Electronic Medical Records
From Paperless to Big Data Initiatives

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Agenda

• Introduction
• Electronic Medial Records – Experience Sharing
• Beyond EMR

http://cdn.24x7mag.com/x7mag/2014/03/robot-stethoscope.jpg
Komes Chandavimol
Wanna be a Doctor
Healthcare Analytics Consultant @M4SC
Data Scientist @Data Science Lab, Thailand
Electronic Medical Records

- An electronic medical record (EMR) is a digital version of the traditional paper-based medical record for an individual.

http://health.usnews.com/health-news/most-connected-hospitals/articles/2011/07/18/most-connected-hospitals
Paperless

Electronic Medical Records

- Paperless
- Basic EMR
- Integrated EMR
- Meaningful Uses
- EMR + Big Data

http://ehnusa.com/solution/problem
Software

EMR Software helps doctors and medical professionals keep track of health-related information for their patients and give staff access to these records through centralized electronic systems.

http://www.healthcareitnews.com/sites/default/files/hitn_ehr.jpg
http://www.capterra.com/infographics/top-emr-software
• As of 2015 Epic has 315 customers.
• 54% of patients in the United States*
• This includes 69% of Stage 7 U.S. Hospitals, 71% of children's hospitals, and 83% of Stage 7 Clinics
• Employee 9000+
• Found in Verona, Wisconsin

http://learnhealthtech.com/epic-systems-modules/
https://en.wikipedia.org/wiki/Epic_Systems#cite_note-12
Epic Modules

Emergency

R

S

Epic Care

ADT

Inpatient

Revenue Cycle

HB

PB

http://learnhealthtech.com/epic-systems-modules/
Epic System

Epic Reporting System

Epic System หน้าจอของแพทย์

http://www.epic.com/
Epic System หน้าจอข้อมูลคนไข้

http://www.epic.com/
Electronic Medical Records

- Basic EMR
- Integrated EMR
- Meaningful Uses
- EMR + Big Data

http://ehnusa.com/solution/problem
• Nemours ประกอบด้วย 3 กลุ่มโรงพยาบาล
  – Nemours Alfred I. duPont Hospital for Children (129 Beds)
  – Nemours Children's Clinics, Jacksonville, Florida
  – Nemours Children’s Hospital, Orlando, Florida

• เป็นกลุ่มโรงพยาบาลแรกๆ ของอเมริกาที่ลงระบบ Electronic Medical Records (2002)

• เริ่มต้นมีทีม 3-4 คน และขยายเพิ่มมากเพื่อรับความต้องการของลูกค้า ทั้งในด้านคนเตรียมรายงาน และ  คนดูและระบบ EMR System
Lessons Learn

The promise is that they're going to help us deliver better care with better outcomes. But you can't just have an EMR—you have to learn to use the tools in the right way.

http://health.usnews.com/health-news/most-connected-hospitals/articles/2011/07/18/most-connected-hospitals
Lessons Learn

Assembling the **Right** EHR Project Teams

- A “Clinical Champion”
- An EHR Project Manager
- Evaluation & Selection Team Members
- EHR Implementation Team Members

Nemours – Children Hospital

Registration/Scheduling Reports

Revenue Cycle Reports

Clinical Reports

RVU-based Reports
Physician Group (University of Illinois)

- University of Illinois Medical แยกบริษัทออกมาเพื่อบริหารรายรับ รายจ่าย ของแพทย์
- เน้นการให้บริการข้อมูล EMR สำหรับรายรับ รายจ่ายของแพทย์ (Revenue Cycle)

- Anesthesiology
- Dermatology
- Emergency Medicine
- Family Medicine
- Medicine
- Neurology
- Neurosurgery
- Obstetrics and Gynecology
- Orthopedics
- Otolaryngology
- Pathology
- Pediatrics
- Pharmacology
- Psychiatry
- Radiology
- Surgery
- Urology
Physician Group (University of Illinois)

- Anesthesiology
- Dermatology
- Emergency Medicine
- Family Medicine
- Medicine
- Neurology
- Neurosurgery
- Obstetrics and Gynecology
- Orthopedics
- Otolaryngology
- Pathology
- Pediatrics
- Pharmacology
- Psychiatry
- Radiology
- Surgery
- Urology

Credit: SAP Business Object software, www.sap.com
Seattle Children Hospital

Safety Net Payment Reimbursement

• Flat rate per patient visit
• 6.3%, 7% increased reimbursement rates

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4242845/
Cedars-Sinai Medical Center

- Non-profit, tertiary 958-bed hospital and multi-specialty academic health science center
- พัฒนาระบบเดิม และเพิ่มเติมระบบใหม่ เพื่อรองรับความต้องการทางข้อมูล

Legacy System

Inpatient

Emergency

Legacy System

http://clinfowiki.org/wiki/index.php/Epic
Percentage of office-based physicians with EHR systems: United States, 2001–2013

SOURCE: CDC/NCHS, National Ambulatory Medical Care Survey and National Ambulatory Medical Care Survey, Electronic Health Records Survey.
The Medicare and Medicaid Electronic Health Records (EHR) Incentive Programs will provide incentive payments to eligible **PROFESSIONALS** and eligible **HOSPITALS** as they demonstrate adoption, implementation, upgrading, or meaningful use of certified EHR technology.

### Penalties

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015+</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>$15,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>$12,000</td>
<td>$18,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>$8,000</td>
<td>$12,000</td>
<td>$15,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>$4,000</td>
<td>$8,000</td>
<td>$12,000</td>
<td>$12,000</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>$2,000</td>
<td>$4,000</td>
<td>$8,000</td>
<td>$8,000</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>$0</td>
<td>$2,000</td>
<td>$4,000</td>
<td>$4,000</td>
<td></td>
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<tr>
<td>2017</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
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</tr>
<tr>
<td>TOTAL</td>
<td>$44,000</td>
<td>$44,000</td>
<td>$39,000</td>
<td>$24,000</td>
<td>$0</td>
</tr>
</tbody>
</table>

*Note: Years are calendar years  **Penalties for non-participation

Penalties:
- 1% penalty**
- 2% penalty**
- 3% penalty**
"ALL THESE EFFORTS ARE ... TO SEND THE MESSAGE THAT WE WANT TO START PAYING FOR THE THINGS THAT SHOULD BE HAPPENING IN THE HEALTHCARE SYSTEM."

—STUART GUTERMAN, VICE PRESIDENT OF MEDICARE AND COST CONTROL, THE COMMONWEALTH FUND

“MEANINGFUL USE”

"It is very important to have measurement drive us in the right direction."

—ANITA UNG, M.D., medical director for quality improvement and quality measurement at Atrius Health

How to Award the Incentive?

Measurement?

http://www.sfms.org/NewsPublication/SFMSBlog/TabId/467/PostId/1179/mu-audit-ca.aspx
Core Measure for MU

The goal of "core measures," is not to measure. Rather, it's to drive improved performance across health care organizations and depending on whom you ask, it's to police hospitals to ensure certain patients are treated in line with what has been determined to be standard and necessary based on their diagnosis.

Core Measures

- Acute Myocardial Infarction (AMI) – Heart Attack
- Heart Failure
- Pneumonia
- Surgical Care Improvement Project (SCIP)
- Computerized Provider Order Entry (CPOE)

Meaningful Use of Data

**CPOE**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Stage 1</th>
<th>Stage 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use CPOE for medication orders directly entered by any licensed healthcare professional who can enter orders into the medical record per state, local and professional guidelines</td>
<td>Use computerized provider order entry (CPOE) for medication, <em>laboratory and radiology orders</em> directly entered by any licensed healthcare professional who can enter orders into the medical record per state, local and professional guidelines</td>
<td></td>
</tr>
</tbody>
</table>

| Measure | More than 30% of unique patients with at least one medication in their medication list seen by the EP have at least one medication order entered using CPOE | More than 60% of medication, 30% of *laboratory, and 30% of radiology orders* created by the EP during the EHR reporting period are recorded using CPOE |

*Note:* On August 23, 2012, CMS announced the Meaningful Use Stage 2 final rule which also impacted the Stage 1 CPOE measure. See the [Stage 1 CPOE Changes as of August 2012](http://www.huffingtonpost.com/janet-dillione/easing-core-measure-pain-_b_1573695.html) for more information.

<table>
<thead>
<tr>
<th>Core</th>
<th>Compliance</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPOE for Medication Orders</td>
<td>0%</td>
<td>30%</td>
</tr>
<tr>
<td>Maintain Problem List</td>
<td>100%</td>
<td>80%</td>
</tr>
<tr>
<td>Maintain an up-to-date problem list of current and active diagnoses</td>
<td>Numerator: 1</td>
<td></td>
</tr>
<tr>
<td>For each patient seen during the measurement period, add a diagnosis to the patient’s Problem List or indicate the patient has no problems by checking the “no problems” checkbox</td>
<td>Denominator: 1</td>
<td></td>
</tr>
<tr>
<td>e-Prescribing (eRx)</td>
<td>0%</td>
<td>40%</td>
</tr>
<tr>
<td>Active Medication List</td>
<td>100%</td>
<td>80%</td>
</tr>
<tr>
<td>Medication Allergy List</td>
<td>100%</td>
<td>80%</td>
</tr>
<tr>
<td>Record Demographics</td>
<td>100%</td>
<td>50%</td>
</tr>
<tr>
<td>Record Vital Signs</td>
<td>100%</td>
<td>50%</td>
</tr>
<tr>
<td>Record Smoking Status</td>
<td>100%</td>
<td>50%</td>
</tr>
<tr>
<td>Clinical Quality Measures (CQMs)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Clinical Decision Support Rule</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Electronic Copy of Health Information</td>
<td>100%</td>
<td>50%</td>
</tr>
<tr>
<td>Clinical Summaries</td>
<td>100%</td>
<td>50%</td>
</tr>
<tr>
<td>Electronic Exchange of Clinical Information</td>
<td>No</td>
<td>Once</td>
</tr>
<tr>
<td>Protect Electronic Health Information</td>
<td>Yes</td>
<td>Once</td>
</tr>
</tbody>
</table>

EHR ➡️ $$$
12 hospitals, 27 Senior care facilities,
6 Urgent care/immediate care centers
Presence Medical Group

Hospital with 191 beds

Sutter Health
We Plus You

24 acute care hospitals
8 physician foundations
Cancer centers, Long-term Care
University, Research institutes

Credit Resurrection Healthcare, Sutter Health, Children Hospital Oakland  www.wiki.com
The impact of Meaningful Uses!

### Office-based Physician Use of EHR Systems

![Line graph showing the increase in use of EHR systems from 2001 to 2014.]

### US Physician Use of EHR Systems

![Bar chart showing the increase in use of EHR systems from 2013 to 2015.]

[Datasource: datascience@berkeley]
A U.S. company, MedWatcher, is having an important impact on public health and accountability. Using data from the Food and Drug Administration, MedWatcher maintains a database of adverse side effects reported from different drugs. Though the company is still building its database, it will eventually serve as an important tool for patients in choosing between drug treatment programs.

Healthgrades is a U.S. service comparing healthcare providers, including hospitals, nursing homes, physicians and dentists based upon open patient safety data. Its ratings aim, for instance, to inform patients about where they are more likely to survive their hospitalization or encounter the least risk of major complications.²

US company WiserTogether gathers open data through its Wiser Health Platform from consumers and doctors who have encountered similar medical issues and creates a list of best options based on clinical efficacy, financial considerations and treatment preferences. The aim of its products, using crowdsourced information, is to help patients “choose the right care at the right time” and make “evidence-based, cost-effective treatment decisions that are aligned to their personal preferences and
Healthcare Startup

Rothman Index (RI): The Universal Patient Score

- All Patients
- Automated Calculation
- Real Time
- Disease Agnostic
- No Manual Data Entry
- Common Clinical Language
- Integrated with EHR
- Criteria: 50+ Measures
  - Physiological
  - Clinical Assessments
  - Lab Results
  - Includes measures of previous score algorithms
  - Built on Heuristic Modeling

EXISTING EHR DATA
Labs
Vitals
Clinical Assessments

“ROTHMAN INDEX” Single Numeric Score

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Data Science Experience Sharing, Big Data Challenge #2, Bangkok Thailand
Quality of Hospital Care

Reduce Rate of Readmission
1. Collecting EHR
2. Integrate financial and clinical data
3. Structure the data elements Diagnosis, Procedure, Billing information, patient info)
4. Predictive Modeling Attached a risk score % to readmit)

Credit: Adventis Medical Center (demo)
• 17,791 physicians
• 9 millions patients
• 49,778 nurses,

30 petabytes of EMR data
• 38 medical centers
• 620 medical offices

3000+ IT staff

Lessons Learn

The promise is that they're going to help us deliver better care with better outcomes. But you can't just *have* an EMR—you have to learn to use the tools in the right way.

Meaningful  Within the right team
Lessons Learn

Assembling the Right EHR Project Teams

• A “Clinical Champion” Within the right supports
• An EHR Project Manager Within knowledge, skills
• Evaluation & Selection Team Members With teamwork
• EHR Implementation Team Members With experience

Electronic Medical Records

- Basic EMR
- Integrated EMR
- Meaningful Uses
- EMR + Big Data

http://ehnusa.com/solution/problem
Implement **HealthConnect**, the new computer system to ensure data exchange across all medical facilities and promote the use of electronic health records.

The integrated system has improved outcomes in cardiovascular disease and achieved an estimated $1 billion in savings from reduced office visits and lab tests.

Credit Kaiser Permanente, [www.kp.com](http://www.kp.com) [www.wiki.com](http://www.wiki.com)
• Need a solution to manage and extract valuable insights from vast amounts of complex data.

• Implement an emergency dashboard system to track patients and populations across all visits and interactions. This dashboard enables Seattle Children’s to analyze massive volumes of hospital and patient data to gain a holistic view and improve care.

This dashboard enables Seattle Children’s to analyze massive volumes of hospital and patient data to gain a holistic view and improve care.

The enterprise master patient index or EMPI that allows for "patient centric" care

Using the Master Data Management to integrate several patient-related records and identify the single Patient ID. This benefits to Sutter Health Facilities and affiliates to understand patient data and provide the right care

Epic with the patient at the heart

- Patient Engagement
- Clinicals
- Government Regulations
- Community Connect
- Care at a Distance
- Interoperability
- Revenue Cycle
- Specialties
- Population Health

Credit: www.epic.com
The Future: Connecting Health to Care

The Future: Connecting Health to Care

A Shared Nationwide Interoperability Roadmap

Shared Nationwide Interoperability Roadmap: The Journey to Better Health and Care

The nation relies on Health IT to securely, efficiently and effectively share electronic health information with patient consent to achieve better care, smarter spending and healthier people. Interoperability will transform our health system from a static one to a learning health system that improves individual, community and population health.

Where We Are

94% of non-federal acute care hospitals use a certified EHR to collect electronic data about patients.1

78% of office-based physicians use an EHR system to collect electronic patient data.1

1 in 3 Number of consumers burdened with providing their own health information when seeking care for a medical problem (such as a test result or medical history).2

STATE LINE

Most states have different laws and regulations making it difficult to share health information across state lines.

7 The number of providers a typical Medicare beneficiary sees annually.4

By the end of 2017

The majority of individuals and providers can send, receive, find, and use a common set of clinical information.

IN 3 YEARS

SPEED BUMPS TO INTEROPERABILITY

Health information is not sufficiently standardized

Aligning payment incentives

Misinterpretation and differences in existing privacy laws

Lack of trust

51% Only half of hospitals can electronically search for critical health information from outside sources (such as in an emergency or office visit).5

14% of office-based providers electronically share patient information with other providers.9

62% In 2013, more than six in ten hospitals electronically exchanged health information with providers outside of their system.3

Taking a leisurely 17 years for evidence to go from research to practice.4

1 in 8 the number of Americans in 2013 who tracked a health metric like blood pressure.
Where We Are Going

Determinants of Health

- Social
- Diet and Exercise
- Health Care System
- Economic
- Environmental

80%-90%

of health determinants are NOT related to health care.

By the end of 2020

Connecting an expanded set of users and data sources through the use of mHealth and wearables. Advances in the sharing and use of patient-generated health data leads to consumer empowerment, person-centered care, active individual health management and greater information sharing with the public health community.

By the end of 2024

A Learning Health System reduces the time from evidence to practice. This enables ubiquitous connectivity, improves population health and helps researchers analyze data from a variety of sources.

Dramatically reduce the time it takes for evidence from research to become common practice (thus better evidence-based diagnosis, treatment and personalized medicine).

Continuous Learning Cycle

Learning Health System

Healthier People
Smarter Spending
Better Care

Research Rd
Public Health Pl
Big Data

**Every Minute of the Day**

- **Skype Users Make**
  - 110,040 Calls

- **Uber Passengers Take Rides**
  - 694

- **Buzzfeed Users View**
  - 34,150 Videos

- **Snapchat Users Share**
  - 284,722 Snaps

- **Tinder Users Swipe**
  - 590,278 Times

- **Vine Users Play**
  - 1,041,666 Videos

- **Amazon Receives**
  - 4,310 Unique Visitors

- **Reddit Users Cast**
  - 18,327 Votes

- **Netflix Subscribers Stream**
  - 77,160 Hours of Video

- **Facebook Users Like**
  - 4,166,667 Posts

- **Twitter Users Send**
  - 347,222 Tweets

- **YouTube Users Upload**
  - 300 Hours of New Video

- **Instagram Users Like**
  - 1,736,111 Photos

- **Pinterest Users Pin**
  - 9,722 Images

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**The Global Internet Population Grew 18.5% from 2013-2015 and Now Represents 3.2 Billion People.**

https://www.domo.com/learn/data-never-sleeps-3-0

Big Data

The proverbial 3 V’s of big data: volume, velocity and variety and what constitutes each classification for the finance sector.

Source: Exist.com 2013

https://www.domo.com/learn/data-never-sleeps-3-0
Data Lake
Big Data

How to start?

https://www.domo.com/learn/data-never-sleeps-3-0
But Why we Need Big Data?
Volume? Varieties? Velocity?

http://www.sfms.org/NewsPublication/SFMSBlog/TabId/467/PostId/1179/mu-audit-ca.aspx
Value!

http://www.sfms.org/NewsPublication/SFMSBlog/TabId/467/PostId/1179/mu-audit-ca.aspx
How to start?

https://www.domo.com/learn/data-never-sleeps-3-0
How to Start?

Big Data
How to Start?

Big Data = Values
How to Start?

Big Data + Analytics = Values
How to Start?

Big Data + Analytics = Values
(Science)
Lessons Learn

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Meaningful  Within the right team

+ Data Science

http://health.usnews.com/health-news/most-connected-hospitals/articles/2011/07/18/most-connected-hospitals
Lessons Learn

Assembling the **Right** EHR Project Teams

- A “Clinical Champion”  
- An EHR Project Manager
- Evaluation & Selection Team Members
- EHR Implementation Team Members

+ Academics
+ Researcher
+ Scientists

With big data, the next cure really can be around the corner. In the future...

The time between research and discovery will collapse as researchers access vast stores of data, instead of creating it through long study cycles.

Discoveries will be informed by data from thousands of patients, not just handfuls of study participants.

You will receive personalized care as the data foretells the treatments that work best for you.