3- Paper Medical Record and Electronic Medical Record (EMR)

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- **References:** 436 Doctor's Slides and notes , E.H. Shortliffe and Marsden

Objectives

Not found ☹

Color index

- ■ Doctor's notes
- ■ Extra information and further explanation
- ■ Important
- ■ Main titles
- ■ Subtitles

This slide from doctor's slides   This slide from the book

Traditional Paper-based Medical Record

- **Purpose:** to record observations and could be reminded of patients details

Input sources
History
Notes
Labs
Radiology
Reports
Coding
Others

Output sources

Medical records can be used by healthcare professionals (doctors, surgeons, nurses… etc.), patients themselves, insurance company

❖ **Paper based medical records disadvantage:**

1. Find the record (lost, being used elsewhere)
2. Find data within the record (poorly organized, missing)
3. Read data (legibility)
4. Update data (manual)
5. Record fragmentation
6. Moving records
7. Redundancy (re-enter data in multiple forms)
8. Statistics and Research (can not search across patients)
9. Passive (no automated decision support)

- Paper based medical records doesn't need more time to enter data compare to electronic records

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Documentation

❖ Main purpose of documentation:

1. Remembering what you did and why; form basis for historical record

2. Conveying information to medical team members; support communication among providers

3. Coding and billing

4. Legal issues

5. Anticipate future health problems

6. Record standard preventive measures

7. Identify deviations from expected trends, e.g. growth chart

8. Support clinical research

9. Remembering what was done and why: legibility, ease of search, granularity of information, miss filing, lost chart

❖ Disadvantages:

- Learning curve

- Slower-time

- Security/privacy concerns

- Cost, initial cost, running and maintenance

- Upgrades and depreciation

❖ Role of medical records:

- Transcription

- Coding

- Quality check

- Security

- Administration

- Training

- Research

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degree to which a particular EHR achieves benefits depends on:

A.   comprehensiveness of information :contain information about health as well as illness? Does it include information from all organizations and clinicians who participated in a patient's care?

B.   Duration of use and retention of data :A record that has accumulated patient data over 5 years will be more valuable than one that contains only the last month's records.

C.   Degree of structure of data: Narrative notes stored in electronic health records have the advantage over their paper counterparts in that they can be searched by word. EHR data require structured data. One way to obtain such data is to ask the clinical user to enter information through structured forms whose fields provide dropdown menus or restrict data entry to a controlled vocabulary

D.   Ubiquity of access: system that is accessible from a few sites will be less valuable than one accessible by an authorized user from anywhere .

Purpose of a Patient Record

▪   purpose of a patient record is "to recall observations, to inform others, to instruct students, to gain knowledge, to monitor performance, and to justify interventions. have a single goal—to further the application of health sciences in ways that improve the well-being of patients, including the conduct of research and public health activities that address population health. Electronic Health Record Systems We anticipate that it will carry all of person's health related information from all sources over their lifetime The term electronic health record system(also referred to as a computer-based patient- record system) EHRs include information management tools to provide clinical reminders and alerts, linkages with knowledge sources for health care decision support, and analysis of aggregate data both for care management and for research.

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Deference between Health Record And Paper-Based Record.

1. the EHR is flexible and adaptable Data maybe entered in one format to simplify the input process and then displayed in many different formats according to the user's needs. The entry and display of dates is illustrative. Most EHRs can accept many date formats, i.e. May 1, 1992, 1 May 92, or1/5/92, as input; store that information in one internal format, such as 1992-05-01; and display it in different formats according to local customs. The EHR can incorporate multimedia information, such as radiology images and echocardiographic video loops, which were never part of the traditional medical record.

2. Inaccessibility is a problem with paper records. They can only be in one place and with at most one user at one point in time . In contrast, many users, including patients, can read the same electronic record at once.

3. EHR content more legible and better organized than the paper alternative and the computer can increase the quality of data by applying validity checks as data is being entered. The computer can reduce typographical errors through restricted input menus and spell checking.

EHR system has some disadvantages.

1. It requires a larger initial investment than its paper counterpart due to hardware, software, training,).

2. take time to learn and to change works flows

3. Computer-based systems have the potential for catastrophic failures that could cause extended unavailability of patients' computer records. However, these risks can be mitigated by using fully redundant components, mirrored servers, and battery backup

Medical Records

❖ **Medical records serves a variety of functions for organizations not involved directly in care:**

▪ Insurers (government and private) to justify payment for medical services rendered, and to detect fraud

▪ Quality review, administrative review, and utilization studies to manage the business aspect of healthcare

▪ Used for societal purposes, such as, social service and welfare system management, law enforcement, screening and licensing and determining life insurance eligibility

▪ Medical research, public health management
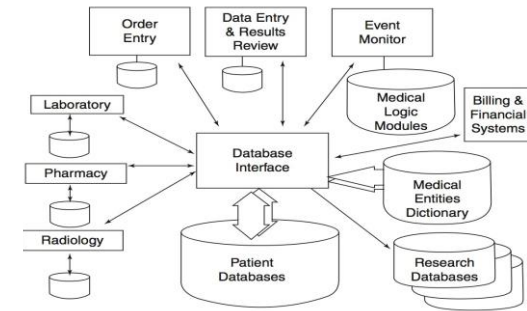
Block Diagram showing multiple systems feeding into patient database. The Database Interface or Interface Engine may perform intelligent filtering, translating and alert functions

Electronic Medical Record (EMR)

▪ A general term describing computer-based patient record systems. It is sometimes extended to include other functions like order entry for medications and tests, amongst other common functions.

▪ EMR (Electronic Medical Record) – the set of databases (lab, pharmacy, radiology, clinical notes, etc.) that contains the health information for patients within a given institution or organization

Electronic Medical Record components:

1. Results reporting
2. Data repository
3. Decision support

4. Clinical messaging and communications e.g. e-mail
5. Documentation
6. Order entry

Electronic health Record

- **Definition: patient specific** repository of electronically maintained information about an individual's health status and healthcare, stored electronically such that it can serve the multiple legitimate uses and users of the record (the physicians)[1].

- **Healthcare Information and Management Systems Society (HIMSS) definition:** longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting (so it is a record that includes the patient's information from birth to death not only for a one hospital nor one health care condition)

- **Electronic Health Record System:** includes the active tools that are used to manage the information. Electronic health record and electronic health system are the same

- Interoperability standards to exchange info outside a single healthcare delivery system

- Supports other care-related activates directly or indirectly (evidence-based decision, support, quality management and outcomes reporting)

- ❖ **Computer-based Patient Record (CPR)**

- Electronic health records is interchangeable with computer-based patient record

- Comprehensive lifetime record

- Attributes identified by the Institute of Medicine (IOM) provide the basis for today's understanding of the EHR.

[1] another definition: a computerized lifelong care record for an individual than incorporate data from all sources that provide treatment for the individual

Electronic Medical Records vs. Paper-Based Records

	Paper record	Electronic Medical Record
Availability and accessibility	One location. If one physician took that records and another physician needs that record they won't find it	Multiple, users in multiple location
Display	One format	Several format
Security	Low	High, especially 1- if there is an audible trial where the administrator can see who see each part of the record at which time 2- put more restriction for the users
Data	Difficult to extract	Should be easy to extract
Legibility (would I be able to read the data?)	Low, maybe because of bad hand writing	More, bc it is written electronically
Duplication of records	Yes. If I was treated in KKUH and got the same condition but went to different hospital, the data will be duplicated	No – can all be linked, so the information will be written once about the same patient
Duplication of tests	Yes. Not just from different hospital but maybe from the same hospital, bc lost of paper	Rare
Patient interaction	None	Full – if desired (if the hospital allowed the patient to enter their health record)

Functional Components of an Electronic Medical Record System

❖ **An EHR is not simply an electronic version of the paper record, it is:**

▪ Integrated view of patient data

▪ Clinician order entry

▪ Clinical decision support

▪ Access to knowledge resources

▪ Integrated communication and reporting support

1. Integrated view of patient data:

- goal of an EHR. However, capturing everything of interest is not possible because: (1) Some patient data do not exist in electronic form like hand-written data in old charts. (2)clinical data that do exist in electronic form but isolated external computer systems like office practice, radiology center, home health agency, nursing homes.(3) Even when electronic and organizational links exist, a fully integrated view of the data may be thwarted by the difference in conceptualization of data among systems from different vendors, and among different installations of one vendor's system in different institutions. important challenge to the construction of an integrated view is the lack of a national patient identifier in the United States. Because each organization assigns its own medical record number, a receiving organization cannot directly file a patient's data that is only identified by a medical record number from an external care organization. Linking schemes based on name, birth date and other patient characteristics must be implemented. Today, most clinical data sources and EHRs can send and receive clinical content as version 2.× Health Level 7 (hl7) messages. Large organizations use interface engines to send, receive, and, when necessary, translate the format of, and the codes within, such messages.

2. Clinician order entry:

- the point at which clinicians make decisions and take actions, and the computer can provide assistance. This will reduce errors and costs .Orders collected directly from the decision maker can be passed in a legible form to the intended recipient without the risk of transcription errors. order entry systems pop up alerts about any interactions or allergies associated with a new drug order. simple orders like "vital signs three times a day," or very complicated orders such as total parenteral nutrition (TPN).Once a clinician order-entry system is adopted by the practice, simply changing the default drug or dosing based on the latest scientific evidence can shift the physician's ordering behavior toward the optimum standard of care

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3. Clinical decision support:

- the practice uses the batch list of patients generated by decision support to contact the patient and encourage him or her to reach a goal or to schedule an appointment for the delivery of suggested care. This is the only mode that can reach patients who repeatedly miss appointments. The best way for the computer to suggest actions that require an order is to present a preconstructed order to the provider who can confirm or reject it with a single key stroke or mouse click. decision support system from Intermountain Health Care that uses a wide range of clinical information to recommend antibiotic choice, dose, and duration of treatment. Clinical alerts attached to a laboratory test result can include suggestions for appropriate follow up or treatments for some abnormalities .

4. Access to knowledge resources:

- Some EHR systems are proactive and present short informational nuggets as a paragraph adjacent to the order item that the clinician has chosen. EHRs can also pull literature, textbook or other sources of information relevant to a particular clinical situation through an Info button

5. Integrated communication and reporting:

- the delivery of patient care requires multiple health care professionals and may cross many organizations; thus, the effectiveness, efficiency, and timeliness of communication among such team members and organizations are increasingly important. Therefore, communication tools should be an integrated part of the EHR system. hospital, and the emergency room should all be linked together not a technical challenge with today's Internet, but still an administrative challenge due to organizational barriers. Connectivity to the patient's home will be increasingly important to patient- provider communication: for delivery of reminders directly to patients, and for home health monitoring, such as home blood pressure and glucose monitor. EHR systems can also help with patient handoffs, during which the responsibility for care is transferred from one clinician to another, receiving clinician understand the patient's problems and treatments.

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Data Capture

- EHRs use two general methods for data capture:

1. electronic interfaces from systems, such as laboratory systems that are already fully automated.

2. direct manual data entry, when no such electronic source exists or it cannot be accessed.

ELECTRONIC INTERFACES :

- Implantation on electronic interfaces between electronic health record (EHR) & existing electronic data sources: pharmacy system, laboratory system, home monitoring devices.

- Easier when organization owns EHR.

Integration

❖ **Integrated view of patient data:**

- Available at anytime anywhere

- Clinical Data has complexity and diversity

- Clinical Data requires different format and terminology

- Requires standards like health level 7 (HL7) to integrate the clinical data. HL7 is a standard that help to send the information as massages from one system to another system

- Local terminologies needs to be translated into standardized terminologies

- Interface Engine helps to become mediator for EHR to be connected to other vendor systems(Tracking system, Imaging system, Medication dispenser etc.) interface engine: I put between each system an interface engine that help me to translate the information from one system to the other system, so I can easily exchange the information between them

- Various views: Flowsheet, Chronological views, Summary Views
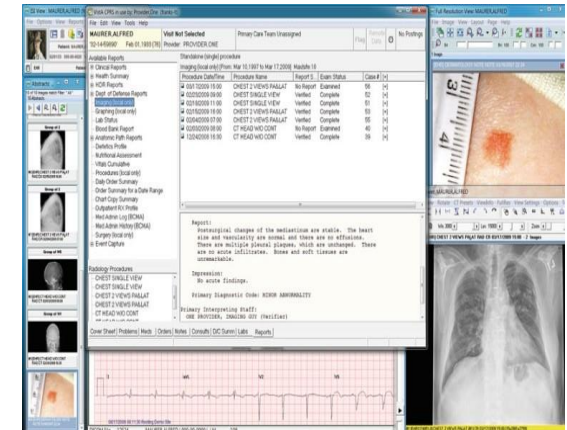
> sometimes not all the information only maintained on the medical record, some of the information I need to take it from other system in the hospital for example the radiology system

❖ **Integrated Communication and Reporting Support (important)[2]:**

- Communication tools could be an integrated part of the EHR system.
- Patient handoffs (when I shift the responsibility from one clinician to another I need to give them a little bet about that patient, this can be send electronically and can includes the patient's summary, treatment plan, do-list of that patient, examination. All this information will help the other physician to make more suggestions)
- Health Information Exchanges (HIE) here the provider caring for the patient could reach beyond his/her local institution to automatically obtain patient information from any place that carried data about the patient

[2] healthcare is usually provided by different healthcare provider and usually between different healthcare organization, so we need a communication tool that helps to identify patient's information and help the referral part to understand the patient condition

Electronic Medical Record (EMR)

❖ **Electronic order entry can improve health care at several levels (computerized physician order entry "CPOE"):**

- Reduce errors and costs. E.g. it will decrease the medication error due to eligible hand writing
- Deliver decision support at the point where clinical decisions are being made. E.g. if the patient have allergy to a medication, if the physician ordered that medication a pup up alert will appear on the system to alert the physician and may also give suggestions of another alternative medication the physician may use

Clinician Order Entry

❖ **Patients benefits:**

1. Decrease wait time for treatment
2. Increased access/control over health information
3. Increased use of best practices/decision support
4. Increased ability to ask informed questions
5. Quicker turnaround time for ordered treatments
6. Greater clarity to discharge instruction
7. Increased responsibility for own care
8. Alerts and reminders for appointments and scheduled tests
9. Increased satisfaction and understanding of choices

▪ **Issue:** When a patient could access his/her own health information like in other online services ? (Pros, Cons)

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Clinician Order Entry

❖ **Data Ownership:**

- Paper medical records are the property of the creators with full responsibilities: storage, accuracy
- Many providers share / update the same electronic data in many sites, who is the responsible owner in EHR?

❖ **Caregiver Resistance:**

1. EHRs are perceived as lacking essential features and awkward/inconvenience to use

2. Some people have been unable /unwilling to use computers !

3. Rather pay penalties than bear EHR implementing cost

4. Professionals don't want to change their "familiar", "traditional" practices

5. May even refuse patients

6. Need "incentives"

❖ **Enabling Factors,** the degree to which a particular EHR achieves benefits depends on several factors:

- **Comprehensiveness of information**, it means: 1-does the EHR covers all setting office, practice, hospital, inpatient, outpatient or it is only implemented for inpatient and the outpatient still have paper record 2- does it includes all the clinical data, e.g. laboratory tests, medications details.
- **Duration of use and retention of data**, so if the EHR system in the hospital for 5 years I have more information about that patient and I can make better decision

- **Degree of structure of data.** The computer can only understand structure data -bc it is coded- so when there is less structured data the computer will not be able to extract the information directly from the record
- **Ubiquity of access.** If the system can be assessable just in the hospital, the physician cannot go and look to the patient record if he/she at home, so the physician cannot make decision or allocate them selves about their patient

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Manual Data Entry

❖ **Data may be entered as:**

- Narrative free-text

- Codes: used for Diagnoses, Allergies, Problems, Orders ,and Medications.

- Combination (Narrative free-text and codes)

The coding of diagnosis, allergies etc. is of special importance using a process called Auto-complete, this process can be fast and efficient when the computer includes a full range of synonyms and has frequency statistics (short list of most frequently occurring items)

❖ **Major advantages of Coding :**

Coding makes the data "understandable" for the computer thus enabling:

- Selective retrieval of data

- Clinical research

- Quality improvement

- Clinical operations management

Physicians-Entered Data

Physicians spend 20% of their time documenting the clinical encounter. **A physicians notes can be entered into EHR via:**

- **Dictation with transcription:** It's a common approach for entering narrative information. **Speech recognition** offers an approach to dictating without the cost or delay of transcription.

- **Structure Encounter Form:** Physicians record information on a structured encounter form from which their notes are transcribed or possibly scanned.

- **Direct Entry of data:** Care providers enter data into the computer directly.

❖ **Direct entry of data through Physicians/Care providers :**

- *Advantages*
    1. 1Immediately checks entry for consistency with previously stored information
    2. Ask for additional detail or dimensions conditional to the information just entered
    3. Some of this data will be entered into fields which require selection from pre-specified menus. For ease of entry, such menus should not be very long, require scrolling, or impose a rigid hierarchy

- *Disadvantages*
    1. A major issue associated with direct entry is Time cost.
    2. Generate excessive boilerplate and discourage specificity

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Quality improvement activities enable by EHR

1. Enhance provider communication
2. Analyze aggregate clinical information
3. Adherence to clinical guidelines
4. Enhance real-time reporting capability

Fundamental Issues

❖ **Data Validation**

- Range checks (out of range value)

- Pattern checks

- Computed checks (values have the correct mathematical relationship, e.g. if I put three things in percentage the computer will make sure the sum of these three equal 100%)

- Consistency checks: detect errors by comparing entered date (e.g. if the doctor put the diagnosis of prostate cancer while the patient is female, so the system will give the physician an error)

- Delta checks (large and unlikely differences between the values)

- Spelling checks

❖ **Query and Surveillance Systems**

- Find records of patients that satisfy pre-specified criteria and export selected data. For example in this hospital I want to know all patients how are female, hypertensive, diabetic and + 50 years old, so I can export all these women's record and get the information from it, this is can be done for:

1. Clinical care
2. Clinical research
3. Quality reporting
4. Retrospective studies
5. Administration (e.g. resource consumption)
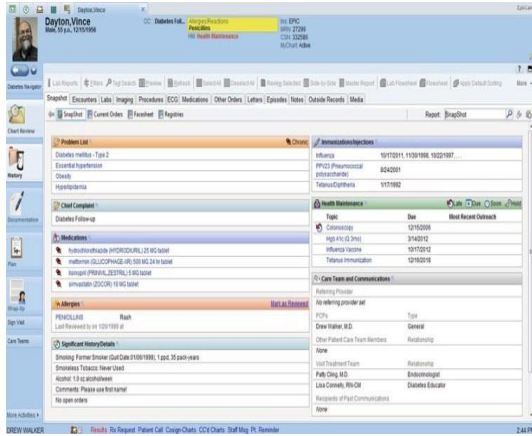
Fundamental Issues

- **Data display:** Once stored in the computer, data can be presented in numerous formats for different purposes without further entry work
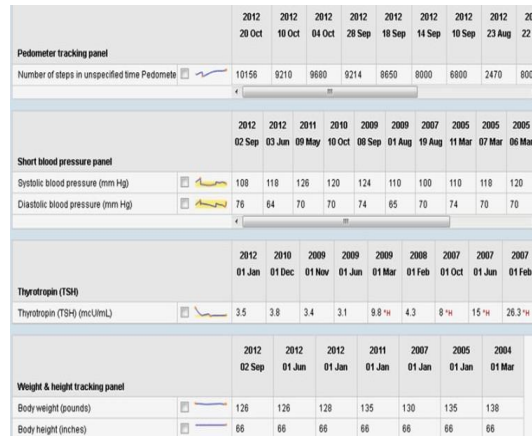
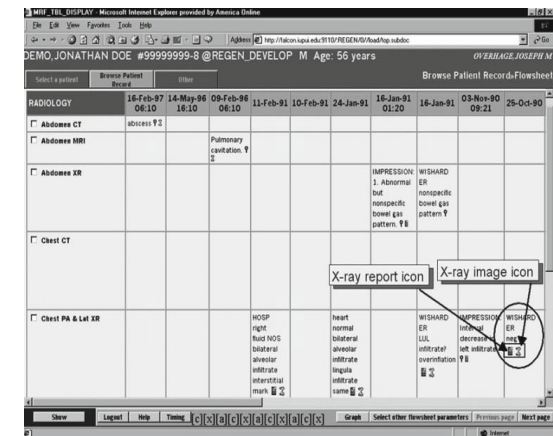| Summaries and Snapshots	Timeline graphs	Timeline flowsheets
Can highlight all the important allergies, active problems, active treatment and recent observation for that patient in one screen	A graphical presentation can help the physician to assimilate the information quickly and draw conclusions (Sparklines)	radiology impressions with the rows representing different kinds of radiology examinations and the columns representing study dates.

- **Dynamic Search (important)**
  - Search tools help the physician to locate relevant data. (e.g. to see whether the patient had done a certain test and what was the result, or whether the patient took the treatment, or if the patient response well to the treatment)
  - The EHR can then display these data as specialized presentation formats (e.g., flowsheets or graphics).

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Open Data Interface (ODI)
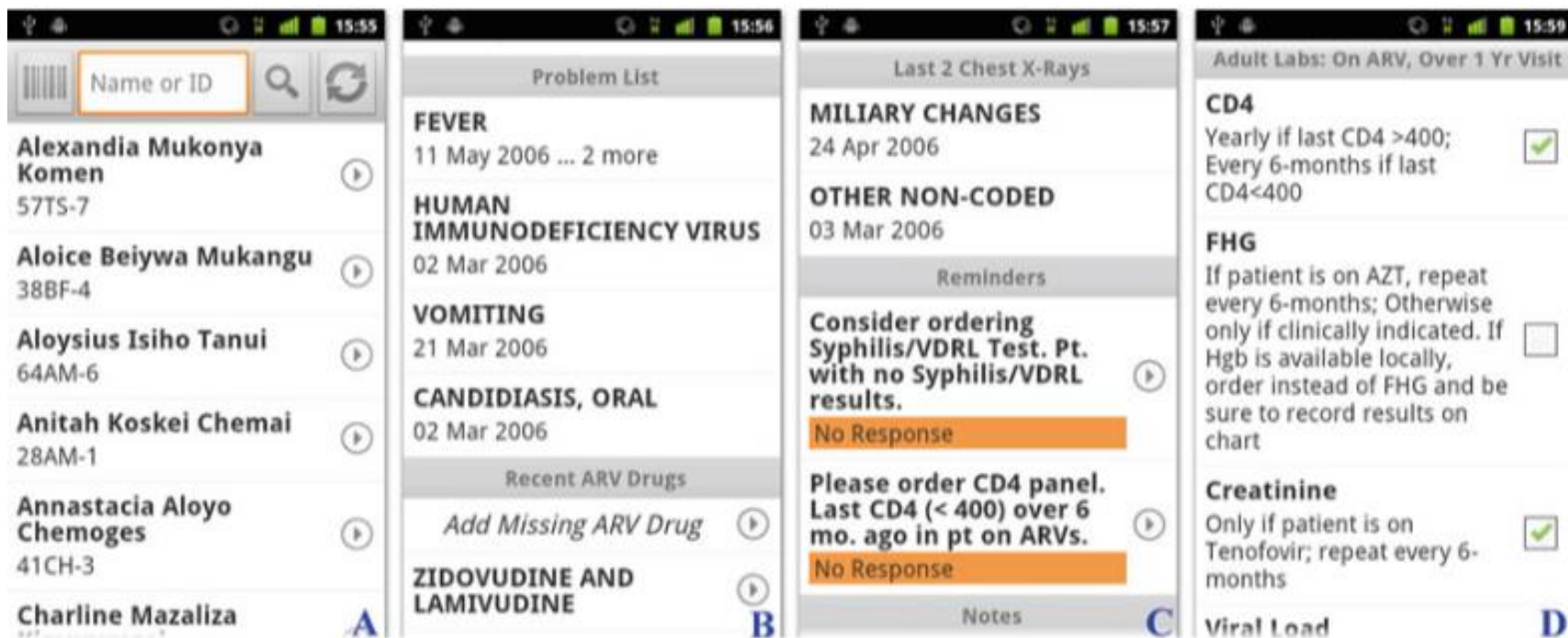
Tablets and smart phones provide new opportunities for data capture by clinical personnel including physicians.

Figure 12.11 shows four screen shots from a medical record application of ODI. The first *(Fig. 12.11a)* is the patient selection screen. After choosing a patient, the user can view a summary of the patient's medical record. Scrolling is usually required to view the whole summary. *Figure 12.11b,c* show screen shots of two portions of the summary. and *(d)* specific lab data from an OpenMRS electronic medical record system

What to Do About Data Recorded on Paper Before the Installation of the EHR ?

- One approach is *to interface the EHR to available electronic sources*—such as a dictation service, pharmacy systems, and laboratory information systems—and load data from these sources for 6–12 months before going live with the EHR.

- Second approach is to abstract selected data, such as key laboratory results, the problem lists, and active medications from the paper record and hand enter those data into EHR prior to patients visit.

- Third approach is to scan and store 1–2 years of the old paper records. This approach can be applied to any kind of document including handwritten records, produced prior to EHR instalment.

- **Optical Character Recognition** (**OCR**) capability is built into most document scanners today, and converts typed text within scanned documents to computer understandable text with 98–99 % character accuracy.

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Data validation

Because of the chance of transcription errors with the hand entry of data, EHR systems must apply **validity checks** scrupulously. A number of different kinds of checks apply to clinical data

Range
Can detect or prevent entry of values that are out of range (e.g., a serum potassium level of 50.0 mmol/L— the normal range for healthy individuals is 3.5– 5.0 mol/L)

Pattern
Can verify that the entered data have a required pattern (e.g., the three digits, hyphen, and four digits of a local telephone number).

Computed
Can verify that values have the correct mathematical relationship (e.g., white blood cell differential counts, reported as percentages, must sum to 100)

Consistency
Can detect errors by comparing entered data (e.g., the recording of cancer of the prostate as the diagnosis for a female patient).

Delta
Warn of large and unlikely differences between the values of a new result and of the previous observations (e.g., a recorded weight that changes by 100 lb in 2 weeks)

Spelling
Can verify the spelling of individual words.

Data Display

- Once stored in the computer, data can be presented in numerous formats for different purposes without further entry work

- Advanced web security features such as Transport Layer Security (TLS) — a revised designation for Secure Sockets Layer (SSL) — can ensure the confidentiality of any such data transmitted over the Internet.

Challenges ahead

- **Users information needs** (developers must understand the needs and workflows of a clinician)

- **Usability** (an efficient and intuitive interface)

- **Standards** (uniform standards are essential for systems to incorporate and exchange data in meaningful ways)

- **Privacy and security** (HIPAA and HITECH have established and enhanced confidentiality of individually identifiable health information)

- **Costs and Benefits**

- **Leadership** (Leaders from all segments of the health care industry must work together to articulate the needs, to define the standards, to fund the development, to implement the social change, and to write the laws to accelerate the development and routine use of EHR systems in health care.)

Barriers of EHR in Saudi Arabia

- **Human Barriers:** -lake of Awareness of the importance and benefits of EHR. – lake of Knowledge and experience of using EHRs Experience of computer applications. -Negative beliefs and impressions about EHRs and about their ability to use EHRs.

- **Financial Barriers:** -High initial cost of EHRs implementation and upgrading. -High operation and maintenance costs of EHRs. -Lack of feasibility studies[3] that show the benefits versus costs of implementing and using EHRs.

- **Legal and regulatory barriers:** -Lack of policies that govern EHRs on both hospital and national levels. -Using EHRs may threaten confidentiality of health information.

- **Organizational barriers:** -Workflow needs redesign to match with EHRs[4]. -Hospital management doesn't have the necessary experience to choose & implement the best EHRs. -Hospital management doesn't provide the necessary training for the staff on using EHRs.

- **Technical barriers:** -Computers and networks have a lot of maintenance problems. -EHRs are not satisfying different users' needs[5]. The main difficulty with EHRs is data entry and data retrieval (staff think handwriting is easier for them, to solve this problem we can use software like touch screen, hand-held device, voice recognition).

- **Professional barriers:** -Lack of motivation to learn and train on using EHRs. -EHRs slows down work/decreases productivity.

Future Trends of EHR

- Patient access will increase

- Cloud technology for EHR. Instead of having services or hardware, I can put it on cloud

- Movement toward a nationalized database. Enable having .. medical record for each patient so we will not duplicate the record in different health organization

- Mobile accessibility.

[3] before the implementation we conduct the feasibility study to compare between benefits and costs
[4] because I can't imagine having a paper record and conducting a specific process I can copy and past that to the EHR system absolutely not, I should redesign the workflow and my process to make sure there is no duplication of the process after having EHR system
[5] I can solve it by doing requirement analysis before implanting EHR system by asking the staff what is the most important features they need

Questions

1. computer-based patient record systems. It is sometimes extended to include other functions like order entry for medications and tests , amongst other common functions. Definition of?

A. Electronic medical record   B. Electronic heath record   C. Medical informatics   D. Health and technology system

2. All are Barriers of EHR in Saudi Arabia except one:

A. Legal and regulatory barriers   B. Human Barriers   C. Professional barriers   D. Ethical barriers

3. Chose the right Component of EMR :

A.   Decision support   B. Quality reporting   C. Coding   D. Billing

4. Offices, the hospital, and the emergency room should all be linked together, which of the following is the main barrier that prevent such linkage ?

A. Ethical barriers   B. technical barriers   C. Organizational barriers   D. Regulatory barriers

5. Which one is a Functional Component of EMR System ?

A. Clinician order entry   B. patient decision support   C. Quality reporting   D Documentation

6. a repository of electronically maintained information about an individual's Health status and health care, stored such that it can serve the multiple legitimate uses and users of the record. Define which of the following ?

A. Electronic medical record   B. Electronic heath record   C. Medical informatics   D. Health and technology system

1. A
2. D
3. A
4. C
5. A
6. B

FEEDBACK