



## Examining Structural Constraints and Electronic Health Record Use In Acute Care Hospitals

Presented at  
The International Conference on Health Information  
Technology Advancement 2011 (ICHITA 2011)  
Western Michigan University, Kalamazoo, Michigan  
October 28, 2011

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## Introduction

- ▶ Healthcare costs are expected to hit \$4 trillion by 2015 or 20% of GDP (Borger et al., 2006; Bourgeois et al., 2009).
- ▶ “HIT has the potential to transform the healthcare industry by increasing productivity, reducing errors and costs, facilitating information sharing and improving the quality of healthcare services (Brailer, 2005)” Katsamakas et al., 2009: p. 19).
- ▶ This is achieved through integration (Ilie et al., 2009).



## Introduction

- ▶ HIT growth is primarily led by two applications; results viewing (ERV) and computerized provider order entry systems (CPOE) (Dorenfest, 2004).
- ▶ *Functional sophistication* (Bourgeois et al., 2009).
  - ERV = basic (EHR) use
  - CPOE = advanced EHR use (Jha et al., 2009).
- ▶ While all hospitals use EHR to some extent, the levels of sophistication vary substantially (Cohen, 2005).



## Introduction

- ▶ Heterogeneity in EHR use may be contingent on a variety of factors present in a hospital's operational context (Helms et al., 2008; Spil et al., 2009).
- ▶ A potential contingency might be a hospital's structural constraints such as location or type (Li et al., 2002).
- ▶ Understanding the extant contingencies may "...help to smooth IT implementation in the future," (Spil et al., 2009; p. 70).



## Introduction

- ▶ RQ1: Are certain hospital types more advanced than others with respect to EHR use?
- ▶ RQ2: If so, what contingencies may be driving this heterogeneity in EHR use?



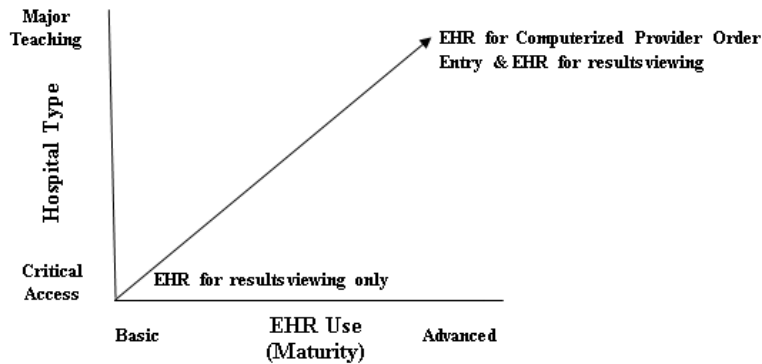
## Theory & hypotheses

- ▶ The contingency perspective argues that the success of many organizational initiatives can be linked to contextual factors (Jayaram et al., 2010).
- ▶ Contingency factors can emerge in the form of structural constraints such as the location, size, and/or teaching status of the hospital which can influence operational practices and outcomes (Li et al., 2002).



# Theory & hypotheses

## Relationship between hospital type and EHR use.



# Theory & hypotheses

## Variable definitions.

Subconstruct	Definition	Literature
Basic EHR use	the extent to which a hospital uses electronic health records for results viewing purposes (e.g., lab reports, consultant reports, etc.).	Ash et al., 2004; AHA, 2005; Cutler et al., 2005; Jha et al., 2009.
Advanced EHR use	the extent to which a hospital uses electronic health records for Computerized Provider Order Entry (e.g., lab tests, consultation requests, etc.).	Ash et al., 2004; AHA, 2005; Cutler et al., 2005; Jha et al., 2009.
Critical Access Hospital	the extent to which a hospital is 1) located in a rural area, 2) located more than 35 miles away from any other hospital (or 15 miles in mountainous terrain), 3) maintain not more than 25 inpatient beds, and 4) maintain an annual average length of stay (ALOS) of 96 hours or less.	HRSA, 2010; McCullough et al. 2011.
Major Teaching Hospital	the extent to which a hospital is affiliated with a medical school and maintains teaching and research as core to its mission.	Li et al. (2002); McDermott and Stock (2007); Jha et al. (2009).



## Theory & hypotheses

- ▶ CAH “face many challenges in health IT adoption including financial constraints, limited access to capital, inadequate infrastructure, and limited health IT workforce,” (McCullough et al., 2011: p. 329).
- ▶ Operational context may retard CAH’s adoption of EHR, even basic use.
- ▶ *H1: Critical access hospitals will demonstrate lower levels of basic EHR use (Results Viewing) than non-critical access hospitals.*



## Theory & hypotheses

- ▶ Generally speaking, hospital EHR use is hamper by many factors. (Hough et al., 2005).
- ▶ Hospital IT adoption has been slow, particularly with advanced IT applications such as EHR (Reardon, 2009).
- ▶ *H2: Critical access hospitals will demonstrate the same levels of advanced EHR use (CPOE) as non-critical access hospitals.*



## Theory & hypotheses

- ▶ MTHs tend to employ cutting edge best practices (McDermott and Stock, 2007).
- ▶ Li et al. (2002) found that MTHs tend to be larger and treat more complex cases which require the use of better systems.
- ▶ *H3: Major teaching hospitals will demonstrate higher levels of EHR for CPOE (advanced EHR) use than non-major teaching hospitals.*



## Theory & hypotheses

- ▶ Studies have hypothesized differences between teaching and non-teaching hospitals and found no statistically significant differences in such practices (see Goldstein and Naor, 2005; Tucker et al., 2007; McFadden et al., 2009).
- ▶ MTHs may only be significantly different in terms of the most advanced practices.
- ▶ *H4: Major teaching hospitals will demonstrate the same levels of EHR for Results Viewing (basic EHR) use than non-major teaching hospitals.*



## Theory & hypotheses

- ▶ It is reasonable to expect that MTHs demonstrate a high level of EHR use at both the basic and advanced levels.
- ▶ McCullough et al. (2011) suggest that general differences in EHR use may exist between CAH and MTH.
- ▶ *H5: Major teaching hospitals will demonstrate higher levels of EHR for Results Viewing (basic EHR) use and of EHR for CPOE (advanced EHR) use than critical access hospitals.*



## Research methods (survey)

- ▶ 312/671 = 46.5% response rate (Qi et al., 2009).
  - 2 were removed for missing values (Qi et al., 2009)
  - 8 responses from multiple raters were averaged (McFadden et al., 2009).
  - 5 were deleted owing to positive responses in both categories.
  - Final  $n = 297$
- ▶ T-tests (Swafford et al., 2006) and Chi-square tests (Meyer and Collier, 2001) produced negative results for non-response bias (against 124 'decliners').
  - Bed size & Hospital type (tertiary, community, or critical access)



## Research methods

Sample characteristics.	
Characteristics	Respondents
<b>Hospital type</b>	
Tertiary care center	66 (22%)
Community hospital	188 (63%)
Critical access hospital	34 (11%)
Other/missing values	9 (3%)
<b>Ownership status</b>	
For-profit hospital	39 (13%)
Non-profit hospital	222 (75%)
Public hospital	30 (10%)
Other/missing values	6 (2%)

\* Hospitals from 47 states participated in the study.  
 Note: Numbers represent frequency, followed by the percentage (rounded) of the sample in parentheses.



## Research methods

Sample characteristics.	
Characteristics	Respondents
<b>Teaching status</b>	
Major teaching hospital	59 (20%)
Minor teaching hospital	92 (31%)
Nonteaching hospital	141 (48%)
Other/missing values	5 (2%)
<b>Size - number of beds</b>	
< 49	39 (13%)
50-99	59 (20%)
100-199	64 (22%)
200-399	76 (26%)
> 400	53 (18%)
Other/missing values	6 (2%)

\* Hospitals from 47 states participated in the study.  
 Note: Numbers represent frequency, followed by the percentage (rounded) of the sample in parentheses.





## Research methods

Respondent characteristics (job titles)	
Characteristics	Respondents
Job title	
Director of Case Management	63 (21%)
Chief Nursing Officer	43 (15%)
Vice President of Patient Care Services	43 (15%)
Director of Nursing	21 (7%)
Director of Quality Initiatives	17 (6%)
Quality Assurance Manager	14 (5%)
Director of Patient Care Services	10 (3%)
Chief Operating Officer	7 (2%)
Unit Manager	6 (2%)
Vice President of Quality Initiatives	4 (1%)
Chief Executive Officer	2 (1%)
Vice President of Medical Affairs	1 (0%)
Vice President of Case Management	1 (0%)
Other	47 (16%)
Did not report.	22 (7%)
Note: Numbers represent frequency, followed by the percentage (rounded) of the sample in parentheses.	

## Analysis & results

### Operational definitions and EFA

Measurement items	EHR for results viewing	EHR for Computerized Provider Order Entry
<i>We use EMR to view:</i>		
ERV2 radiology reports.	0.93	
ERV1 lab results.	0.91	
ERV4 diagnostic test results.	0.90	
ERV3 radiology images.	0.87	
ERV5 diagnostic test images.	0.81	
<i>We use EMR to order:</i>		
CPOE2 radiology tests.		0.95
CPOE1 laboratory tests.		0.95
CPOE4 consultants reports.		0.90
CPOE3 medications.		0.87
CPOE5 nursing orders.		0.82

#### Notes:

1. Extraction Method: Principal Component Analysis.
2. Rotation Method: Varimax with Kaiser Normalization.

# Analysis & results

## Descriptive statistics

Variable	$\mu$	$\sigma$	Skewness	Kurtosis	$\alpha$	Corr.
EHR for results viewing	4.56	0.57	-1.95	6.20	0.92	n/a
EHR for Computerized Provider Order Entry	3.57	1.06	-0.75	-0.01	0.94	0.189***

### Notes:

Sample  $n = 297$

Corr. = correlation between the two variables significant at \*\*\*  $p < 0.01$ .



# Analysis & results

- ▶ H1: Critical access hospitals will demonstrate lower levels of basic EHR use (Results Viewing) than non-critical access hospitals.
- ▶ H2: Critical access hospitals will demonstrate the same levels of advanced EHR use (CPOE) as non-critical access hospitals.

## T-tests for CAH

Variables and means	Basic EHR use (ERV)	Advanced EHR use (CPOE)
Critical access hospitals ( $n = 34$ )	4.36	3.30
Non-critical access hospitals ( $n = 263$ )	4.58	3.61
t-value	2.20**	1.77 <sup>ns</sup>

\*\*Significant at  $p < 0.05$ . Scale anchors: 1 = strongly disagree, 5 = strongly agree.



## Analysis & results

- ▶ H3: Major teaching hospitals will demonstrate higher levels of EHR for CPOE (advanced EHR) use than non-major teaching hospitals.
- ▶ H4: Major teaching hospitals will demonstrate the same levels of EHR for Results Viewing (basic EHR) use than non-major teaching hospitals.

### T-tests for MTH

Variables and means	Basic EHR use (ERV)	Advanced EHR use (CPOE)
Major teaching hospitals ( <i>n</i> = 59)	4.60	3.89
Non-major teaching hospitals ( <i>n</i> = 238)	4.55	3.49
t-value	0.57 <sup>n/s</sup>	3.04***

\*\*\*Significant at  $p < 0.01$ ; \*\*  $p < 0.05$ . Scale anchors: 1 = strongly disagree, 5 = strongly agree.



## Analysis & results

- ▶ H5: Major teaching hospitals will demonstrate higher levels of EHR for Results Viewing (basic EHR) use and of EHR for CPOE (advanced EHR) use than critical access hospitals.

### T-tests for CAH and MTH

Variables and means	Basic EHR use (ERV)	Advanced EHR use (CPOE)
Critical access hospitals ( <i>n</i> = 34)	4.36	3.30
Major teaching hospitals ( <i>n</i> = 59)	4.60	3.89
t-value	2.03**	3.11***

\*\*\*Significant at  $p < 0.01$ ; \*\*  $p < 0.05$ . Scale anchors: 1 = strongly disagree, 5 = strongly agree.



## Implications & conclusions

### *For Executives and Policy Makers...*

- ▶ This study provides a much needed understanding of current HIT trends and directions for improvement (Spil et al., 2009).
- ▶ EHR adoption is heterogeneous and may be explained by contingency theory (Li et al., 2002).
- ▶ Findings may lend support to McCullough et al. (2011) and Helms et al. (2008) who suggest that CAH suffer from limited access to capital, financial constraints, inadequate infrastructure, and limited HIT workforce.



## Implications & conclusions

### *For Scholars...*

- ▶ This research provides a theoretical basis for understanding the factors contributing to EHR use (Jayaram et al., 2010).
- ▶ This study provides a rare multi-item measure of EHR use for basic and advanced applications.





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**THANK YOU!**

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