

Telehealth

Waitlist 6

View all

Patient	Priority	Wait Time	
Kevin Andrews DOB 07/12/1978	High	2d 4h	<button>Offer Earlier Slot</button>
Rachel Green DOB 03/28/1985	High	1d 6h	<button>Offer Earlier Slot</button>
Anthony Wilson DOB 11/02/1965	Medium	3d 2h	<button>Offer Earlier Slot</button>
Priya Shah DOB 06/17/1992	Medium	2d 1h	<button>Offer Earlier Slot</button>
Mark Thompson DOB 02/05/1971	Low	4d 3h	<button>Offer Earlier Slot</button>
Jessica Adams DOB 09/14/1990	Low	5d 5h	<button>Offer Earlier Slot</button>

Resource Matching

Provider	Dr. Sarah Patel Available	✓
Nurse	Maria Gonzales, RN Available	✓
Room	Room 4 Available	✓
Equipment	Ultrasound Machine 2 Available	✓

Confirm Assignment

Selected Appointment

Follow-up

Tue, May 20, 2025 • 8:30 AM • 30 min

Emily Clark

DOB 04/12/1988 • MRN 10024567

Reason: Hypertension follow-up

Provider: Dr. Sarah Patel

Pre-Visit Instructions



Fast for 8 hours
No food or drinks except water.



Bring medication list
Include all prescriptions and supplements.



Arrive 20 minutes early
For check-in and any required paperwork.

View Patient Chart



Care Pathway – Coordinated Plan



Total Care Time: ~ 75 min



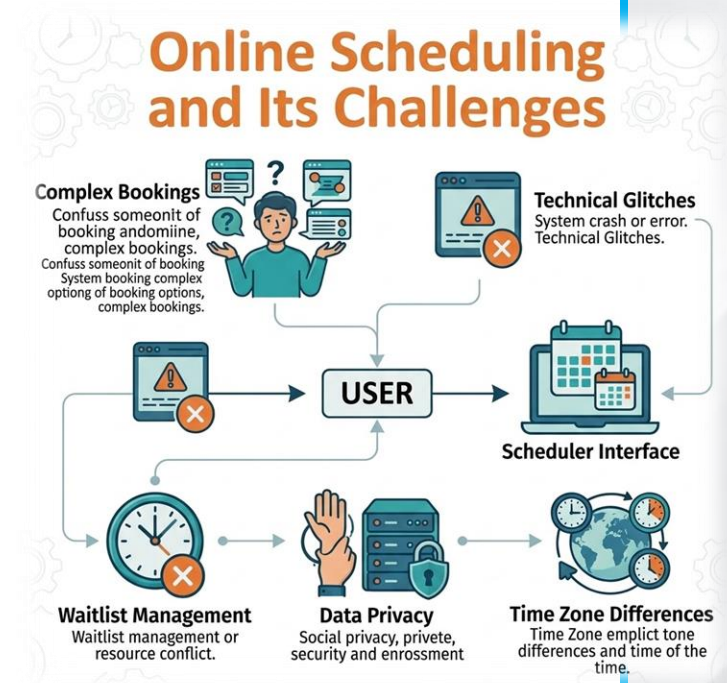
AI Recommendation

Consider opening 1 additional follow-up slot on Thu 5/22 at 2:30 PM to reduce waitlist by 1 day.

Apply Suggestion

Online Scheduling and Its Challenges

- Patients may book through portals or websites.
- Online scheduling can improve access and convenience.
- Patients may not know complex clinical rules.
- Some visits require approval or necessity checks.
- The correct service, duration, and provider must be chosen.



Following the Patient Through the Visit

- Measure time from arrival until room placement.
- Measure waiting time inside the room.
- Record time spent with the nurse and physician.
- Calculate the total visit time.
- Use the data to improve flow, resources, and satisfaction.

Clinical Systems, Architecture, and Departmental Workflows



B. The Clinical Side of the EHR

➤ **The clinical side of an Electronic Health Record (EHR) helps healthcare professionals:**

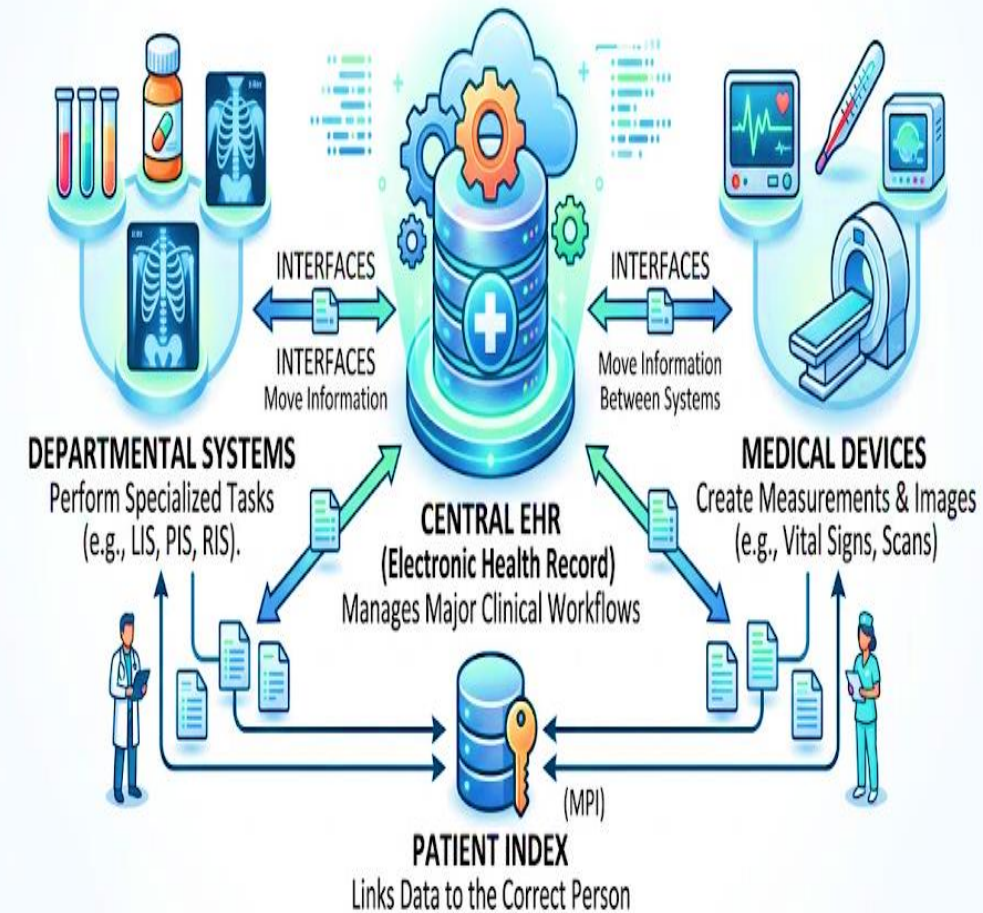
1. Review the patient's clinical history.
2. Enter clinical orders and review results.
3. Create and update clinical documentation.
4. Manage medications and treatments.
5. Coordinate follow-up care and communication.

One System or Several Systems?

- One large EHR can support most activities.
- Specialized systems may fit department work better.
- A unified system may improve sharing and consistency.
- Several systems need reliable interfaces.
- Leaders must balance specialty fit with integration.

Understanding EHR Architecture

- The central EHR manages major clinical workflows.
- Departmental systems perform specialized tasks.
- Devices create measurements and images.
- Interfaces move information between systems.
- A patient index links data to the correct person.



1. Order Entry (CPOE)

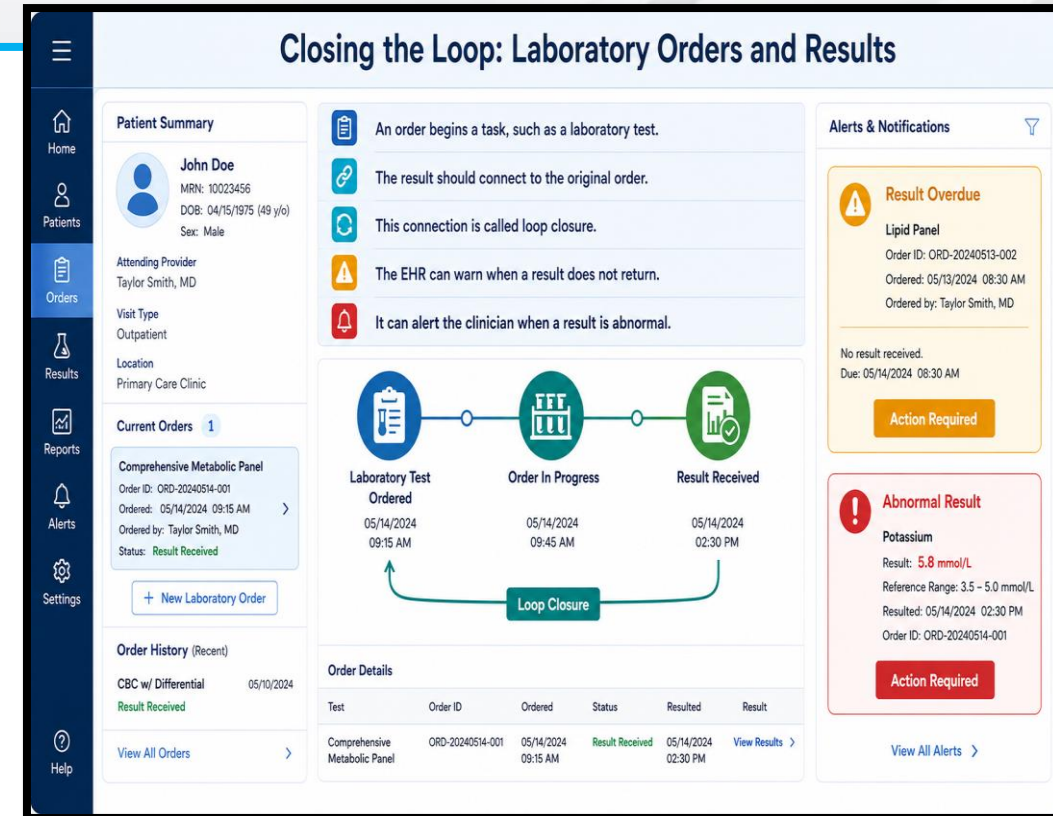
- Clinicians request medicines, tests, and procedures.
- Electronic orders go to the department that performs them.
- Every order needs correct patient and clinical information.
- Order sets can group commonly required orders.
- Electronic ordering reduces paper and repeated entry.



Chapter 04

Closing the Order–Result Loop

- An order begins a task, such as a laboratory test.
- The result should connect to the original order.
- This connection is called loop closure.
- The EHR can warn when a result does not return.
- It can alert the clinician when a result is abnormal.



2. Results Reporting

- Early clinical systems mainly displayed laboratory results.
- Numbers are usually easier to organize and display.
- Text results include pathology and radiology reports.
- Images need large storage and special viewing systems.
- Every result must appear in the correct patient context.

3. Laboratory Workflow

- The clinician enters a laboratory order.
- The order to be sent to the laboratory system.
- Staff identify the patient and label the specimen.
- Devices perform testing and upload results.
- Verified results return to the EHR for review.

1. Enter Order

EHR

Dashboard

Patients

Orders

Results

Messages

Reports

Settings



EHR

New Laboratory Order

Patient

John Doe
MRN: 10001234
DOB: 01/01/1970 | M

Encounter

Outpatient Visit - 05/15/2025

Orderable

Comprehensive Metabolic Panel

Priority

Routine

Collected

Today

Sign Order

2. Send to Laboratory

Order Summary

Patient John Doe
MRN 10001234
Order Comprehensive Metabolic Panel
Priority Routine
Collected 05/15/2025



Laboratory System

3. Identify & Label



Patient Identified ✓

Specimen Labeled ✓



4. Test & Upload



5. Verify & Review

EHR

Dashboard

Patients

Orders

Results

Messages

Reports

Settings



EHR

Results

John Doe
MRN: 1001234 | DOB: 01/01/1970
M

Comprehensive Metabolic Panel

Collected: 05/15/2025 09:15 AM

Test	Result	Units	Reference Range
Na	140	mmol/L	135-145
K	4.2	mmol/L	3.5-5.0
Cl	103	mmol/L	98-107
CO ₂	25	mmol/L	22-29
BUN	14	mg/dL	7-20
Creatinine	0.9	mg/dL	0.6-1.2
Glucose	95	mg/dL	70-99

Result Verified ✓

4. Radiology Workflow

- The clinician places an imaging order.
- The radiology system schedules staff, room, and equipment.
- The imaging device produces the images.
- Images are stored in a Picture Archiving and Communication System (**PACS**).
- The radiologist reviews images and reports findings.

EHR Usability and Workflow Optimization



The Clinician's EHR Workload

- Reviewing patient information.
- Writing documentation.
- Entering orders.
- Completing billing and coding tasks.
- Managing messages and alerts.

Why EHR Work Can Become Burdensome

- The electronic workflow may not match clinical work.
- Screens may contain too much information or too many tabs.
- Users may not receive enough practical training.
- Administrative rules increase documentation.
- Messages, alerts, passwords, and clicks consume time.

Workflow Optimization: Start with the User

- Observe how clinicians currently complete their work.
- Find repeated steps, delays, and unnecessary movement.
- Show each user the information they need.
- Remove unused fields, tabs, and options where possible.
- Design the system around the specialty and task.

Workflow Optimization: Support the Team

- Let patients enter suitable information before the visit.
- Let trained staff prepare and reconcile the chart.
- Give each task to the correct team member.
- Route routine messages and refills correctly.
- Protect clinician time for clinical judgment.

Wrap Up

1. An EHR is both a clinical record and a workflow system.
2. Administrative and clinical functions must work together.
3. Correct identity is the base of safe information flow.
4. Orders, results, notes, and departments must stay connected.
5. Value depends on usability, training, and improvement.



Thank You