Examples of the Electronic Health Record (EHR)

• Using the Veterans Health Information Systems and Technology Architecture (VistA)
• Why VistA?
  – State-of-the-art EHR that has transformed healthcare in the Veteran’s Health Administration (VHA) (Perlin, 2006; Byrne, 2010)
  – Not that pretty, but has all of the modern features of the EHR, e.g., clinical decision support (CDS), computerized provider order entry (CPOE), etc.
  – Distributed under open-source model, unlike most other vendors who do not even allow screen shots to be shown outside their customers’ institutions
• Fascinating story (Allen, 2017), but VistA now being phased out in favor of Cerner EHR adopted by Department of Defense (VA, 2017)
  – https://www.ehrm.va.gov/
Some details about VistA

- Server written in M (formerly called MUMPS), accessed via command-line interface
  - Runs in commercial Intersystems Cache (on many platforms) or open-source GT.M (Linux only)
- Client (called CPRS) written in Delphi and provides graphical user interface
  - Only runs on Windows (just about all versions)

Logging on to CPRS, the front end to VistA
Choosing a patient

![Patient Selection Screen]

Cover sheet – overview

![Cover Sheet Overview]

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**Patient Selection Screen**

- **Patient List**
  - Options: None, Providers, Clinics, Teams/Personal, Words, Specialties

- **Patients (All Patients)**
  - Filters: Eighteen, Inpatient, Eight, Outpatient, Eight, Patient, Eighteen, Inpatient, Eight, Outpatient

- **Notifications**
  - Info, Location, Urgency, Alert Date/Time, Message

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**Cover Sheet Overview**

- **SEVEN, INPATIENT**
  - Department: 3 W, Unit 3901
  - Provider: DOCTOR, One

- **Active Problems**
  - Fatigue
  - Hypertrophy, benign growth of prostate without urinary obstruction
  - Malignancy and transplacentat fibroid, history of dental implants

- **Medications**
  - No active medications found

- **Recent Lab Results**
  - No orders found

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*WhatIs5*
Drilling down to details of a problem

Details of an allergy
Viewing vital signs over time

More details on problems
List of active orders

Viewing the patient’s notes
Writing a new note

WhatIs5

Viewing labs

WhatIs5
Including critical values

More information on lab tests
Including (for some) cost

Another patient
Clinical decision support: reminders

Clinical decision support uses allergy information
Let’s try to prescribe a medication

How about some amoxicillin?
Oops, patient is allergic

Maybe erythromycin?
No, interacts with statin drugs

Another patient – drug interactions
Prescribing nitrates for angina

Oops!

CRITICAL drug-drug interaction. NITROGLYCERIN & SILDENAFIL CITRATE [SILDENAFIL TAB 50MG TAKE ONE TABLET BY MOUTH AS NEEDED] (PENDING)
More about VistA

• Pure open-source version is also known as FOIA VistA
• There are two other streams of VistA activity
  – WorldVistA (http://worldvista.org/) follows a more traditional open-source pathway
  – OpenVista (http://osehr.org/) is more commercially oriented, and some vendors have proprietary extensions from the base code (e.g., https://www.medsphere.com/)
• Transition to Cerner with Department of Defense is proceeding, starting in Pacific Northwest and slated to take 8-10 years
  – https://www.va.gov/opa/pressrel/pressrelease.cfm?id=5286

Other open-source EHRs

• Most recent analysis of free and open-source EHR systems found 54 systems implemented or under development (Alsaffar, 2017)
  – Many downloads but tiny operational usage
• Only two currently have ONC certification
  – OpenEMR – https://www.open-emr.org/
• More use of other noteworthy systems
  – Indian Health Service Resource and Patient Management System (RPMS) – derived from VistA; future unclear (HIS, 2019; Cullen, 2020)
    • http://www.ihs.gov/rpms/
  – OpenMRS – https://openmrs.org/
  – OpenEHR – https://www.openehr.org/
  – LibreHealth – https://librehealth.io/
Despite appeal of open source, market belongs to commercial vendors

- Halamka (aka, Geek Doctor) notes “Era of Epic,” where integration and vendor performance trump innovation and “best of breed” (Halamka, 2013)
  - Epic (https://www.epic.com/) dominates high end of market, e.g., academic and other large medical centers
  - “No one ever got fired for buying Epic”
  - Epic methodology focuses on workflow, meaningful use
  - Product cycle creates effective demand management
- Epic is privately held, 40 years old, and run by Judy Faulker (Newman, 2019)
- Early research-oriented “home grown” EHR systems have given way to commercial systems (Hersh, 2017)
Who leads hospital EHR marketplace in US (Drees, 2019)?

• From KLAS Research 2019 US Hospital EMR Market Share report of 5,447 acute care hospitals, vendor market share
  – Epic – 28%
  – Cerner – 26%
  – Meditech – 16%
  – CPSI – 9%
  – Allscripts – 6%
  – Medhost – 4%
  – athenahealth – 2%
  – None/other – 9%
• Four vendors provided service to hospitals with 500+ beds in 2018
  – Epic – 163
  – Cerner – 77
  – Allscripts – 16
  – Meditech – 12