

Chapter 4: Electronic Health Records

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Acknowledgement

- * The original slides are from:
 - * Robert Hoyt MD
 - * Vishnu Mohan MD
- * The chapter: chapter 4
- * Book title: Hersh, W. R., & Hoyt, R. E. (2018). *Health Informatics: Practical Guide Seventh Edition*. Lulu.com.

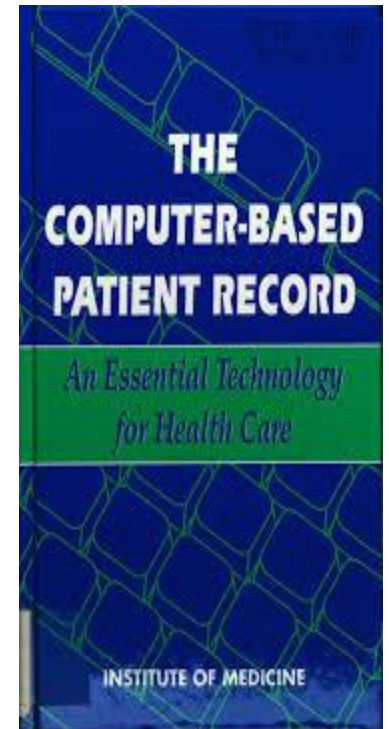
Learning Objectives

After reading this lecture the students should be able to:

- * State the definition of electronic health records (EHRs)
- * Describe the limitations of paper-based health records
- * Identify the benefits of electronic health records
- * List the key components of an electronic health record
- * Describe the benefits and challenges of computerized order entry and clinical decision support systems
- * State the obstacles to purchasing, adopting and implementing an electronic health record
- * Enumerate the steps to adopt and implement an EHR

Introduction

- * There is no topic in health informatics as important, yet controversial, as the electronic health record (EHR)
- * In spite of fledgling EHRs being around for the past 35-40 years they are still controversial in the eyes of many
- * In 1991, IOM recommended EHR as a solution for many problems.
- * *The Computer-Based Patient Record: An Essential Technology for Health Care.*



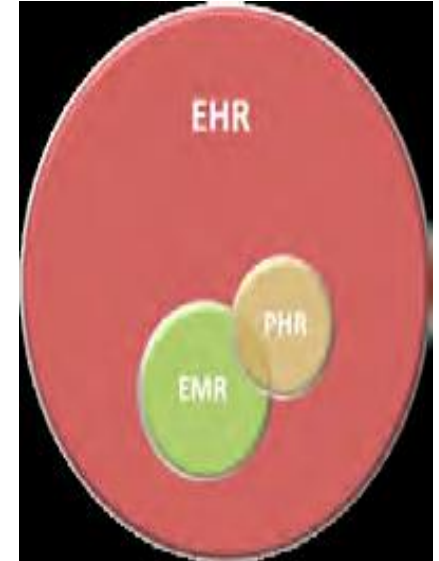
Definitions

- * **Electronic Health Record:** “An electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be created, managed and consulted by authorized clinicians and staff across more than one healthcare organization”



Definitions

- * **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.”
- * **Personal Health Record:** “An *electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards and that can be drawn from multiple sources while being managed, shared and controlled by the individual.”*



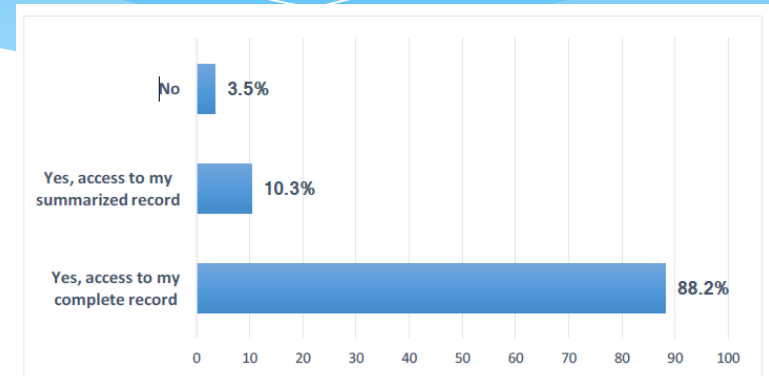
Why do we need EHRs?

- * Paper records are severely limited.
- * Need for improved efficiency and productivity
- * Quality of care and patient safety

A scan of a medical history and physical form. The form is titled "HISTORY AND PHYSICAL" and includes fields for patient name, age, date, and insurance status. It contains various checkboxes and handwritten notes for symptoms and physical exam findings. The form is filled out with handwritten text and checkmarks, indicating a patient's medical history and current physical status. The form includes sections for "HYPER" (Hyperthyroidism) and "HYPO" (Hypothyroidism) symptoms, as well as a detailed physical exam section covering various body systems like eyes, ears, nose, throat, heart, lungs, and abdomen. There are also sections for laboratory tests and a "RECORDS REVIEWED" section at the bottom.

Why do we need EHRs?

- * **Public expectations**
- * **Financial savings**
- * **Technological advances**
- * **Need for aggregated data**



Reference: Almulhem, J. A. (2017). Layperson Perceptions and Attitudes Towards a National Electronic Health Record Introduction in Saudi Arabia.

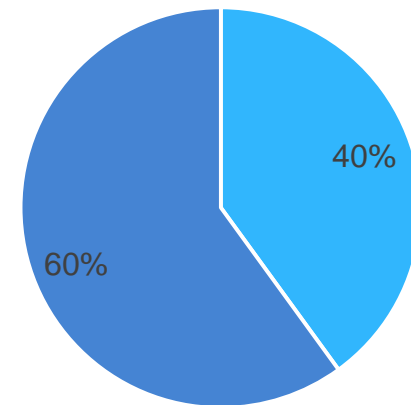
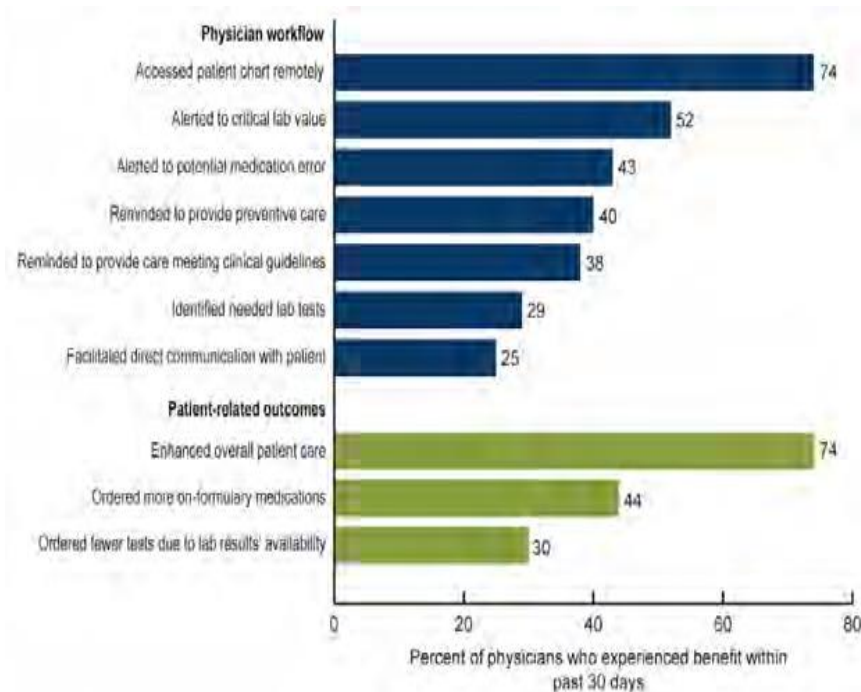
Why do we need EHRs?

- * **EHR as a transformational tool**
- * **Need for coordinated care**



Why do we need EHRs?

Overall satisfaction



■ satisfied ■ not satisfied

Electronic Health Record Key Components

- * Clinical decision support
- * Secure messaging
- * Computerized physician order entry
- * Practice management
- * Referral management
- * Results retrieval
- * Prior encounter retrieval
- * Patient reminders
- * Electronic encounter notes
- * Multiple input methods
- * Access via mobile technology
- * Remote access from home
- * Electronic prescribing
- * Integration with images
- * Integration with physician and patient education
- * Public health reporting
- * Problem summary lists

Electronic Health Record Key Components

- * Ability to scan in data
- * Ability to graph and track results
- * Ability to create patient lists
- * Ability to create registries
- * Privacy/security compliance
- * Robust backup systems
- * Support for client server or application service provider (ASP) modes

Computerized Physician Order Entry (CPOE)

- * CPOE is an EHR feature that processes orders for medications, lab tests, imaging, consults and other diagnostic tests.
- * CPOE has many potential benefits:
 - * Reduce Medication Errors
 - * Reduce costs
 - * Reduce Variation of Care
- * Unintended adverse consequences



Clinical Decision Support Systems (CDSSs)

- * **Clinical Decision Support** : “any electronic or non-electronic system designed to **aid directly in clinical decision making**, in which characteristics of individual patients are used to generate patient-specific assessments or recommendations that are then presented to **clinicians for consideration**.
- * **Types of CDSS:**
 - * **Knowledge support:** UpToDate, diagnostic (ICD-10) codes, and *infobuttons*.
 - * **Calculators:** appropriate antibiotic dosing

Clinical Decision Support Systems (CDSSs)

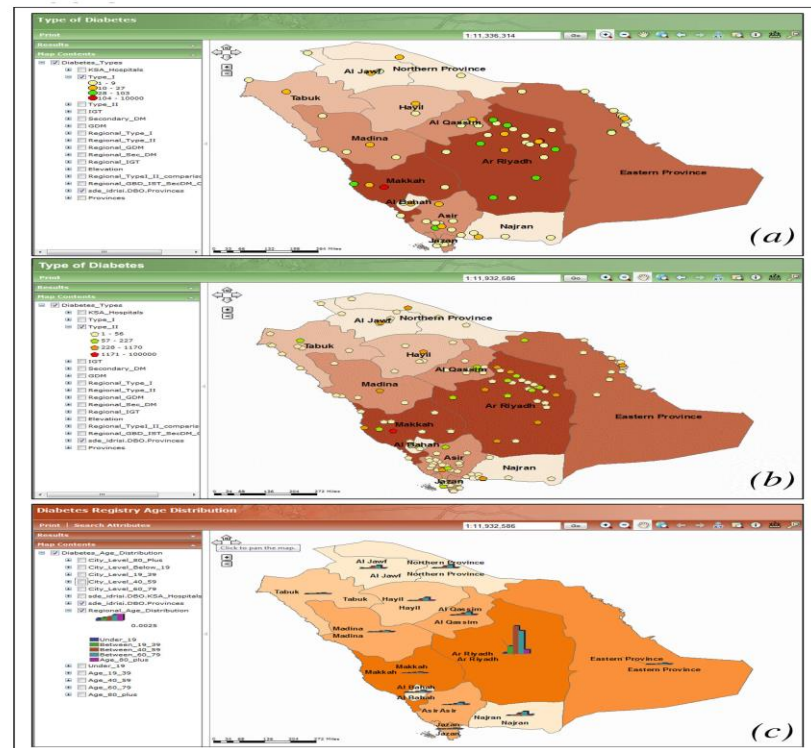
- * **Types of CDSS (continued):**
 - * **Flow charts and graphs:** to look at lab or vital sign trends over time
 - * **Medication order support**
 - * **Reminders:** remind clinician or patient about pending tests, etc.
 - * **Order sets:** inpatient clinical practice guidelines for specific scenarios.
 - * **Differential diagnosis:** software exists that helps clinicians analyze symptoms and signs, to arrive at a diagnosis
 - * **Lab and Imaging decision support**
 - * **Public health alerts:** primarily infectious disease alerts for new outbreaks, e.g. MERS virus

EHR Registries

- * Definition: “an organized system that uses observational study methods to **collect uniform data** (clinical and other) to **evaluate specified outcomes for a population** defined by a particular **disease, condition, or exposure**, and that serves one or more predetermined scientific, clinical, or policy purposes”.
- * **Types:**
 1. Chronic disease management registries
 2. Research registries
 3. Safety registries
 4. Public health registries
 5. Quality registries

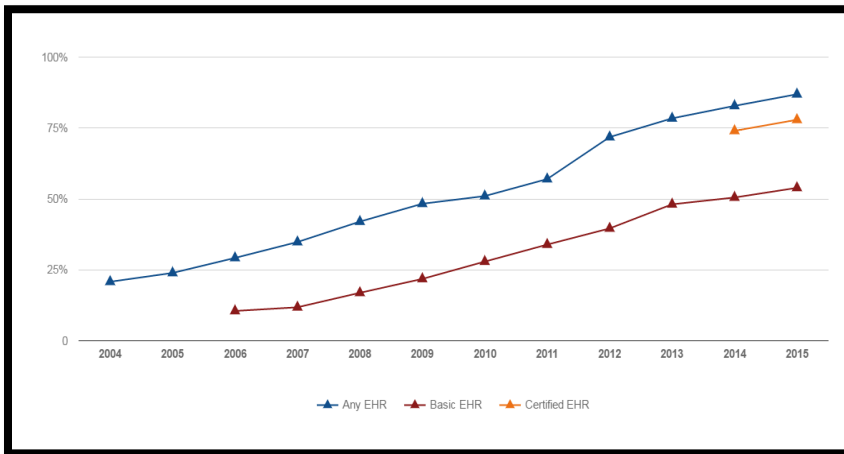
EHR Registries

- * Geographic information system (GIS) maps demonstrating the diabetic patient distribution for
- * (a) type 1 diabetes and
- * (b) type 2 diabetes at the country level, and
- * (c) the distribution of different age groups in all health sectors.

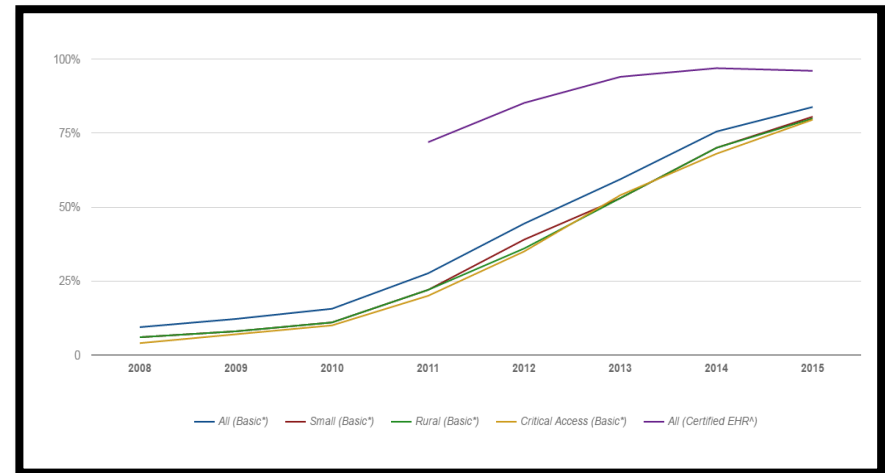


Reference : Al-Rubeaan, K. A., Youssef, A. M., Subhani, S. N., Ahmad, N. A., Al-Sharqawi, A. H., & Ibrahim, H. M. (2013). A Web-based interactive diabetes registry for health care management and planning in Saudi Arabia. *Journal of medical Internet research*, 15(9), e202.

EHR Adoption



Outpatient EHR adoption



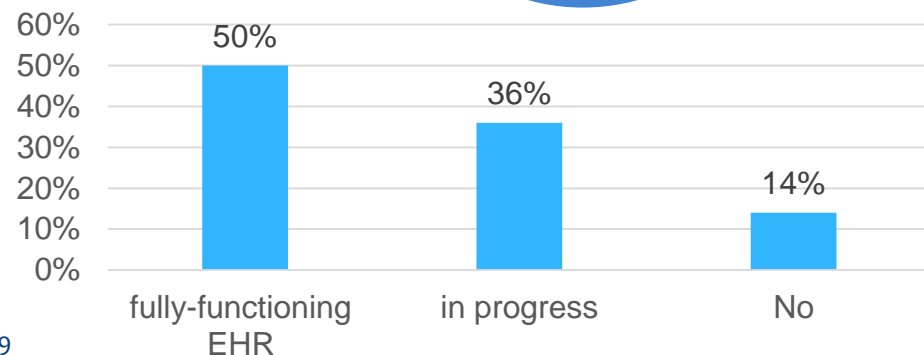
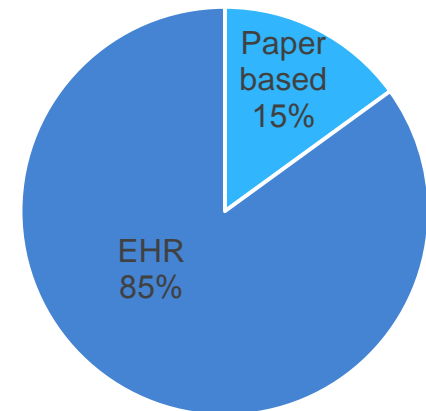
Inpatient EHR adoption

Reference: 1- Office of the National Coordinator for Health Information Technology. 'Office-based Physician Electronic Health Record Adoption,' Health IT Quick-Stat #50. dashboard.healthit.gov/quickstats/pages/physician-ehr-adoption-trends.php. January 2019.
2- office of the National Coordinator for Health Information Technology. 'Non-federal Acute Care Hospital Electronic Health Record Adoption,' Health IT Quick-Stat #47. dashboard.healthit.gov/quickstats/pages/FIG-Hospital-EHR-Adoption.php. September 2017.

EHR Adoption in Saudi Arabia

- * **Eastern Province study** (Bah, Alharthi, El Mhali, 2011): Only **3 of 19** hospitals adopted EHR. They implemented the same EHR system which includes three main modules; **laboratory, radiology, and pharmacy.**

Riyadh (Aldosari, 2014).



EHR Challenges

- * **Financial barriers.**
- * **Physician resistance**
- * **Loss of productivity**
- * **Workflow changes**
- * **Reduced physician-patient interaction**

EHR Challenges

- * **Usability issues:**

- * *“effectiveness, efficiency and satisfaction with which specific users can achieve a specific set of tasks in a particular environment”.*
- * Commercial EHRs might be different that healthcare environment.

- * **Integration and interoperability issues:**

- * Data standards such as HL7

EHR Challenges

- * **Privacy concerns:** hacking into EHRs could result in loss of privacy for thousands, rather than a single paper chart
- * **Legal:**
 - * It is not known if EHRs will increase or decrease malpractice over the long haul
 - * e-iatrogenesis
 - * Clinical documentation
 - * Clinical decision support
- * **Inadequate proof of benefit:** in spite on many published studies, there is not adequate proof that EHRs improve quality of care

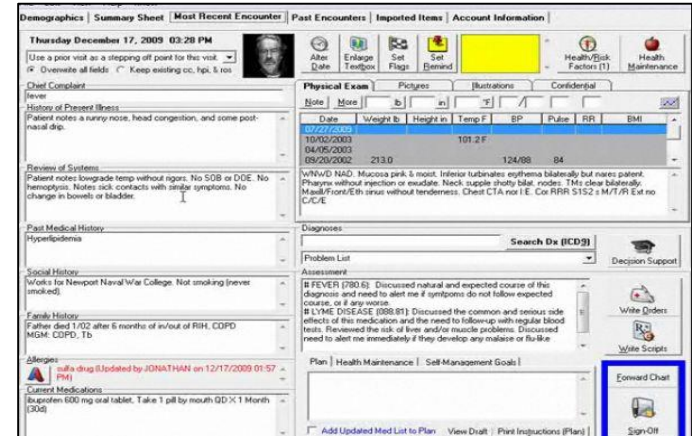
EHR Challenges

- * **Patient safety and unintended consequences:**
 - * not only are studies suggesting improved patient safety mixed, there is evidence that new medical errors may occur (at least in the short term) with EHR use.
 - * “E-iatrogenesis” : medical errors due to technology
 - * Reliability issues

Small EHR Example

Amazing Charts

- * Low cost that includes 3 month free trial
- * Fully featured.
- * #1 EHR for Ease of Use and #1 EHR for Satisfaction
- * Available as a client or web based (ASP) model
- * Appeals to small practices, particularly primary care



Reference: Medscape. (2016). Medscape EHR Report 2016: Physicians Rate Top EHRs. Retrieved 17 September 2019, from <https://www.medscape.com/features/slideShow/public/ehr2016>

Medium EHR Example eClinicalWorks

- * Medium priced for medium sized practices of multiple specialty types
- * More clinician and patient features to include mobile and a health information exchange (HIE) solution

The screenshot displays the eClinicalWorks EHR interface for a patient named Darren, Gary 10 Y, M. The interface is organized into several sections:

- Header:** Patient name, date of birth (04/18/10), gender (Male), and insurance information (Medicare).
- Allergies/Intolerance:** A section for allergies, currently showing "Penicillamine".
- Objective:** A section for vital signs, showing BP 130/90, HR 72, Wt 202, and BMI 27.39.
- Past Results:** A section for lab results, including Lipid Panel, Cholesterol, Triglycerides, HDL Cholesterol, and LDL Cholesterol.
- Examination:** A section for physical examination findings, including General Appearance, HEENT, Neck, Lungs, Heart, Abdomen, Neurologic Exam, and Skin.
- Assessment:** A section for the current assessment, currently blank.
- Lab Results Panel:** A panel on the right side of the screen showing a list of lab results, including TSH, CBC with Differential/Platelet, H. pylori Breath Test, H.PYLORI AB (IGA), PT AND PTT, Creatinine, Serum, Urinalysis, Routine, Dipstick, Serum, and CEC.

The interface includes a navigation bar at the top with tabs for Medical Summary, Orders, Labs, etc. The bottom of the screen shows a standard Windows taskbar with icons for Print, Fax, Record, Lock, Details, Labs, Templates, Claim, Letters, and DA.

Large EHR Example

Epic

- * Intended for very large practices such as Kaiser-Permanente
- * Includes numerous innovations such as a comprehensive patient portal and several mobile solutions

The screenshot displays the Epic EHR interface for a patient named Anderson, Andrea. The interface is divided into several sections:

- Header:** Includes "Chart Talk" and "Patient Saved" status. It shows the current patient's name, "Anderson, Andrea (139-66-7582)", and the referring doctor, "Dr. Sanja Gupta, MD".
- Left Sidebar:** Contains navigation icons for Patients, Visits, Documents, Scheduler, Tools, Import/Export, and Reports.
- Demographics:** Lists patient details such as Age (55 y/o), Sex (Female), Preferred Language (ENGLISH), Race (White), and Ethnicity (Hispanic or Latino).
- Vitals:** Shows Blood Pressure (110/80), Blood (16.3), and Smoking Status (Former smoker).
- Medications:** Lists active medications including Synthroid (levothyroxine), Feldene (piroxicam), Loraz (lorazepam), and Lasix (furosemide) with their respective dosages and dates.
- Allergies:** Lists allergies such as ampicillin and penicillin g potassium.
- Problems:** Lists medical conditions like Malignant Hypertension, Personal History of Urinary Tract Infection, and Hypertension - Primary pulmonary.
- Lab Results:** Shows recent lab results for Hematocrit (45), INR (2.6), Platelet Count (169), and Prothrombin Time (27.4).
- Treatment Plan:** Includes a note from the provider: "I will prescribe Ms. Anderson a small dose of lisinopril and see increase the dose to 10 mg daily to bring her blood pressure within target. I will see Ms. Anderson in a followup evaluation in approximately one year or sooner if the need arises."

Implementing an EHR Steps

Steps:

Pre-implementation:

- * Decision of purchasing EHR.
- * Workflow mapping

Implementation:

- * *Team: clinical champion, project manager, a senior administrative sponsor.*
- * *Tactics*
- * *Technology*

Post-implementation

Conclusions

- * Paper based health records are severely limited
- * In spite of many potential benefits of EHRs, multiple challenges are associated with adoption
- * Planning, training and strategizing about EHRs is more important than the actual EHR brand purchased