Health Insurance and the Role of Health IT Systems

Kartik K Ganju

Delhi
December 2019

Overview

- Different forms of health insurance in India
  - Public: Schemes such as Ayushman Bharat - Pradhan Mantri Arogya Yojana (AB-PMJAY)
  - Private: Bajaj, Reliance, Birla, Apollo ...
- Coverage roughly 10%
- Push towards greater coverage
- As incomes increase, greater healthcare expenditure & greater insurance demand
- Unforseen health expenditure also can bankrupt poor
- Schemes such as AB-PMJAY and RSBY provide public health insurance

History of Public Reimbursement in the US

- Largest insurer is public: Medicare
  - Covers patients above 65 years of age
  - Implemented in 1966
  - Reimbursements of $136B/year
- Medicare reimburses hospitals/physicians
- How do insurers reimburse hospitals?
  - Fee For Service (FFS): Hospitals reimbursed for all services provided
  - Capitation Model: Hospitals reimbursed a lump sum

Fee- For-Service Model

- Hospitals reimbursed for all services provided
- Reimbursed separately for all hospital visits, tests, procedures etc.
- 82% of healthcare expenditure in India follows FFS model (Jayaram & Ramakrishnan 2013)
- Hospitals reimbursed for all their expenses
- Incentivizes hospitals to provide excessive service as they will be reimbursed (overutilization)

Capitation Model 1

- Hospitals reimbursed a lump sum for treating a patient with a certain condition
- Eg. A hospital gets the same amount for all patients treated for a respiratory ailment (without complications)
- Procedures are grouped into Diagnoses Related Groups (DRGs)
- Insurers don't care how long it takes to treat patients within same DRG
  - Patient 1 has respiratory ailment $\rightarrow$ 3.6 days
  - Patient 2 has respiratory ailment $\rightarrow$ 6.3 days
  - Hospital reimbursed at same rate for both patients

Capitation Model 2

- Approach promotes efficiency (as it forces hospitals to reduce unnecessary care)
- Shift to DRG system of reimbursement in USA lead to:
  - Lower length of stays
  - Lower cost
  - Providers reducing number of tests
  - Care moving to less costly outpatient settings (Davis & Rhodes 1988)
- Reduces cost of healthcare

Capitation Model 3

- Certain patients are provided a higher reimbursement
- Patients with diabetes are likely to develop complications and hence hospitals are reimbursed more if the patient has a complication
- Formal name "Complication and Co-morbidity"
- Suppose a patient is admitted for a respiratory ailment
  - Patient has a CC $\rightarrow$ \$7,900
  - Patient does not have a CC $\rightarrow$ \$4,865
- Financial incentive for the hospital to identify patient's CCs
- Hospitals also fraudulently code patients with CCs (known as upcoding)
- \$50 billion worth of fraud and abuse

EHR system adoption in the US

- Prior to 2009, hospitals were free to adopt and use their own Electronic Health Record (EHR) systems
- Pres. Obama's first legislation was HITECH Act
- Hospitals were forced to adopt and *meaningfully utilize* EHR systems
  - Record patient's vitals electronically
  - Maintain active medication list
- Hospitals would be provided funds to adopt EHRs
  - Penalized if they didn't meet meaningful use criteria

Do Electronic Health Record Systems Inflate Medicare Reimbursements?

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Hilal Atasoy

Paul A Pavlou

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- Medicare is largest insurer in the US; reimbursements at $136B
  - EHR systems hoped to reduce reimbursements
- Arguments that EHR systems can be used to increase reimbursements (Adler-Milstein et al. 2014; Li 2014; Gowrisankaran et al. 2016)
- Issue attracts the attention of the Obama administration

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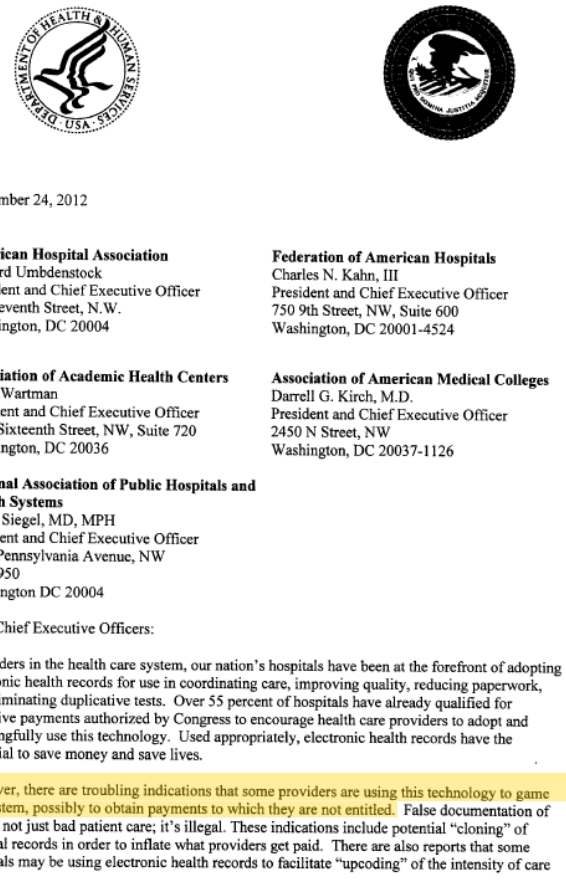

September 24, 2012

American Hospital Association
Richard Umbdenstock
President and Chief Executive Officer
325 Seventh Street, N.W.
Washington, DC 20004

Federation of American Hospitals
Charles N. Kahn, III
President and Chief Executive Officer
750 9th Street, NW, Suite 600
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Association of American Medical Colleges
Darrell G. Kirch, M.D.
President and Chief Executive Officer
2450 N Street, NW
Washington, DC 20037-1126

National Association of Public Hospitals and Health Systems
Bruce Siegel, MD, MPH
President and Chief Executive Officer
1301 Pennsylvania Avenue, NW
Suite 950
Washington DC 20004

Dear Chief Executive Officers:

As leaders in the health care system, our nation's hospitals have been at the forefront of adopting electronic health records for use in coordinating care, improving quality, reducing paperwork, and eliminating duplicative tests. Over 55 percent of hospitals have already qualified for incentive payments authorized by Congress to encourage health care providers to adopt and meaningfully use this technology. Used appropriately, electronic health records have the potential to save money and save lives.

However, there are troubling indications that some providers are using this technology to game the system, possibly to obtain payments to which they are not entitled. False documentation of care is not just bad patient care; it's illegal. These indications include potential "cloning" of medical records in order to inflate what providers get paid. There are also reports that some hospitals may be using electronic health records to facilitate "upcoding" of the intensity of care

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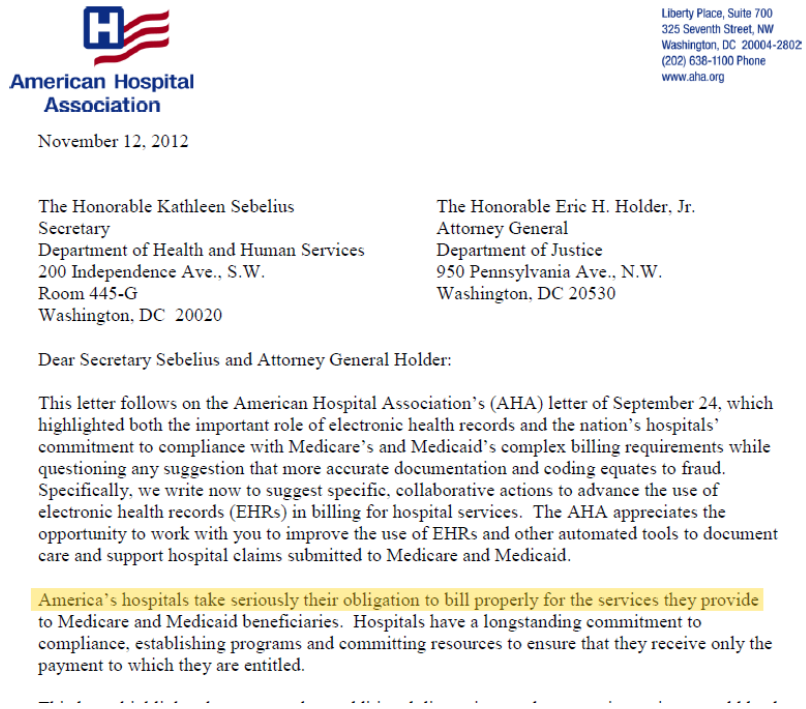
Research Question

AHA pushes back "Hospitals take seriously their obligation to properly bill"

Do EHR systems increase Medicare reimbursements?

- Does an audit program moderate this effect?



American Hospital Association

Liberty Place, Suite 700
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November 12, 2012

The Honorable Kathleen Sebelius
Secretary
Department of Health and Human Services
200 Independence Ave., S.W.
Room 445-G
Washington, DC 20020

The Honorable Eric H. Holder, Jr.
Attorney General
Department of Justice
950 Pennsylvania Ave., N.W.
Washington, DC 20530

Dear Secretary Sebelius and Attorney General Holder:

This letter follows on the American Hospital Association's (AHA) letter of September 24, which highlighted both the important role of electronic health records and the nation's hospitals' commitment to compliance with Medicare's and Medicaid's complex billing requirements while questioning any suggestion that more accurate documentation and coding equates to fraud. Specifically, we write now to suggest specific, collaborative actions to advance the use of electronic health records (EHRs) in billing for hospital services. The AHA appreciates the opportunity to work with you to improve the use of EHRs and other automated tools to document care and support hospital claims submitted to Medicare and Medicaid.

America's hospitals take seriously their obligation to bill properly for the services they provide to Medicare and Medicaid beneficiaries. Hospitals have a longstanding commitment to compliance, establishing programs and committing resources to ensure that they receive only the payment to which they are entitled.

$2 billion in additional reimbursements

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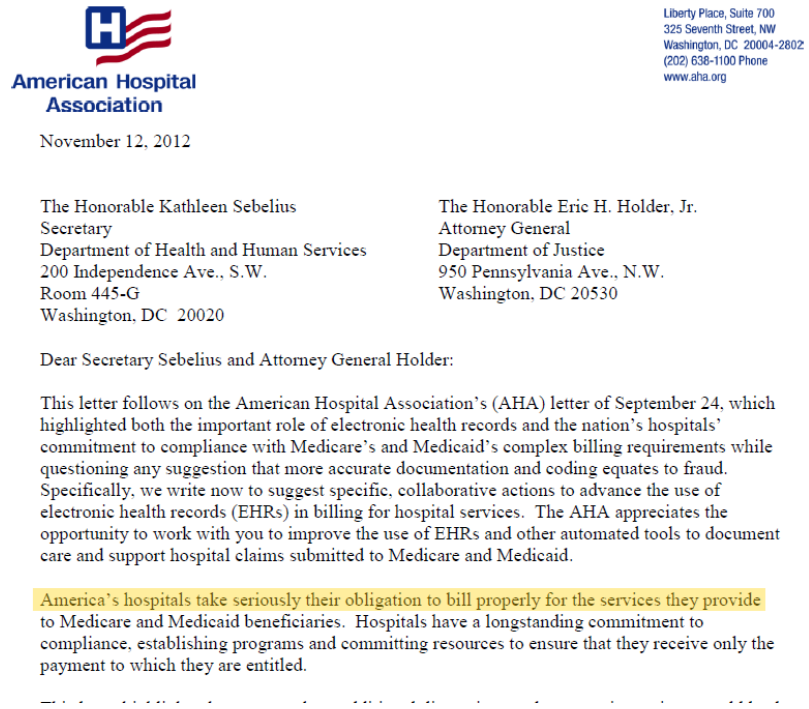

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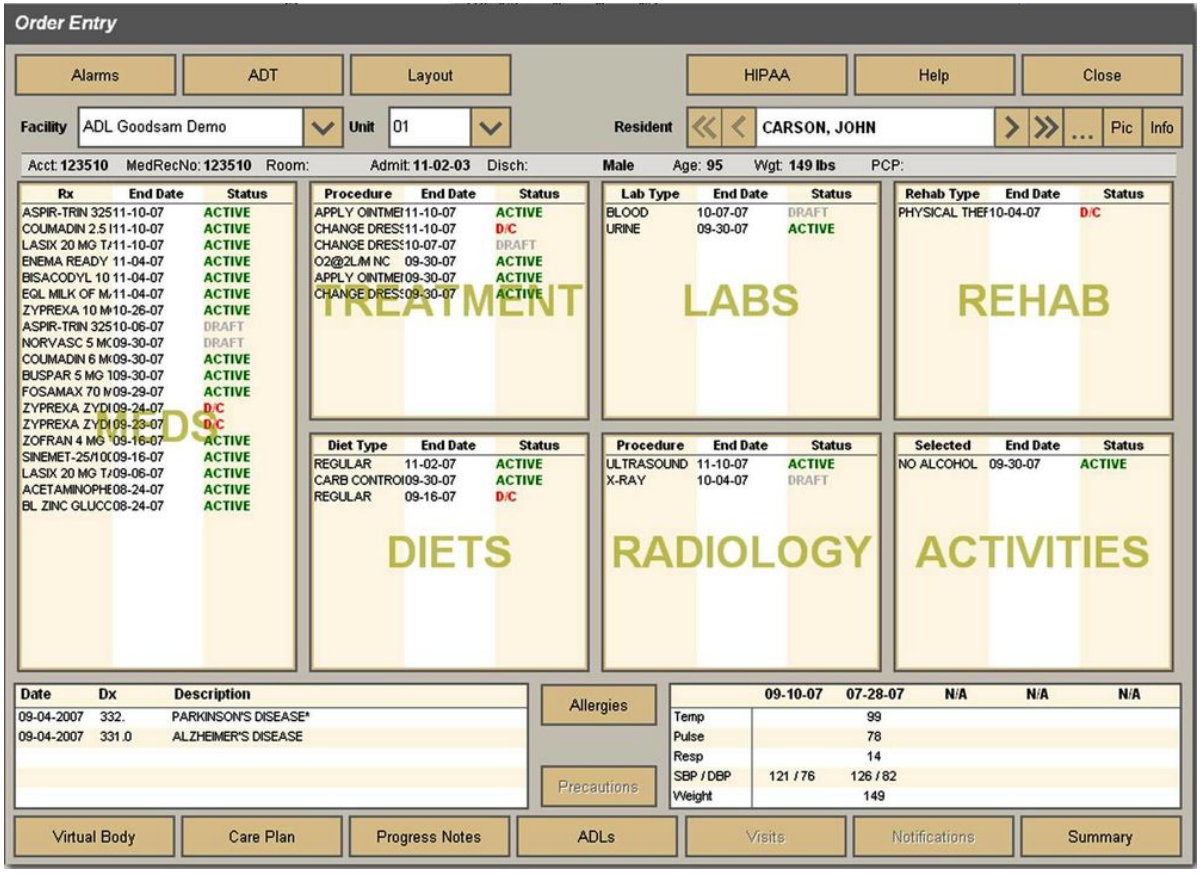
CPOE systems

Computerized Physician Order Entry system allow physicians to electronically store data and place pharmacy orders



Use order sets to insert multiple orders simultaneously

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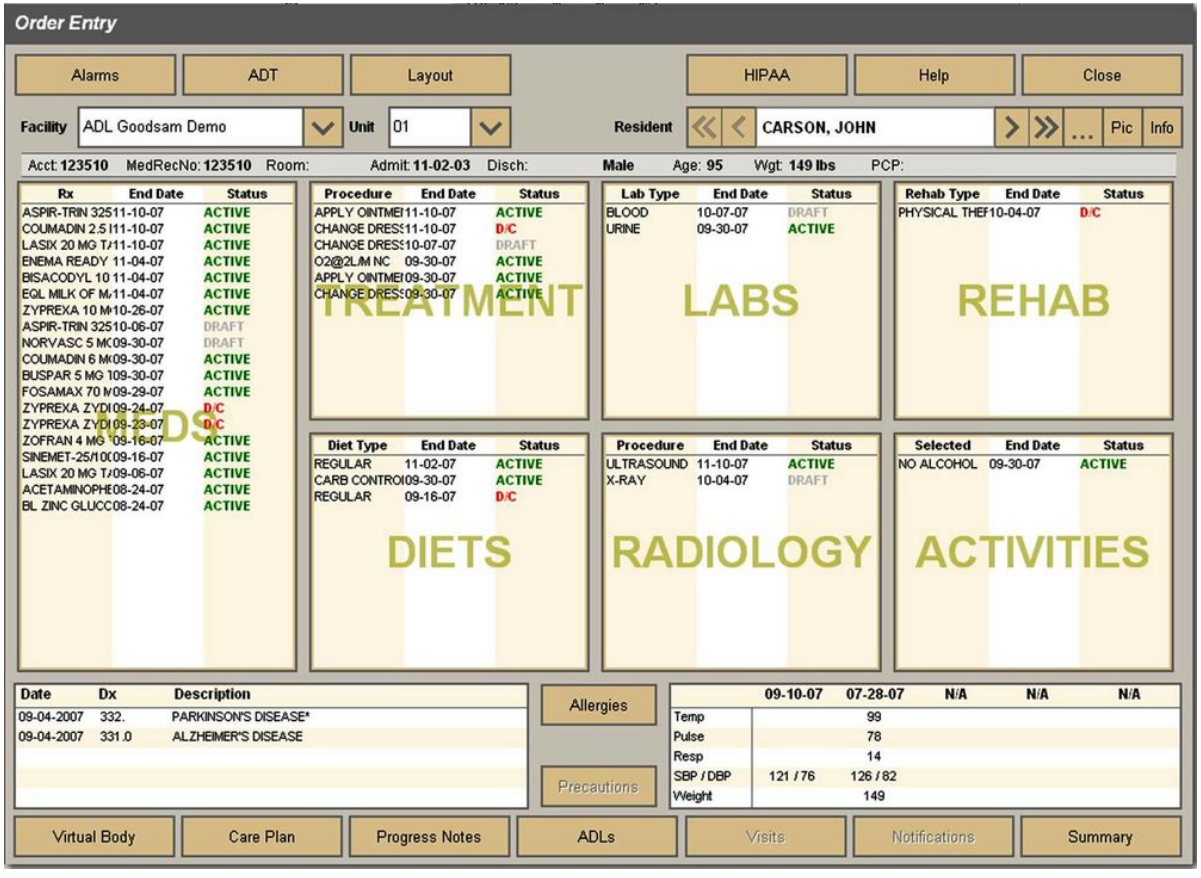

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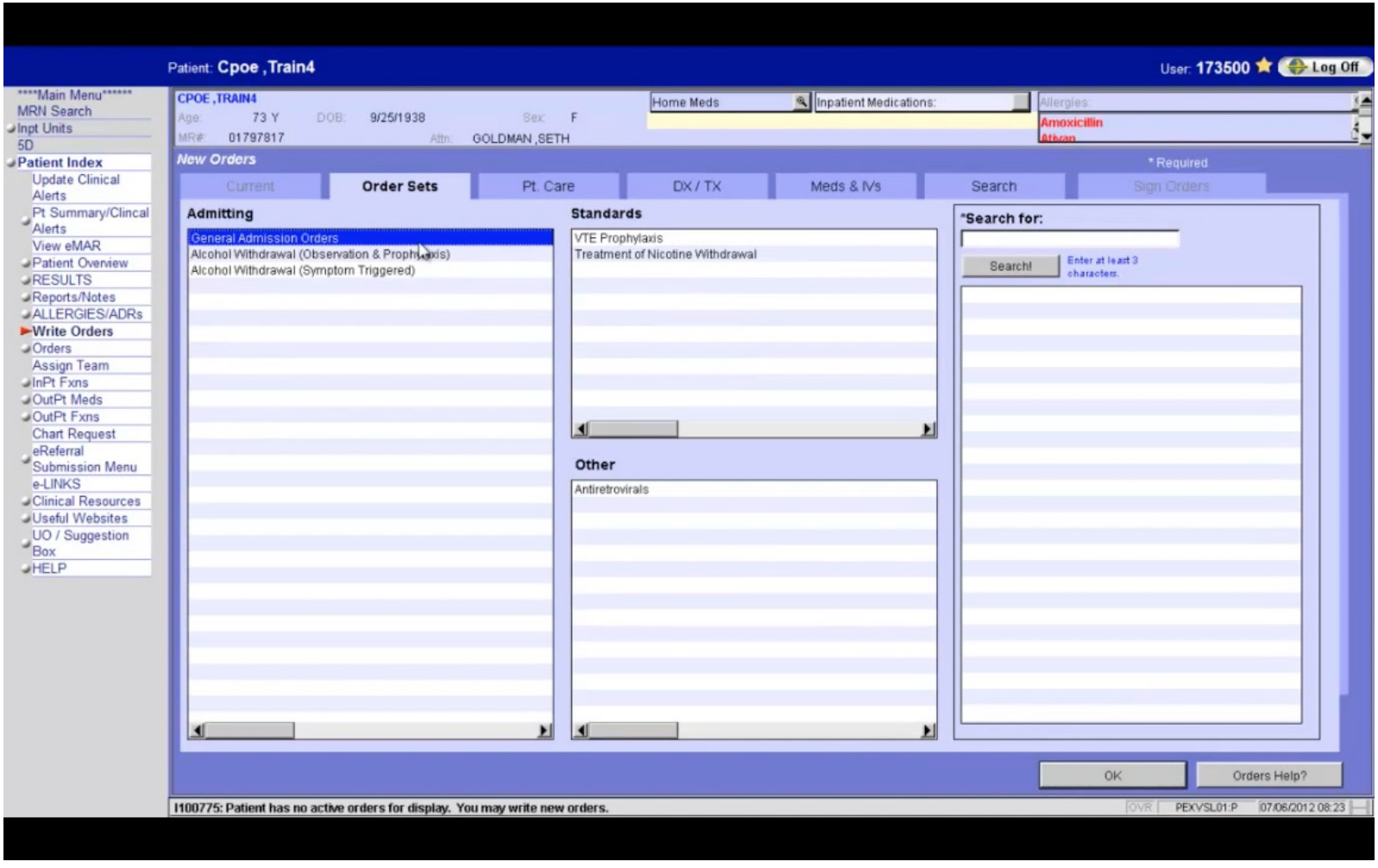
Use of Order Sets



CPOE Admitting
http://youtu.be/WHFIAdfjKNQ

Information included by default

- Information included by default (e.g. VTE Prophylaxis, history of diabetes, injuries etc.)
- Similar patients placed in same Diagnoses Related Group (DRGs)
- Patients with complications (diabetes, injuries, shock etc.) placed in separate DRG
  - "Respiratory infections with MCCs": $7,900
  - "Respiratory infections without MCCs": $4,865
- Information included by default (using templates & copied data) has potential to be biased (e.g. Wang and Strong 1996)

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Audit Program

- Medicare implemented the Recovery Audit Program to see if auditors could identify and adjust improper payments
- Statement of objectives: "Recovery auditor may issue denial... when... the submitted service was upcoded" (CMS 2015)

- Reduction in earnings manipulation due to oversight (Dechow et al. 1996)

H2: The positive relationship between the adoption of a CPOE system by a hospital and the reported patient complexity of a hospital is attenuated by the Recovery Audit Program.

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Details on Audit Program

- Implemented in a staggered manner
  - 2005: Florida, New York, California
  - 2007: Arizona, Massachusetts and South Carolina
  - 2010: Rest of the US
- All hospitals get 10% of their Medicare claims audited
- Hospitals can appeal auditor decisions
- $3.7 billion in savings
- Discussions with experts has indicated that Data Analytics used to identify incorrect coding
  - Identify copy-pasted data and template use

Data

- CPOE adoption: Healthcare Information and Management Systems Society (HIMSS) database
- Census of Inpatient visits from Kentucky, Maryland, Arizona, Florida
  - DV: Proportion of patients coded with MCCs (Gowrisankaran et al. 2016)
- US Census (Demographic data)
- Medicare cost reports (Hospital operational data)
- Panel of 129,088 hospitals-year from 2004 to 2013

Empirical Specification

$$\pi_{ijt} = \beta_0 + \beta_1 CPOE_{it} + \beta_2 CPOE_{it} * Audit_{it} + \beta_3 Audit_{it} + \beta_4 Z_{ij} + \delta_j + \mu_i + \gamma_t + \epsilon_{ijt}$$

- π_{ijt} : Proportion of patients coded with MCCs for the i^{th} hospital in j^{th} disease category in year t
- $CPOE_{it}$: Binary variable for CPOE use in i^{th} hospital in t^{th} year
- $Audit_{it}$: Binary variable for Audit in i^{th} hospital in t^{th} year
- Z_{it}: Hospital level controls including other EMR systems
- μ_i: Hospital fixed effects
- δ_j: Disease Category fixed effects
- γ_t: Time fixed effects

Endogenity concerns

- CPOE adoption non-random at hospital level
  - Instrument for the adoption of CPOE systems
- There may be pre-adoption differences in the adoption of CPOE systems
  - Use a Relative Time Model
- Systematic differences between the hospitals in the states covered by the preliminary audit program
  - Match hospitals in FL & AZ to those in MD & KY
- CPOE systems would allow for "better coding"
  - Higher coding should persist under audit program
- Heterogeneity in the complexity of patients in hospitals
  - Replicate results with Hospital-Base DRG fixed effect

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Results: All data

Variables	All Hospitals	All Hospitals	Audit = 0	Audit = 1
CPOE	-0.0002	0.0185***	0.0420***	-0.0062
	(0.0045)	(0.0080)	(0.0099)	(0.0045)
Audit		0.0016		
		(0.0104)		
CPOE * Audit		-0.0222***		
		(0.0081)		
Controls	Yes	Yes	Yes	Yes
Observations	129,088	129,088	37,325	91,763

Hospital, DC and year fixed effects included in all models
Standard errors in parentheses are clustered by hospital and year
**** p<0.001, ** p<0.01, * p<0.05*

Results: Preliminary Audit Program

Variables	Before 2010	Before 2010	Before 2010 & Audit = 0	Before 2010 & Audit = 1
CPOE	0.0126	0.0351***	0.0420***	-0.0130
	(0.0087)	(0.0094)	(0.0099)	(0.0104)
Audit		-0.0007		
		(0.0109)		
CPOE * Audit		-0.390***		
		(0.0117)		
Controls	Yes	Yes	Yes	Yes
Observations	69,937	69,937	37,325	32,612

Hospital, DC and year fixed effects included in all models
Standard errors in parentheses are clustered by hospital and year
**** p<0.001, ** p<0.01, * p<0.05*

Results: Auditor Capabilities

- All hospitals in a state have the same auditor
- Some auditors able to identify use of templates and copied patient data

Variables	All Hospitals	Audit = 1
CPOE	0.0187**	0.0112
	(0.0083)	(0.0097)
Copy Identification * CPOE	-0.0250***	-0.0213**
	(0.0089)	(0.0103)
No Copy Identification * CPOE	-0.0122	
	(0.0099)	
Copy Identification	-0.0013	-0.0055
	(0.0112)	(0.0292)
No Copy Identification	0.0138	
	(0.0195)	
Observations	129,088	91,763

Hospital, DC, year fixed effects and controls included in all models
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Adoption of CPOE systems is an endogenous decision

Instrumental variable approach:

- Adoption of CPOE systems by other co-located hospitals
- Non-clinical IT systems

	Audit = 0 Peer CPOE	**Audit = 1** Peer CPOE	**Audit = 0** Non-clinical IT	**Audit = 1** Non-clinical IT
		Second Stage		
CPOE	0.0456**	-.0066	.0535**	-.0029
	(0.0183)	(0.0060)	(.0230)	(.0210)
		First Stage		
Peer CPOE	.9268***	.9204***		
	(.0091)	(.0055)		
Non-clinical IT			.5575***	.4038***
			(.0075)	(.0093)
Observations	37,325	91,763	36,810	90,631

Hospital, DC and year fixed effects included in all models

Standard errors in parentheses are clustered by hospital and year

**** p<0.001, ** p<0.01, * p<0.05*

Temporal Direction of Effect

Use relative time model:

$$\pi_{ijt} = \beta_0 + \beta_1 \alpha_{it} + \beta_2 \alpha_{it-1} + \beta_3 \alpha_{it-2} + \beta_3 \alpha_{it-3} + \delta_j + \mu_i + \gamma_t + \epsilon_{ijt}$$

	Audit = 0	**Audit = 1**
3+ years before	-0.0012	0.0099
	(0.0168)	(0.0076)
2 years before	-0.0109	0.0037
	(0.0125)	(0.0054)
1 year before	Omitted	
Year of adoption	0.0298***	-.0022
	(0.0086)	(0.0053)
1 year after	0.0284***	-.0100
	(0.0086)	(0.0083)
2 years after	0.0253	-0.0120
	(0.0207)	(0.0109)
3+ years after	0.0495**	-.0010
	(0.0199)	(0.0151)
Observations	23,608	57,943

Coarsened Exact Matching across States

Systematic differences between hospitals covered by the audit program

Match hospitals on

- Year of CPOE adoption
- Proportion of patients with MCCs
- Number of beds

Variables	All Hospitals	Before 2010
CPOE	0.0166*	0.0370***
	(0.0092)	(0.0094)
Audit	-0.0012	0.0013
	(0.0108)	(0.0117)
CPOE * Audit	-0.0215**	-0.0501***
	(0.0091)	(0.0122)
Controls	Yes	Yes
Observations	96,534	55,666

Hospital, DC and year fixed effects included in all models

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Hospital specific time trends

Replicate analysis with Hospital specific time trends

Variables	All Hospitals	Audit = 0
CPOE	0.0158***	.01889*
	(0.0055)	(0.0107)
Audit	0.0122	
	(0.0127)	
CPOE * Audit	-0.0331	
	(0.0108)	
Controls	Yes	Yes
Observations	129,088	37,318

Hospital, DC and year fixed effects included in all models
Standard errors in parentheses are clustered by hospital and year
**** p<0.001, ** p<0.01, * p<0.05*

Hospital specific patient complexity

Replicate analysis with Hospital-DRG Fixed Effects

Variables	All Hospitals	Before 2010
CPOE	0.0257***	0.0426***
	(0.0081)	(0.0088)
Audit	0.0013	0.0018
	(0.0103)	(0.0110)
CPOE * Audit	-0.0257***	-0.0339***
	(0.0082)	(0.0113)
Controls	Yes	Yes
Observations	129,064	69,955

Hospital- DC and year fixed effects included in all models
Standard errors in parentheses are clustered by hospital and year
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Consequences of the Adoption of EHR Systems

- Do Electronic Health Record Systems Inflate Medicare Reimbursements?
- The Spillover Effects of Health IT Investments on Regional Health Care Costs (Management Science)
- How Does the Implementation of Enterprise Information Systems Affect a Professional's Mobility? An Empirical Study (ISR)
- Does Information and Communication Technology Lead to the Well-Being of Nations? A Country-Level Empirical Investigation (MISQ)

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- The Role of Decision Support Systems in Attenuating Racial Biases in Healthcare Delivery
- "Where to, Doc?" Electronic Medical Record Systems and Patient Mobility
- Do EHR systems allow hospitals to retain high-value patients?
- Do EHR systems increase physician's productivity or changes in tasks?

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Thank You!

kartik.ganju@mcgill.ca

Shuffle test

Variables	Coefficient
Mean of Computerized Physician Order Entry	.0001
Std Dev. of Computerized Physician Order Entry	.0030
Number of Replications	1000

Summary Statistics

Variables	Mean	Std. Dev.
Computerized Physician Order Entry	.23	.42
Case Mix Index	1.41	.26
Clinical Data Repository	.83	.38
Clinical Decision Support System	.76	.43
Order Entry	.93	.26
Physician Documentation	.27	.45
Number of Employees	1799	30099
Bed Admits	42974	44769
Beds	185	205
Discharges	11117	10494

Variables	Adoption in 2004	Adoption in 2011
CPOE	.07	.45
TACMI	1.37	1.46

Effect of other EHR Systems

VARIABLES	All Observations	Audit = 0	Audit = 1
CPOE	0.0005	0.0447***	-0.0057
	(0.0045)	(0.0110)	(0.0046)
PD	-0.0064	-0.0118	-0.0038
	(0.0045)	(0.0124)	(0.0046)
CDR	0.0068	0.0036	0.0047
	(0.0062)	(0.0137)	(0.0069)
CDSS	-0.0115*	-0.0141	-0.0039
	(0.0067)	(0.0174)	(0.0066)
OE	0.0002	-0.0011	-0.0180
	(0.0093)	(0.0114)	(0.0389)
Observations	129,088	37,325	91,763
Controls	No	Yes	

Fixed effects included in all models

Standard errors in parentheses are clustered by hospital and year

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Change in variables over time

Variables	Adoption in 2004	Adoption in 2011
CPOE	.07	.45
TACMI	1.37	1.46
CDR	.62	.96
CDSS	.60	.95
OE	.67	.98
PD	.13	.42

Upcoding

- Do hospitals that adopt CPOE increase the case mix?
- Extensive anecdotal evidence for the same.
- CPOE systems allow for the use of templates for generating patient data.
- Generated data leads to insertion of text that can then lead to higher code being assigned.

Upcoding - Example

- Movie perhaps?

Examples

- Templates can automatically insert social data for the patient which can qualify them for high-acuity code.
- "General Examination" in the case of flu examination.

Upcoding

- For-profit hospitals have incentives to indulge in this practice to a higher degree than not for-profit hospitals.
- Administration take over of a not for-profit hospital by for-profit hospital
  - 31% of cases were coded as the top code
  - 76% one year after take over
  - 76% one year after take over
  - 90% one year after take over
- 49% of board members likely to be physicians versus 24% in the case of not for-profit hospitals.
- Align the incentives of the administration side of the business with the physician side of the business.

Recovery Audit Program

- Auditors can issue a denial when "the recovery Auditor determines that .... The submitted service was upcoded."
- Staggered roll-out of the audit program.
  - 2005: California, Florida, New York.
  - 2007: Arizona, Massachusetts and South Carolina.
  - 2010: Rest of the country.
- Aim to recover $2 in improper payments by 2012.

Data

- HIMSS Database

- Panel from 2004-2011.
- Keep hospitals that have EMR and case mix data for all years for our panel.
- Hospitals that do not abandon the use of EMR systems

Identification Strategy

Use a Fixed Effects model.

$$CMI_{ij} = \beta_0 + \beta_1 CPOE_{ij} + \beta_2 Z_{ij} + \beta_3 \nu_{ij} + \beta_4 \delta_i + \beta_5 \gamma_j + \epsilon_{ij} \quad (1)$$

Z_{ij}: Hospital level controls including adoption of other EMR systems
δ_i: Hospital level fixed effects
γ_i: Time fixed effects
ν_{ij}: County level control variables

Results 2

	TACMI All Hospitals	**TACMI** All Hospitals	**TACMI** For-profit Hospitals
CPOE	0.0024	0.0007	-0.0005
	(0.0023)	(0.0026)	(0.0026)
CPOE *	0.0270**		
For-Profit	(0.0093)		
CPOE *No of FP		0.0018**	0.0015*
Hospitals in HRR		(0.0006)	(0.0007)
Constant	28.8920	23.6361	29.0495
	(34.9270)	(34.9419)	(38.0830)
Observations	14,440	14,440	11,920

Table: Table 2: Effect of CPOE on Transfer Adjusted Case Mix

Results 3

	TACMI All Hospitals	**TACMI** For-profit Hospitals	**TACMI** Non-for-profit Hospitals
CPOE	0.0104***	0.0215	0.0086**
	(0.0028)	(0.0141)	(0.0029)
CPOE *	-0.0106***	-0.0025	-0.0122***
Audit	(0.0032)	(0.0154)	(0.0034)
Audit	-0.0019	-0.0103	-0.0038
	(0.0063)	(0.0157)	(0.0069)
Constant	27.0604	-95.9241	35.6486
	(35.0524)	(96.9061)	(38.4008)
Observations	14,440	2,456	11,712

Table: Table 3a: Effect of CPOE on Case Mix under Audit Program

Results 3

	TACMI All Hospitals	**TACMI** Hospitals Under Audit Program
CPOE	0.0063***	0.0087*
	(0.0024)	(0.0044)
CPOE *	-0.0098*	-0.0139*
Copy Identification	(0.0039)	(0.0059)
Copy Identification	-0.0225	-0.0180
	(0.0132)	(0.0230)
Constant	17.1524	285.5725***
	(35.4519)	(85.9745)
Observations	14,440	5,698

Table: Table 3b: Effect of CPOE on Case Mix under Audit Program with Auditors having ability to test for copied Information

My Research

Spillover Effects

- Cost of operation increases for adopting hospital
- Cost of operation decreases for neighboring hospital

Upcoding Effects

- Hospitals may use these systems to increase reimbursements

Abandonment Effects

- What is the effect of abandoning EMR systems?

Recap

- CPOE systems leading to higher case mix
- Case mix increases higher in for-profit hospitals
- Audit Program:
  - Effect not due to better coding (this effect should persist when audit program is in place)
  - Effect not due to sicker patients coming to adopting hospital (effect should persist when audit program is in place)

Robustness

Examine alternate explanations:

- What is the effect of CPOE on neighboring hospitals?
- What is the effect of systems that do not give physicians access to templates?
- Temporal Analysis

Robustness: Effect on Neighboring Hospitals

Does the adoption of CPOE systems attract sicker patients?

- Hospital attracts more complex patients $\rightarrow$, decrease in the complexity of neighboring hospitals
- Test effect of CPOE adoption on level of complexity of neighboring hospitals
-

Robustness: Effect on Other Systems

Examine the effect of the Physician Documentation System.

- Physician Documentation designed to .....

Thank You!

Adler-Milstein, J. and Jha, A. K. (2014). Electronic health records: The authors reply. *Health Affairs*, 33(10):1877–1877.

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