

Using Epic to Conduct Clinical Research – A Series of Pediatric Case Studies

David C Kaelber, MD, PhD, MPH, FAAP, FACP

Internal Medicine and Pediatrics Physician
Chief Medical Informatics Officer
MetroHealth System

Assistant Professor of Internal Medicine and Pediatrics
Case Western Reserve University



Learning Objectives

- To explore fundamental concepts of Epic (electronic medical record) based research (clinical research informatics).
- To examine several case examples that used electronic medical records for clinical research.

Disclosures

- None



Outline

- Introduction/Background
- Case Examples
- Discussion/Questions



Medical Informatics is...

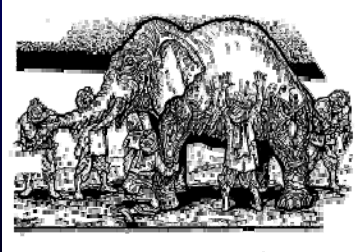
“The field that concerns itself with the cognitive, information processing and communication tasks of medical practice, education and research, including the information science and the technology to support these tasks.”

Greenes RA. Shortliffe EH.
JAMA 1990 Feb 23; 263(8):1114-20.



Medical Informatics

Public health informatics



Patient informatics

Bioinformatics

Personal Health Records

Clinical Research Informatics

Electronic Medical Records

Evidence-Based Medicine

Electronic Medical Record (EMR) Adoption

“only 1.5% of U.S. hospitals have a comprehensive electronic-records system (i.e., present in all clinical units), and an additional 7.6% have a basic system (i.e., present in at least one clinical unit). Computerized provider-order entry for medications has been implemented in only 17% of hospitals”

Jha, et al (2009). *Use of Electronic Health Records in US Hospitals. NEJM. 2009(360):1628-38.*

“4% of physicians reported having an extensive, fully functional electronic records system, and 13% reported having a basic system”

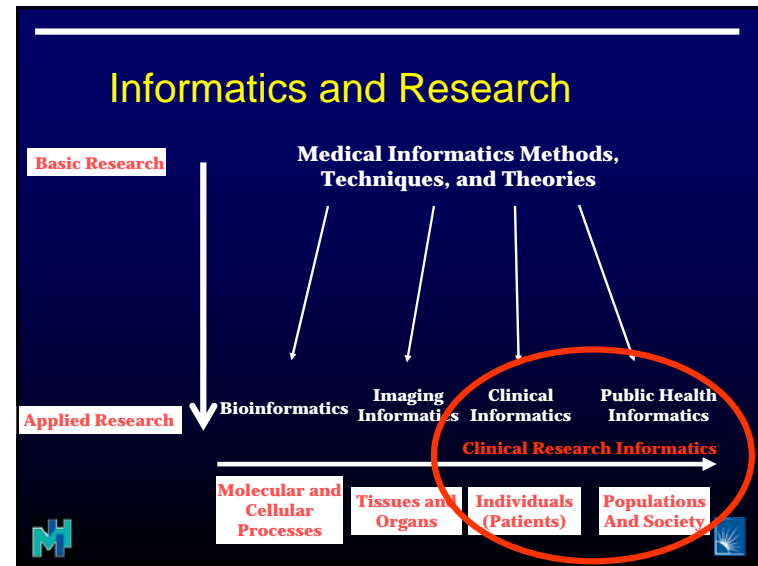
DesRoches, et al (2008). *Electronic Health Records in Ambulatory Care – A National Survey of Physicians. NEJM. 2008(359):50-60.*

Electronic Medical Record (EMR) Adoption

US EMR Adoption Model SM			
Stage	Cumulative Capabilities	2009 Final	2010 Q1
Stage 7	Complete EMR; CCD transactions to share data; Data warehousing; Data continuity with ED, ambulatory, OP	0.7%	0.7%
Stage 6	Physician documentation (structured templates), full CDSS (variance & compliance), full R-PACS	1.6%	1.8%
Stage 5	Closed loop medication administration	3.8%	5.0%
Stage 4	CPOE, Clinical Decision Support (clinical protocols)	7.4%	7.7%
Stage 3	Error checking, PACS available outside Radiology	50.9%	50.0%
Stage 2	CDR, Controlled Medical Vocabulary, CDS, may have Document Imaging; HIE capable	16.9%	16.5%
Stage 1	Ancillaries – Lab, Rad, Pharmacy – All Installed	7.2%	6.9%
Stage 0	All Three Ancillaries Not Installed	11.5%	11.4%

Data from HIMSS Analytics™ Database © 2010 N = 5235 N = 5223

HCO – Healthcare Organization, CCD – Clinical Care Delivery, CDSS – Clinical Decision Support, CPOE – Computerized Physician Order Entry, PACS – Picture Archiving and Communication System
(from http://www.himssanalytics.org/hc_providers/stage7Hospitals.asp)



Research Methodologies in Informatics

- Retrospective cohort or case-control studies
 - huge amounts of potential data in electronic medical records
- Pre-post technology intervention studies
 - hard to isolate giving enterprise-wide technology to a subset of people
- Randomized cluster (group of providers) - control trial
 - decreases technology “contamination” effect in a single provider or within a group of provider
 - one top informatics advance of 2007
 - developed at MetroHealth



MetroHealth and Epic

- Installed ambulatory EpicCare in 1999
- Installed inpatient Epic in 2009
- Epic data at MetroHealth
 - 1.5 million patients
 - 10 million visits
 - 100 million labs/pathology



Clinical Research Implications (retrospective clinical research)

Characteristic	Old Paradigm	New Paradigm
Data	Separate Research Database	Shared Research and Clinic Database (EMR)
Time	1000+ hours	100+ hours
Money	100,000-1,000,000+	0-10,000+
People	Many	Few

*Order of magnitude less time and money
with electronic medical records.*



Outline

- Introduction/Background
- Case Examples
- Discussion/Questions



Case 1 – Pediatric Hypertension

- Can we use Epic to easily research isolated clinical observations?

YES!



Background



Study Design

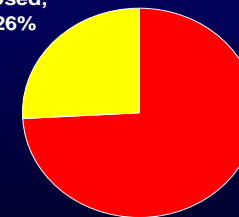
- Design: Cohort study.
- Setting: Outpatient clinics in a large, academic, urban medical system in Northeast Ohio.
- Patients: 14187 children and adolescents age 3-18 years who were seen at least three times for well-child care between June 1999 and September 2006.
- Main Outcome Measures: Diagnosis of hypertension or prehypertension documented in the electronic medical record (EMR). Logistic regression analysis was performed to identify patient factors associated with a correct diagnosis.



Study Results

Children with Hypertension

Diagnosed,
131, 26%



■ Undiagnosed
■ Diagnosed

Undiagnosed
376, 74%

AHA Top 10 Research Advance of 2007!
Ladies' Home Journal Healthcare Breakthrough Award of 2008!



ML Hanson, PW Gunn, and DC Kaelber. Underdiagnosis of Hypertension in Children and Adolescents. Journal of the American Medical Association, 298(8):874-9, 2007.

Study Timeline



1 3rd year medical school student, 1 4th year medical school student,
1 medical informatics fellow, ~150 hours, ~17 months, \$0



Case 2 – Weight Problems in Children

□ Can we use Epic to study disease trends over time?

YES!

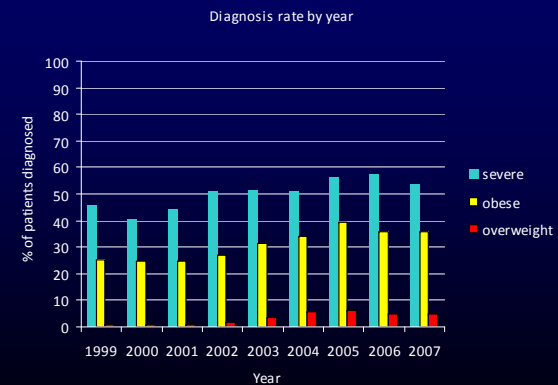


Case 2 – Weight Problems in Children

- Has the increase to publicity about weight problems in children led to better diagnosis
- Over 80,000 patients (8 years)
- Larger data set than National Health and Nutrition Examination Survey (NHANES) (~12,000 participants)



Diagnosis of Weight Problems



L Benson, H Baer, and DC Kaelber. *Trends in the Diagnosis of Weight Problems in Children and Adolescents – 1999-2007. Pediatrics. January 2009.*



Case 3 – Measuring Guideline Adherence

- Can we use Epic to measure compliance with guidelines?

YES!

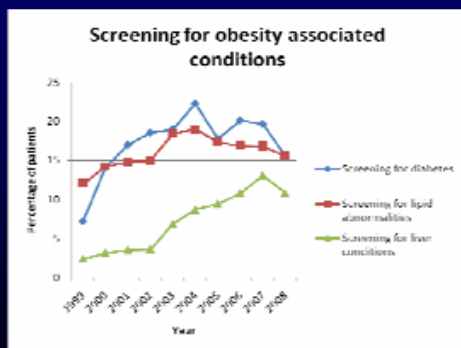


Pediatric Obesity Guidelines

- Clear guidelines exist for the laboratory work-up of overweight children.
- Study looked at physician ordering patterns for guideline recommended screening for cholesterol, glucose, and liver function problem weight related co-morbidities.



Pediatric Obesity Guidelines



LJ Benson, H Baer, and DC Kaelber. Using Electronic Medical Records to Study Guideline Compliance: Screening for Pediatric Obesity Co-Morbid Conditions. American Academy of Pediatrics National Conference and Exhibition, Washington DC, 2009.



Case 4 – Determining When Family History is Obtained

- Can we use Epic to study physician practice patterns?

YES!



Family History Documentation

- *When is family history documented in overweight and hypertensive pediatric patients?*
- Initial studies did not seem to show an association of family history with weight problems and hypertension in children.



Family History Documentation

	Hypertension	Diagnosed Hypertension	Obesity*	Diagnosed Obesity*
# of patients	774	208	5485	1062
Pt w/ relevant FH	35%	46%	41%	51%
FH entered prior to disease/diagnosis	14%	17%	36%	33%
FH entered at or after diagnosis/disease	86%	83%	64%	67%

* - overweight or obese

Disease detection serves as a trigger to obtain family history!



LJ Benson, HJ Baer, PJ Greco, and DC Kaelber. *When is family history obtained? - Lack of timely documentation of family history among overweight and hypertensive paediatric patients.* *Journal of Paediatrics and Child Health*, 2010.



Case 5 – Disease Associations

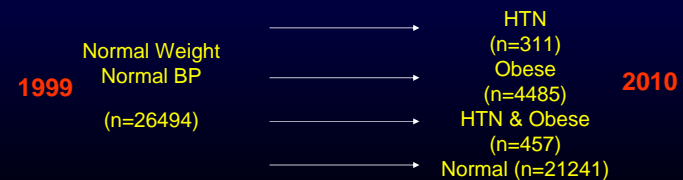
- Can we use Epic explore associations (not cause and effect) between diseases?

YES!



Hypertension and Obesity

- Traditionally obesity has through to be a pre-cursor to hypertension in mother children and adults (For example, NHANES study)
- Good longitudinal studies do not exist, especially in children
- Using Epic we have the ability to identify a cohort that WILL develop hypertension and/or obesity and retrospectively study the natural history of these disease in patients who start with neither disease



Average follow-up after disease onset 4-5 years



Hypertension and Obesity

	Obesity	Abnormal BP
Entire cohort	11.5 y*	12.0
HTN and Obesity	12.5 y*	11.9

* - statistically different ($p < 0.05$) using ANOVO analysis

- Different study design allows for different analysis
- Subset analysis points to different phenotypes (obese patients, HTN patients, and obese hypertensive patients)



Case 6 – System of care

- Can we use Epic to look at the system of care of for children with weight problems?

???



Pediatric Obesity Care

Background: We have ~30,000 children with weight problem, yet only ~300 seen regularly in our Pediatric NEW (Nutrition, Exercise, and Wellness) Lifestyles Program.

Question: Where is the GAP?

- Diagnosis
- Referral
- First visit to Pediatric NEW Lifestyles Program
- Multiple visits to Pediatrics NEW Lifestyles Program



Outline

- Introduction/Background
- Case Examples
- Discussion/Questions



Epic and Clinical Research

- ❑ Large/huge data sets
- ❑ “Clinical data” (not “research data”)
- ❑ Need to understand structured, discrete data (how it is created, used, and extracted)
- ❑ Health Services Research, processes of care
- ❑ Explorays (tool for the future)



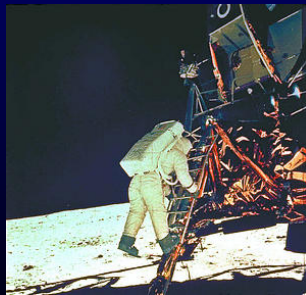
Epic and Clinical Research

- ❑ Can be used to discover ground-breaking clinical research findings
- ❑ Expands who can do clinical research
- ❑ Decreases how long clinical research takes
- ❑ Reduces how much clinical research costs

Epic has ~83 million patients
(~27% of the US population)
(150,000 physicians
(~1% of the world population?)



Using Epic (and other electronic medical records) for clinical research is in its infancy today, but has the power to transform clinical research and clinical care.



THE FUTURE IS NOW!



Dkaelber@metrohealth.org

Questions?
Comments?

