Examples of the 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)
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

![Login screen to VistA](image-url)
Choosing a patient

Cover sheet – overview
Drilling down to details of a problem

Details of an allergy
Viewing vital signs over time

More details on problems
List of active orders

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<tr>
<th>Order</th>
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<th>Provider</th>
<th>Service</th>
<th>Notes</th>
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<td>Doctor O</td>
<td>Lab</td>
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<td>05/03/11 11:00</td>
<td>Doctor O</td>
<td>Lab</td>
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Viewing the patient’s notes

Last 100 Signed Notes
- Aug 27, 2010: Notes from Lactation Consultant
- Aug 26, 2010: Notes from Pediatrist
- Aug 25, 2010: Notes from General Medicine
- Aug 24, 2010: Notes from General Surgery
- Aug 23, 2010: Emergency Department Notes

Next Note:
- Aug 24, 2010: Notes from General Medicine
- Aug 23, 2010: Emergency Department Notes
- Aug 22, 2010: Notes from General Surgery
### Writing a new note

- **7**

### Viewing labs

- **13**
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]]
Some more about VistA

- Pure open-source version is also known as FOIA VistA
- There are two other streams of VistA activity
  - WorldVistA ([www.worldvista.org](http://www.worldvista.org)) follows a more traditional open-source pathway
  - OpenVista ([https://sourceforge.net/projects/openvista/](https://sourceforge.net/projects/openvista/)) is more commercially oriented, and some vendors have proprietary extensions from the base code (e.g., [www.medsphere.com](http://www.medsphere.com))

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 – [www.open-emr.org](http://www.open-emr.org)
- More use of other noteworthy systems
  - OpenMRS – [http://openmrs.org](http://openmrs.org)
  - OpenEHR – [https://www.openehr.org/](https://www.openehr.org/)
  - LibreHealth – [https://librehealth.io/](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 (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

- Early research-oriented “home grown” EHR systems have given way to commercial systems (Hersh, 2017)


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Who leads the hospital EHR marketplace in the US?