

# Understanding Readmissions after Cancer Surgery in Vulnerable Hospitals

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# Hospital Readmissions and Surgery

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- Reducing readmissions have become policy and clinical priority to improve quality of health care and control cost.
- Penalized hospitals will assess up to 3% for higher than average readmission rates for medical conditions.
- Financial penalties have since been expanded for orthopedic procedures.
- These penalties will likely expand to other surgical procedures in the near future.

# Surgical Concerns about ACA Readmissions

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- Differences in surgical vs. medical patients
- Drivers of readmissions after surgical procedures (complications and multi-morbidity) are different from chronic medical Health conditions (e.g. care coordination, poly pharmacy ..etc)
- Social determinants are not considered (SES, race)
- Financial penalties will likely strain already vulnerable hospitals (minority-serving, safety net or high-Medicaid hospitals)
- Most readmission reduction interventions are evolving and of questionable benefit

# Vulnerable Hospitals and Readmissions in the US

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- MSH were twice as likely to be penalized compared with non-MSH for higher readmissions (61% vs. 32%)
- MSH vs. non-MSH readmission penalties are projected to be \$112M vs. \$41M
- X2 higher operative mortality rates at MSH
- Little is known about cancer surgery readmission patterns across vulnerable hospitals in the US



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# Minority Serving Hospitals and Cancer Surgery Readmissions: A Reason for Concern

Young Hong, Chaoyi Zheng, Russell C. Langan, Elizabeth Hechenbleikner,  
Erin C. Hall, Nawar M. Shara, Lynt B. Johnson, Waddah B. Al-Refaie

**To be presented at 2015 American College of Surgeons**



# Objectives

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- Minority Serving Hospital (MSH):
  - Hospitals that ranked in the top 25% for the proportion of black and Hispanic patients served
- Aims:
  - **Primary**
    - Quantify the impact of Minority Serving Hospitals on readmission rates after major cancer surgery
  - **Secondary**
    - Identify possible hospital and/or patient factors associated with variations in hospital readmissions

# Data Source and Cohort

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- Use of 2 complimentary data sources:
    - **2004 – 2011 State Inpatient Database of California:**
      - Large and racially diverse population
- Linked to**
- **Annual Survey Database of American Hospital Association:**
    - Rich in hospital factors
- Patient selection:
    - **110,857 patients in 355 hospitals in California**
- Operative procedures:
    - **Resections of lung, esophageal, gastric, pancreatic, hepatobiliary, rectal, and kidney cancers.**



# Statistical Methods

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## Minority-Serving Hospital:

- Top quartile in % of Black/Hispanic patients

## Covariates:

- HRRP adjustment: age, sex, comorbidity, procedure type, year
- Patient factors: race/ethnicity, insurance, income
- Emergency status
- Hospital factors: bed size, teaching status, case volume, cancer program, ownership

# Statistical Methods

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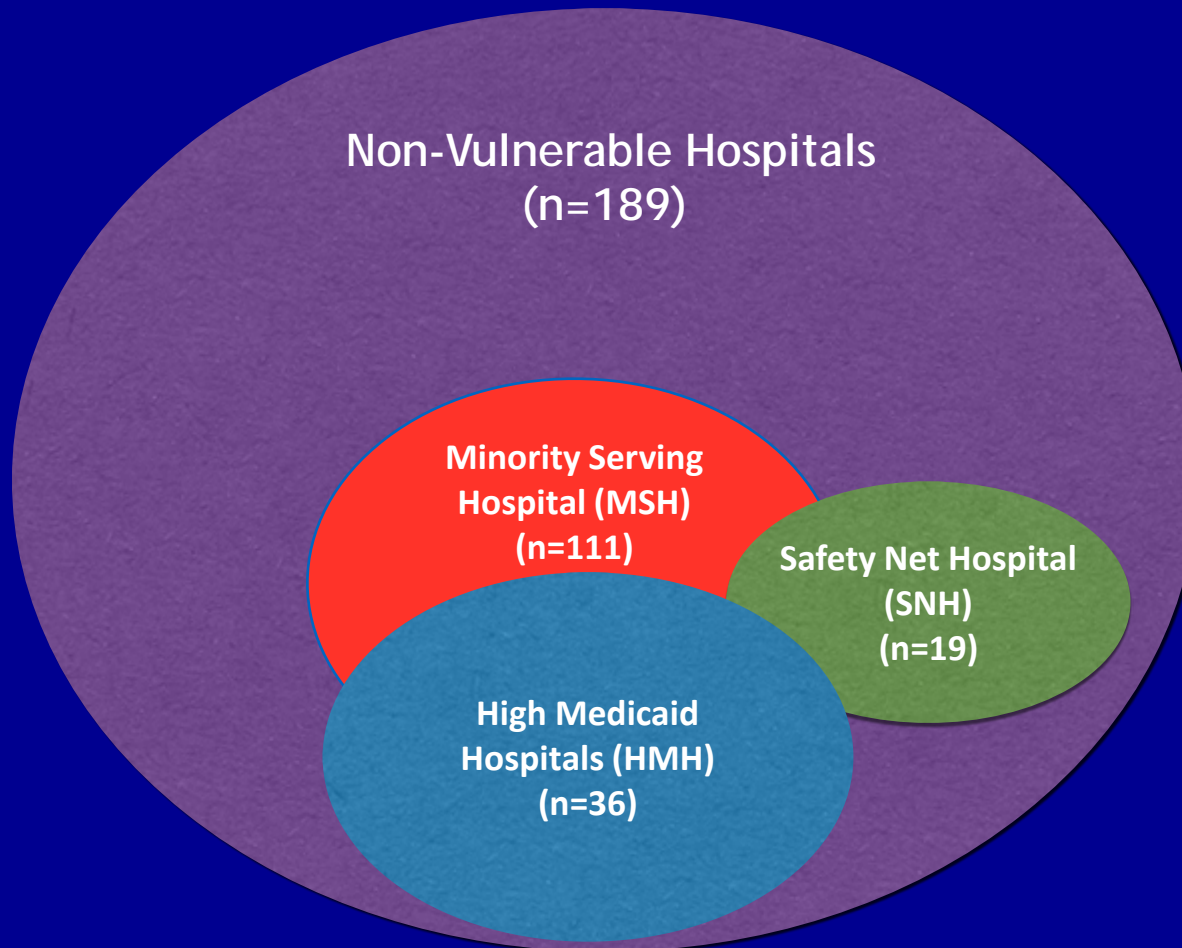
- Outcome (dependent) variables:
  - 30-day (ACA priority)
  - 90-day and repeated readmissions (clinical relevance)
- Multivariate analyses:
  - MSH and readmission rates (Hierarchical model with adjustment for case mix)
  - Blockwise regression analyses by sequentially adding patient, procedure and hospital factors
  - Repeated sensitivity analyses using different MSH proportional (top tertile or decile)

# Results

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# Vulnerable Hospitals in California Performing Major Cancer Surgery (n=355)

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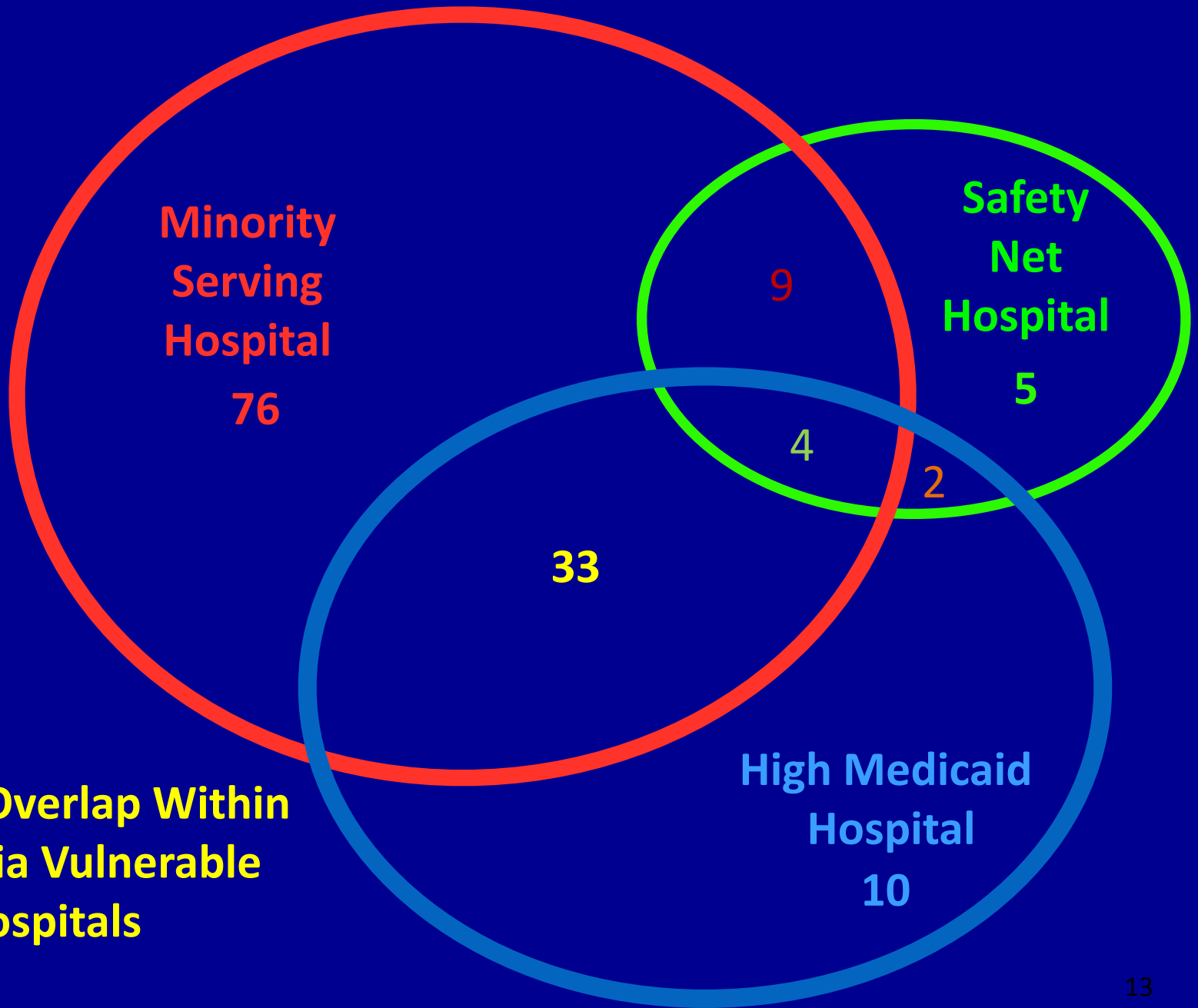


**Minority Serving  
Hospital (Top 25%)**

**High Medicaid Hospital  
(Top 10%)**

**Safety Net Hospital  
(California Association  
of Public Hospital and  
Health System)**

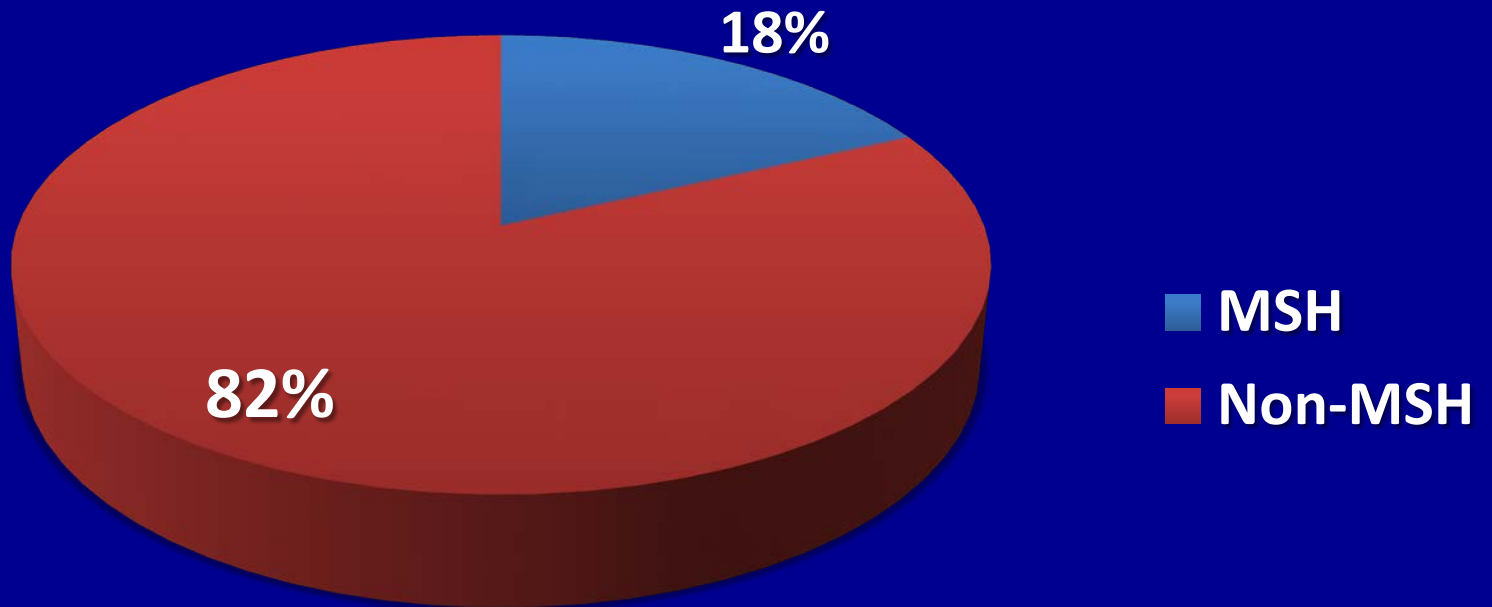
**Relative Overlap Within  
California Vulnerable  
Hospitals**



# MSH Performing Major Cancer Surgery

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## Distribution of Major Cancer Surgery Performed in California



# MSH Patients were Younger, Multi-morbid, and Underwent Emergent Surgery!

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		Non-MSH (%)	MSH (%)	P-Value
Age	18-49	18.2	19.7	<0.0001
	50-64	31.4	<b>36.4</b>	
	65-74	26.9	24.4	
	75+	23.5	19.5	
Charlson Index	0	59.5	56.0	< 0.0001
	1	26.2	26.7	
	2+	14.3	17.3	
Emergency Status	0	92.36	83.69	<0.0001
	1	<b>7.64</b>	<b>16.31</b>	

# MSH vs. non-MSH Attributes

		Non-MSH (%)	MSH (%)	P-Value
Primary Insurance	Medicare	50.49	43.05	<0.0001
	Medicaid	5.09	16.43	
	Private	41.08	32.17	
	Other	3.34	8.36	
Procedure Volume (in tertiles/yr)	Low	28.63	53.33	<0.0001
	Medium	32.09	37.78	
	High	39.28	8.89	
Teaching Status	Teaching	17.5	31.0	0.0061
Designated Cancer Program	Yes	38.9	21.0	0.0016



## Comparable Readmission Diagnosis

	Non-MSH (%)	MSH (%)
Septicemia	4.92	5.83
Intestinal Obstruction without hernia	4.61	4.14
Pneumonia	4	3.74
Complication of device; implant or graft	3.33	3.19
Hypovolemia	3.02	2.36
Acute and unspecified renal failure	2.27	1.77
Urinary tract infections	2.17	2.13

## Higher Adjusted Readmissions Rates at Minority Serving Hospitals

% Minority Served at Hospital	30-Day Readmission OR (95% CI)	90-Day Readmission OR (95% CI)	Repeated Readmissions OR (95% CI)
2nd Quartile (vs. Q1)	1.05 (0.96-1.14)	1.06 (0.98-1.15)	1.06 (0.92-1.23)
3rd Quartile (vs. Q1)	<b>1.13</b> <b>(1.04 - 1.22)**</b>	<b>1.14</b> <b>(1.06 - 1.22)***</b>	<b>1.20</b> <b>(1.05-1.38)**</b>
4th Quartile (MSH) (vs. Q1)	<b>1.16</b> <b>(1.05-1.29)**</b>	<b>1.18</b> <b>(1.08,1.29)**</b>	<b>1.28</b> <b>(1.10,1.50)**</b>

After adjusting for age, sex, comorbidity, type of procedure, race, and yr of admission.

\*\* p < 0.01; \*\*\* p < 0.001.

# Readmission Predominately Driven by Patient Factors

Q4 vs. Q1-3	30-Day Readmission		90-Day Readmission		Repeated Readmissions	
	OR (95% CI)	% Change	OR (95% CI)	% Change	OR (95% CI)	% Change
Unadjusted	1.15 (1.06,1.24)		1.16 (1.09,1.25)		1.21 (1.09,1.34)	
+ HRRP	1.13 (1.04,1.23)	11.8%	1.15 (1.07,1.24)	9.0%	1.16 (1.05,1.29)	21.9%
+ Patient Factors	1.06 (0.96,1.16)	50.9%	1.05 (0.96,1.15)	59.0%	1.06 (0.93,1.22)	47.8%
+ Hospital Factors	1.06 (0.96,1.15)	0.0%	1.06 (0.97,1.15)	-4.5%	1.08 (0.96,1.22)	-9.4%

Sensitivity Analysis using top decile and top tertile demonstrated comparable estimates

# Readmission Predominately Driven by Patient Factors

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Q4 vs. Q1-3	30-Day Readmission		90-Day Readmission		Repeated Readmissions	
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+ Patient Factors	1.06 (0.96,1.16)	50.9%	1.05 (0.96,1.15)	59.0%	1.06 (0.93,1.22)	47.8%
+ Hospital Factors	1.06 (0.96,1.15)	0.0%	1.06 (0.97,1.15)	-4.5%	1.08 (0.96,1.22)	-9.4%

Sensitivity Analysis using top decile and top tertile demonstrated comparable estimates

# Readmissions Predominately Driven by Patient Factors

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+ HRRP	1.13 (1.04,1.23)	11.8%	1.15 (1.07,1.24)	9.0%	1.16 (1.05,1.29)	21.9%
+ Hospital Factors	1.12 (1.04,1.21)	6.0%	1.15 (1.07,1.24)	-0.4%	1.19 (1.08,1.32)	-11.8%
+ Patient Factors	1.06 (0.96,1.15)	44.8%	1.06 (0.97,1.15)	55.0%	1.08 (0.96,1.22)	50.2%

Sensitivity Analysis using top decile/top tertile and order of block regression demonstrated similar outcomes.



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# Vulnerable Hospitals and Cancer Surgery Readmissions: Insights into the unintended consequences of the Patient Protection and Affordable Care Act (PPACA)

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Lynt B. Johnson MD, Nawar Shara PhD, Waddah B. Al-Refaie MD, FACS

To be Presented at 2015 Western Surgical Association





# Definitions

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- **Safety Net Hospitals**: Identified by the California Association of Public Hospitals and Health Systems
- **High Medicaid Hospitals**: Hospitals with highest decile of Medicaid patients (Top 10%)

# Vulnerable Hospitals Have Higher Adjusted 30-day Readmission Rates

Vulnerable Hospital Type	30-Day Readmissions OR (95% CI)	90-Day Readmissions OR (95% CI)	Repeated Readmissions OR (95% CI)
Safety Net vs. Non-Safety Net Hospital	1.29 (1.17-1.42)	1.24 (1.14-1.35)	1.30 (1.15-1.47)
High Medicaid vs. Low Medicaid Hospital	1.12 (1.00-1.25)	1.26 (1.15-1.39)	1.28 (1.05-1.55)

<sup>a</sup>After adjusting for age, sex, comorbidity, type of procedure and year of admission.

<sup>b</sup>Defined as  $\geq 1$  readmission within 60 days from first index readmission.

# Higher Adjusted 90-day Readmission Rates

Vulnerable Hospital Type	30-Day Readmissions OR (95% CI)	90-Day Readmissions OR (95% CI)	Repeated Readmissions OR (95% CI)
Safety Net vs. Non-Safety Net Hospital	1.29 (1.17-1.42)	1.24 (1.14-1.35)	1.30 (1.15-1.47)
High Medicaid vs. Low Medicaid Hospital	1.12 (1.00-1.25)	1.26 (1.15-1.39)	1.28 (1.05-1.55)

<sup>a</sup>After adjusting for age, sex, comorbidity, type of procedure and year of admission.

<sup>b</sup>Defined as  $\geq 1$  readmission within 60 days from first index readmission.

## ..... And Higher Repeated Readmission Rates

Vulnerable Hospital Type	30-Day Readmissions OR (95% CI)	90-Day Readmissions OR (95% CI)	Repeated Readmissions OR (95% CI)
Safety Net vs. Non-Safety Net Hospital	1.29 (1.17-1.42)	1.24 (1.14-1.35)	1.30 (1.15-1.47)
High Medicaid vs. Low Medicaid Hospital	1.12 (1.00-1.25)	1.26 (1.15-1.39)	1.28 (1.05-1.55)

<sup>a</sup>After adjusting for age, sex, comorbidity, type of procedure and year of admission.

<sup>b</sup>Defined as  $\geq 1$  readmission within 60 days from first index readmission.

# Conclusions

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- **Vulnerable hospitals experience higher readmission rates after major cancer surgery compared to non-vulnerable hospitals.**
- **These findings validate current concerns about unintended consequences of PPACA penalties on financially strained hospitals.**
- **Our results have policy implications for amendments of penalties by PPACA to vulnerable hospitals given diminishing reimbursements.**



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# Do Hospital Factors Contribute to Readmissions after Colorectal Procedures?

Elizabeth Hechenbleikner, Chaoyi Zheng, Young Hong, Nawar M. Shara,  
Lynt B. Johnson, Waddah B. Al-Refaie



# Objectives

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- Minority Serving Hospital (MSH):
  - Hospitals that ranked in the top decile for the proportion of black and Hispanic patients served (top 10%)
- Aims:
  - **Primary**
    - Quantify the impact of Minority Serving Hospitals on readmission rates after colorectal surgery
  - **Secondary**
    - Identify possible hospital and/or patient factors associated with variations in hospital readmissions

# Do Hospital Factors Contribute to Readmission?

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- MSH have higher readmission rates
- Which hospital factors drive readmissions after colorectal resections (as a proxy for common surgical procedures) performed at MSH in the context of patient- and procedure-related factors?
- Contribution of hospital factors not well understood



# Data source and cohort

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- Use of 2 complimentary Data sources:
  - 2004 – 2011 State Inpatient Database of California:
    - Large and racially diverse population
- **Linked to**
  - Annual Survey Database of American Hospital Association:
    - Rich in hospital factors
- Patient selection:
  - 168,590 patients in 374 hospitals in California
- Operative procedures:
  - Colon and rectal procedures for benign and malignant conditions.

# Statistical methods

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- **Constructed variables:**
  - Patient: age, race/ethnicity, insurance, region, multi-morbidity, yr
  - Procedure status: urgent
  - Hospitals: bed size, teaching status, volume, RN: bed, ICU, rehab, or cancer center
  - Readmission diagnosis

# Statistical methods

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- Outcome (dependent) variables:
  - 30-day (ACA priority)
  - 90-day and repeated readmissions (clinical relevance)
- Multivariate analyses:
  - MSH and readmission rates (Hierarchical model with adjustment for case mix)
  - Blockwise regression analyses by sequentially adding patient, procedure and hospital factors
  - Repeated sensitivity analyses using different MSH proportional (top tertile or quartiles)

STEPWISE MODEL		Odds Ratios for Readmissions at MSH v. Non-MSH					
		30-Day Readmission		90-Day Readmission		Repeated Readmission	
		Odds Ratio (95% CI)	% Change in OR	Odds Ratio (95% CI)	% Change in OR	Odds Ratio (95% CI)	% Change in OR
Top Decile vs Decile 1-9	Model 1 = Unadjusted Model	<b>1.22</b> <b>(1.09,1.36)***</b>	-	<b>1.21</b> <b>(1.12,1.32)***</b>	-	<b>1.38</b> <b>(1.15,1.65)***</b>	-
	Model 2 = Model 1 + Patient Factors	<b>1.06</b> <b>(0.94,1.19)</b>	<b>71.7%</b>	<b>1.09 (0.99,1.20)</b>	<b>59.0%</b>	<b>1.11</b> <b>(0.91,1.36)</b>	<b>70.6%</b>
	Model 3 = Model 2 + Procedure Factors	<b>1.06</b> <b>(0.94,1.19)</b>	<b>2.2%</b>	<b>1.08 (0.98,1.19)</b>	<b>2.2%</b>	<b>1.11</b> <b>(0.91,1.36)</b>	<b>0.5%</b>
	Model 4 = Model 3 + Hospital Factors	<b>1.02</b> <b>(0.90,1.15)</b>	<b>16.2%</b>	<b>1.04 (0.94,1.15)</b>	<b>20.1%</b>	<b>1.05</b> <b>(0.88,1.26)</b>	<b>14.8%</b>

# Patient Factors Contributed More....

STEPWISE MODEL		Odds Ratios for Readmissions at MSH v. Non-MSH					
		30-Day Readmission		90-Day Readmission		Repeated Readmission	
		Odds Ratio (95% CI)	% Change in OR	Odds Ratio (95% CI)	% Change in OR	Odds Ratio (95% CI)	% Change in OR
Top Decile vs Decile 1-9	Model 1 = Unadjusted Model	1.22 (1.09,1.36)***	-	1.21 (1.12,1.32)***	-	1.38 (1.15,1.65)***	-
	Model 2 = Model 1 + Patient Factors	1.06 (0.94,1.19)	71.7%	1.09 (0.99,1.20)	59.0%	1.11 (0.91,1.36)	70.6%
	Model 3 = Model 2 + Procedure Factors	1.06 (0.94,1.19)	2.2%	1.08 (0.98,1.19)	2.2%	1.11 (0.91,1.36)	0.5%
	Model 4 = Model 3 + Hospital Factors	1.02 (0.90,1.15)	16.2%	1.04 (0.94,1.15)	20.1%	1.05 (0.88,1.26)	14.8%

# Procedure Factors Contributed Far Less....

STEPWISE MODEL		Odds Ratios for Readmissions at MSH v. Non-MSH					
		30-Day Readmission		90-Day Readmission		Repeated Readmission	
		Odds Ratio (95% CI)	% Change in OR	Odds Ratio (95% CI)	% Change in OR	Odds Ratio (95% CI)	% Change in OR
Top Decile vs Decile 1-9	Model 1 = Unadjusted Model	<b>1.22</b> <b>(1.09,1.36)***</b>	-	<b>1.21</b> <b>(1.12,1.32)***</b>	-	<b>1.38</b> <b>(1.15,1.65)***</b>	-
	Model 2 = Model 1 + Patient Factors	<b>1.06</b> <b>(0.94,1.19)</b>	<b>71.7%</b>	<b>1.09 (0.99,1.20)</b>	<b>59.0%</b>	<b>1.11</b> <b>(0.91,1.36)</b>	<b>70.6%</b>
	Model 3 = Model 2 + Procedure Factors	<b>1.06</b> <b>(0.94,1.19)</b>	<b>2.2%</b>	<b>1.08 (0.98,1.19)</b>	<b>2.2%</b>	<b>1.11</b> <b>(0.91,1.36)</b>	<b>0.5%</b>
	Model 4 = Model 3 + Hospital Factors	<b>1.02</b> <b>(0.90,1.15)</b>	<b>16.2%</b>	<b>1.04 (0.94,1.15)</b>	<b>20.1%</b>	<b>1.05</b> <b>(0.88,1.26)</b>	<b>14.8%</b>

# Hospital Factors Contributed Less than Patient Factors!

STEPWISE MODEL		Odds Ratios for Readmissions at MSH v. Non-MSH					
		30-Day Readmission		90-Day Readmission		Repeated Readmission	
		Odds Ratio (95% CI)	% Change in OR	Odds Ratio (95% CI)	% Change in OR	Odds Ratio (95% CI)	% Change in OR
Top Decile vs Decile 1-9	Model 1 = Unadjusted Model	1.22 (1.09,1.36)***	-	1.21 (1.12,1.32)***	-	1.38 (1.15,1.65)***	-
	Model 2 = Model 1 + Patient Factors	1.06 (0.94,1.19)	71.7%	1.09 (0.99,1.20)	59.0%	1.11 (0.91,1.36)	70.6%
	Model 3 = Model 2 + Procedure Factors	1.06 (0.94,1.19)	2.2%	1.08 (0.98,1.19)	2.2%	1.11 (0.91,1.36)	0.5%
	Model 4 = Model 3 + Hospital Factors	1.02 (0.90,1.15)	16.2%	1.04 (0.94,1.15)	20.1%	1.05 (0.88,1.26)	14.8%

# Only Few Hospital Factors Contributed .....

Effect		FULL REGRESSION MODEL		
		30-DAY READMISSION	90-DAY READMISSION	REPEATED READMISSION
		OR (95% CI)	OR (95% CI)	OR (95% CI)
Hospital Volume (in tertile)	Low (38/period)	1.05 (0.99,1.12)	1.01 (0.90,1.14)	1.32 (1.18,1.48)***
	Med (39-104/period)	1.02 (0.95,1.08)	0.98 (0.88,1.10)	1.28 (1.14,1.43)***
	High (>104/period)			
Bedsizes	1-99	0.75 (0.66,0.87)***	0.71 (0.57,0.88)**	0.67 (0.54,0.84)***
	100-399	0.90 (0.83,0.97)**	0.92 (0.81,1.04)	0.94 (0.83,1.07)
	400+			
Teaching Hospital	No	0.91 (0.85,0.97)**	0.83 (0.76,0.92)***	0.97 (0.89,1.07)
	Yes			
Cancer program	No	0.98 (0.93,1.04)	1.03 (0.93,1.13)	0.96 (0.87,1.06)
	Yes			
ICU	Yes	0.94 (0.85,1.05)	1.09 (0.84,1.43)	1.23 (1.00,1.52)
	No			
Wound Center	No	0.95 (0.88,1.03)	1.10 (0.97,1.23)	1.02 (0.90,1.16)
	Yes			
Rehabilitation Center	No	1.07 (1.00,1.15)*	1.12 (1.01,1.25)*	0.98 (0.86,1.10)
	Yes			
Nurse Bed Ratio	1-2	0.99 (0.90,1.08)	0.96 (0.82,1.12)	1.02 (0.85,1.23)
	>=2	1.00 (0.92,1.10)	1.02 (0.88,1.18)	1.04 (0.88,1.25)
	0-1			
MSH v. Non-MSH	Black/Hispanic T10 vs.	1.04 (0.94,1.15)	1.05 (0.88,1.26)	1.09 (0.91,1.31)
	Black/Hispanic T1-9			



# Conclusions

- **Patient-level factors appeared to dominate the increased readmission risk following colorectal resections performed at MSH while hospital factors were less contributory.**
- **These findings need to be further validated to shape quality improvement interventions to decrease readmissions.**

**Thank you!**

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