

Policy effects in Lumbar spine surgery: strategies for bundle payment programs.

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8/18/2015

Disclosures

- Salary support from federal grants related to spine.
- Limited-term paid consultant to WA state L&I.
- Past work as consultant on federal grants related to back pain.
- Interagency Pain Research Coordinating Committee (Public Health: Service and Reimbursement working group member)
- No ties to any commercial interests.

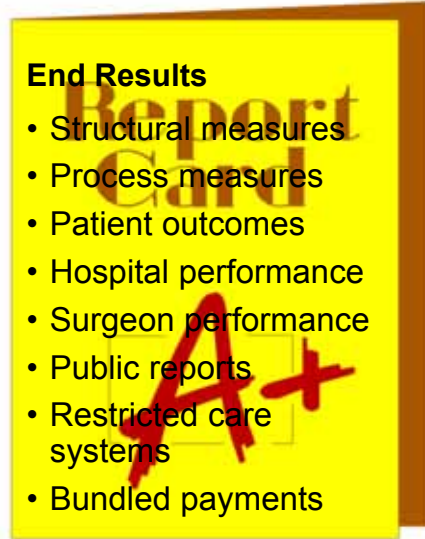
Introduction:
Paradigm Shift for Quality Guarantees

Credentialing

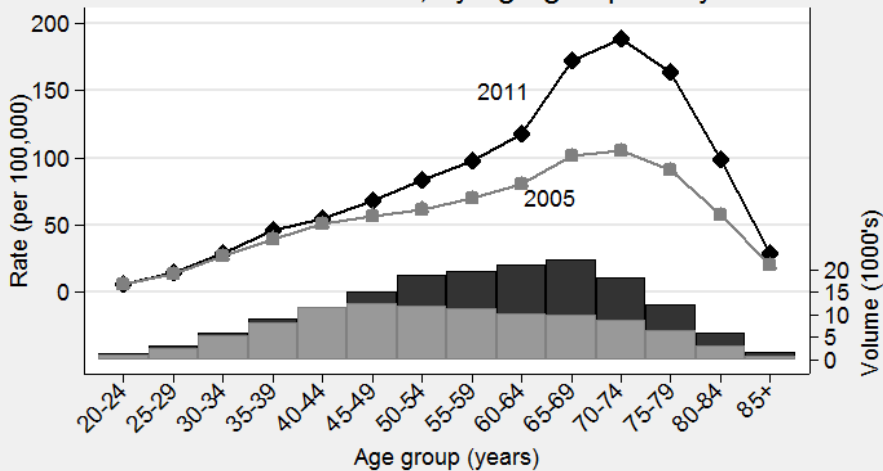
- Joint Commission
- Medical Boards
 - Medical school
 - Specialty
 - Subspecialty
- State Licensure
- Continuing Education
- Professional Societies

End Results

- Structural measures
- Process measures
- Patient outcomes
- Hospital performance
- Surgeon performance
- Public reports
- Restricted care systems
- Bundled payments



Rate (per 100,000) and volume (1000's) of lumbar fusion operations for degenerative diagnoses in the United States, by age group and year



Source: Nationwide Inpatient Sample (NIS) 2004-2011
 Rate estimates based on Poisson regression

Brief overview

- Toolkit for spinal research
- Applications:
 - Two-state comparison of fusion among WC patients
 - Policy effects of lumbar fusion restrictions in NC
 - Early effects of Medicare's bundled payment program
- Opportunities:
 - CMS mandatory expansion of bundled payments

General methods

Data: Retrospective analysis of state & national discharge registries, including AHRQ's Healthcare Cost and Utilization Project, Medicare Data, High Value Health Collaborative.

Algorithm: Applied validated ICD-9-CM coding algorithm to identify spine related admissions, classify surgical indication, describe procedures, and measure outcomes.

Covariates: demographics, operative features, and comorbidity; increasingly linking to hospital and health system data.

Algorithm & validation studies

Mirza SK, Martin BI, Goodkin R, Hart RA, Anderson PA. Developing a toolkit for comparing safety in spine surgery. Instr Course Lect. 2014;63:271-86.

Martin BI, Lurie JD, Tosteson AN, Deyo RA, Tosteson TD, Weinstein JN, Mirza SK. Indications for spine surgery: validation of an administrative coding algorithm to classify degenerative diagnoses. Spine (Phila Pa 1976). 2014 Apr 20;39(9):769-79.

Kazberouk A, Martin BI, Stevens JP, McGuire KJ. Validation of an administrative coding algorithm for classifying surgical indication and operative features of spine surgery. Spine (Phila Pa 1976). 2015 Jan 15;40(2):114-20.

(In progress) Patel N, Moses R, Martin BI. Validation of a claims-based algorithm for identifying surgical safety after lumbar fusion surgery.

Validating a coding algorithm for classifying surgical indications

	SPORT Cohort		
	IDH	SS	DS
SENS	76.2%	86.3%	87.8%
SPEC	98.3%	89.1%	90.2%

Martin BI, 2014.

Validating a coding algorithm for classifying operative features in fusion

Claims data compared to chart review at a single institute.

	Fusion (n = 478)	Inst (n = 247)	Circ (n = 247)	3+levels (n = 247)
SENS	97.6%	81.7%	95.7%	53.0%
SPEC	99.1%	57.1%	78.8%	73.0%

Kazberouk, 2015

Invasiveness Index

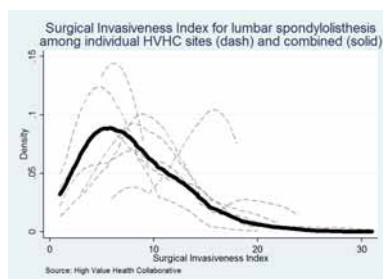
L5-S1 posterior discectomy = 1

L4-S1 laminectomy = 3

L4-S1 posterior fusion with pedicle screws = 6

L4-L5 posterior interbody fusion with L4 and L5 laminectomy, and L4-5 interbody fusion with cages = 10

T1-ilium posterior fusion; pedicle screws bilaterally at T1, T4, T8, L1, L2, L3, L4, L5, S1, and ilium; laminectomy L1 to S1, and interbody fusion with cages at L1-2, L2-3, L4-5 = 47



Disease Levels	Treatment Levels							
	Posterior				Anterior			
	Dec	Fus	Ins	VP	Dec	Fus	Ins	VP
C0								
C1								
C2								
C3								
C4								
C5								
C6								
C7								
T1								
T2								
T3								
T4								
T5								
T6								
T7								
T8								
T9								
T10								
T11								
T12								
L1								
L2								
L3								
L4								
L5								
S1								
S2								
S3								
S4								
CC								
IL								

Mirza, S. K., et al. (2008). "Development of an index to characterize the "invasiveness" of spine surgery: validation by comparison to blood loss and operative time." *Spine (Phila Pa 1976)* 33(24): 2651-2661; discussion 2662

Policy studies (1)

Martin B.I., Franklin G.M., Deyo R.A., Wickizer T, Lurie J.D., Mirza S.K. How Do Coverage Policies Influence Practice Patterns, Safety, and Cost of Initial Lumbar Fusion Surgery? A Population-based Comparison of Workers' Compensation Systems. Spine J. 2014 Jul 1;14(7):1237-46.

Contrasting WC coverage policy

Component	Washington	California
Claims process	State agency*	Private insurance*
Initial fusion	Single level	Non limited
Repeat surgery	Subject to review	Not limited
Prerequisite	Imaging of instability	No requirement
2 nd opinion	No requirement	Binding
* Unless employer is certified as self-insured.		

How do coverage policies influence practice patterns, safety, and cost of initial lumbar fusion surgery? A population-based comparison of workers' compensation systems. Martin BI, Franklin GM, Deyo RA, Wickizer TM, Lurie JD, Mirza SK. The Spine Journal, 2013. {E-pub ahead of print}

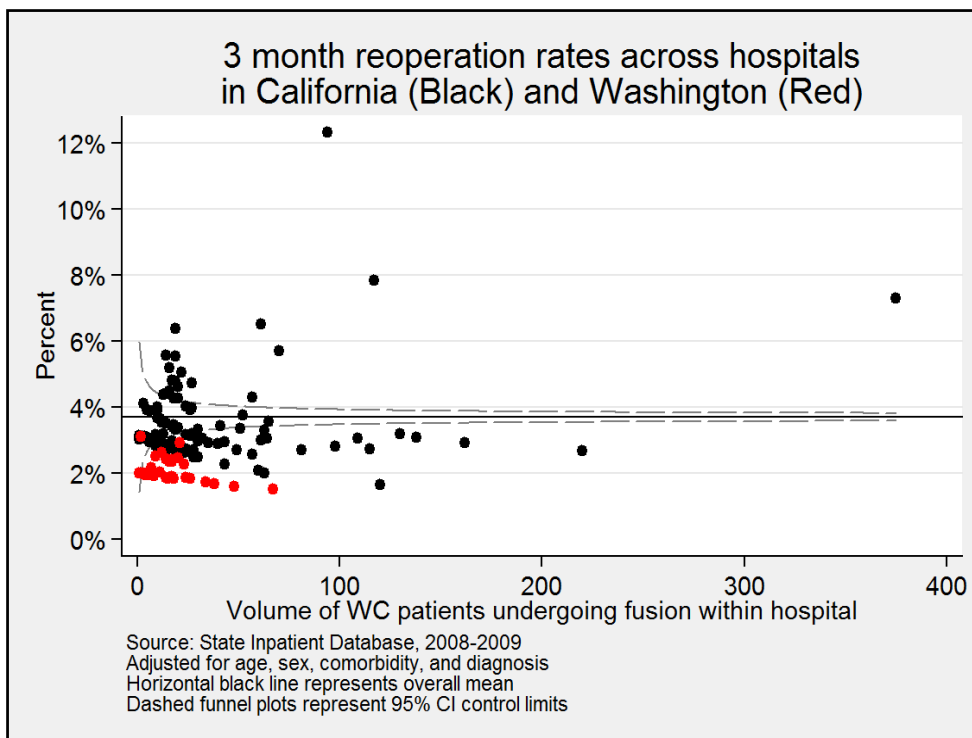
Health utilization

Operative characteristics		Washington	California	p-value
Population rate (pre 100K)		12.9	19.0	<0.001
Diagnosis	Degeneration	21%	28%	<0.001
	Herniated disc	21%	37%	
	Stenosis	15%	6%	
	Spondylolisthesis	41%	25%	
	Scoliosis	3%	4%	
Approach	Posterior	87%	60%	<0.001
	Anterior	8%	14%	
	Circumferential	5%	26%	
3+ disc levels fused		5%	10%	0.011
Bone Morphogenetic Protein		31%	50%	<0.001

Safety outcomes*

	Washington	California	p-value
Lumbar spine reoperation	1.9%	4.8%	<0.001
Readmission (all cause)	9.1%	14.0%	<0.001
Device complication	0.3%	0.7%	<0.001
Wound problems	1.5%	4.1%	<0.001
Life-threatening complications	2.4%	3.3%	<0.001

* Controlling for age, sex, comorbidity & diagnosis



Policy studies (2)

*Martin BI, Deyo RA, Lurie JD, Carey TS, Tosteson ANA, Mirza SK.
Effects of a commercial insurance policy restriction on lumbar
fusion in North Carolina and the implications for national
adoptions. **(Revisions submitted to SPINE).***

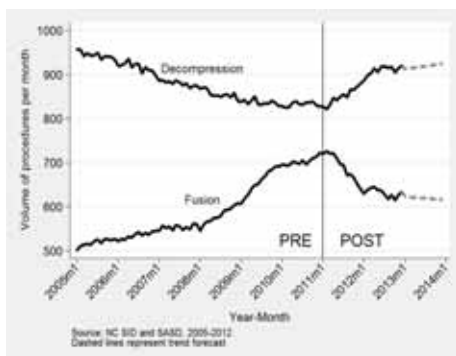
*Based on an evidence review, Blue Cross Blue Shield of North
Carolina (BCBSNC), initiated prior review of lumbar fusion on
January 1st, 2011, issuing denials of coverage where the sole
indication was disc herniation (HNP), degenerative disc disease
(DDD), initial discectomy/laminectomy for neural structure
decompression, or facet syndrome.*

Pre-post changes (ARIMA)

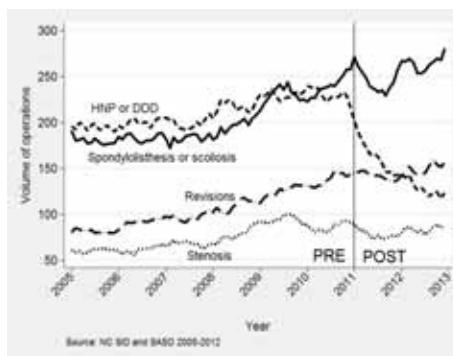
	Any procedure		Fusion				Decompression
	All diagnoses	All diagnoses	HNP/DDD	Stenosis	Listhesis	Revision	All diagnoses
Change in monthly volume							
Post BCBS Policy	-2.207 (-0.89)	-7.857*** (-3.64)	-4.946*** (-4.52)	-0.781 (-1.26)	-0.297 (-0.62)	-1.061*** (-3.32)	6.204** (2.83)
Percent change in proportion female	1.531 (0.61)	1.047 (0.85)	0.198 (0.34)	0.0285 (0.09)	-0.0181 (-0.04)	0.280 (0.60)	0.592 (0.39)
Percent change in mean age	21.56* (1.98)	10.37* (2.29)	0.471 (0.28)	1.734 (1.69)	3.903* (2.42)	3.439* (2.55)	5.042 (0.88)
Percent change in charlson score	-1.626 (-0.80)	-1.335 (-1.91)	-0.385 (-1.59)	0.106 (0.56)	-0.812** (-3.18)	-0.129 (-0.66)	-1.144 (-1.20)
Pre BCBS Policy	0.597 (0.45)	3.051** (2.74)	0.593 (1.31)	0.163 (0.50)	1.135*** (4.34)	0.769*** (3.49)	-1.149 (-1.48)
ARMA							
time lag (1 month)	-0.857*** (-11.94)	-0.771*** (-10.48)	-0.682*** (-7.52)	-0.709*** (-6.94)	-0.967*** (-8.16)	-1.000 (-0.23)	-0.847*** (-10.94)
moving average (2 month)	-1.000 (-0.00)	-0.844*** (-9.72)	-0.774*** (-8.00)	-0.673*** (-5.83)	-0.973*** (-5.39)	-1.000 (-0.01)	-1.000 (-0.00)
Sigma							
Pre BCBS Policy	85.70 (0.00)	49.86*** (12.29)	20.88*** (11.80)	10.95*** (12.32)	18.41*** (10.89)	13.92 (0.01)	53.86 (0.00)
Pre vs. post trend p-value	0.346	<0.001	<0.001	0.256	0.006	<0.001	0.004
Number of months	95	95	95	95	95	95	95

BCBSNC policy change for lumbar fusion

By procedure



By indication



Policy studies (3)

Martin BI, Tosteson ANA, Lurie JD, Jevsevar DS, Mirza SK, Weinstein JN. Early effects of Medicare's Bundle Payment Program: Hip, Knee joint replacement and Lumbar Fusion surgery. (Drafted).

- Key provision of the Affordable Care Act, intended to shift away from fee-for-service reimbursement.
- A predetermined payment for all services related to a targeted condition over a defined period (“episode-of-care”).
- Lower extremity joint replacement and non-cervical spinal fusion are common targets of payment reform.

Center for Medicare & Medicaid Innovation (CMMI) Bundle Payment Program

Model 2: Retrospective payment for hospitals, physicians, and post-acute providers for an episode of care consisting of an inpatient hospital stay followed by post-acute care.



Source: Centers for Medicare & Medicaid Services

Phase I: Preparatory period (January 1, 2013)

Phase II: Risk-Bearing (October 1, 2013)

Aims

- Based on participation in Model 2, following initiation of non-risk bearing program:
 - Describe differences in procedure volume, patient characteristics, hospital features.
 - Estimate changes in 90-day episode-of-care reimbursement
 - Examine changes in surgical safety indicators.

Methods (1)

Data:

- Medicare claims 2012-2013 (IP, OP, Part B, SNF, & HHA)
- Public reports of hospital participation in CMMI's Bundle Payment Program.
- Annual Survey of the American Hospital Association (2012)

Patients:

- OASI beneficiaries (Age 65+) undergoing joint replacement or non-cervical fusion, defined by Diagnosis Related Group.
- Excluded: SSDI, ESRD or Medicare HMO (Advantage)

Methods (2)

Outcome:

- Primary: Inflation-adjusted 90-day reimbursement
- Secondary: Volume, repeat surgery, readmission.

Predictor: Bundle group (Non-participant, Phase I, Phase II)

Covariates: Age group (5-yr increments), Sex, Charlson comorbidity, log bed size & total discharges.

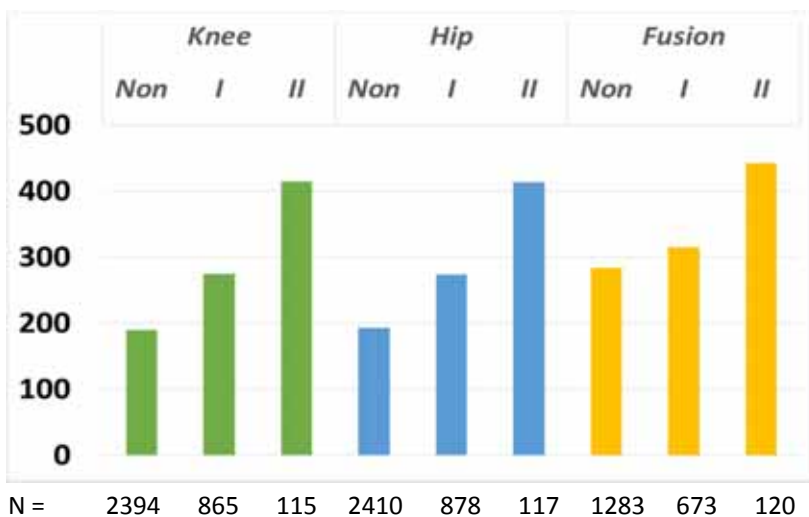
Analysis:

- Generalized regression, clustering for hospital.
- Year denotes initiation of preparatory period; we focused on YEAR * BUNDLE group interactions.
- Included index cases from Jan-Oct of each year in order to ensure 90-day surveillance and avoid bias due to seasonality.

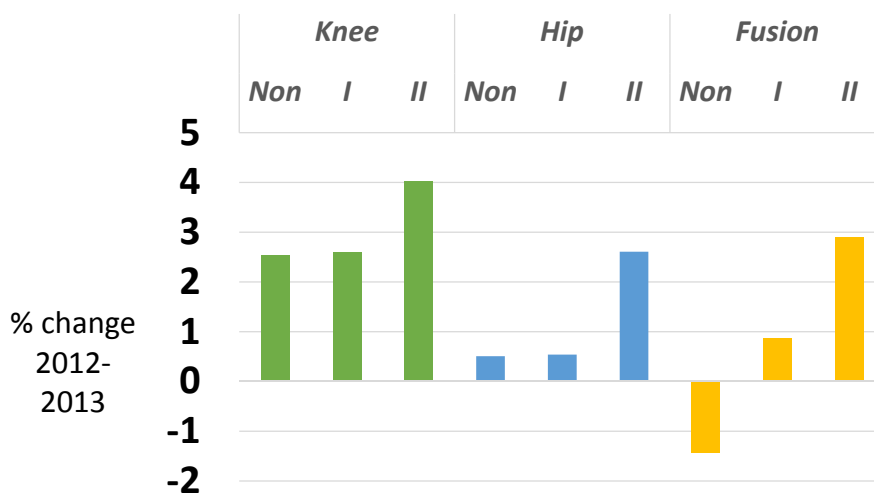
Results (1) –Patients similar across groups

Factors		Knee			Hip			Lumbar Fusion		
		Non	I	II	Non	I	II	Non	I	II
Program										
N (2013)		138K	78K	16K	103K	57K	13K	31K	20K	4K
Age	(mean)	73.7			77.8			73.4		
Female	(%)	63.7			65.5			59.6		
Race -White	(%)	90.7			93.0			92.2		
Comorbidity	0 (%)	54.8			47.7			49.8		
	1 (%)	27.9			25.1			28.8		
	2+ (%)	17.3			27.2			21.4		

Results (2) – Hospital bed size



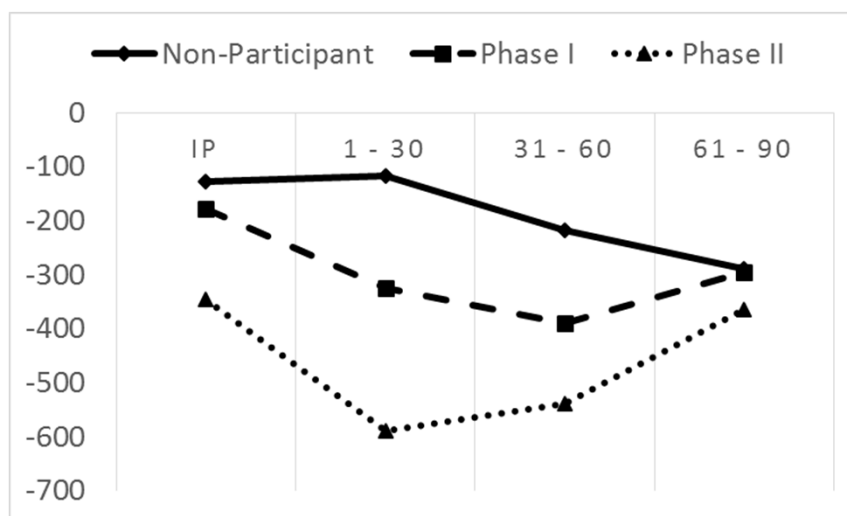
Results (3) – Change in Procedure Volume



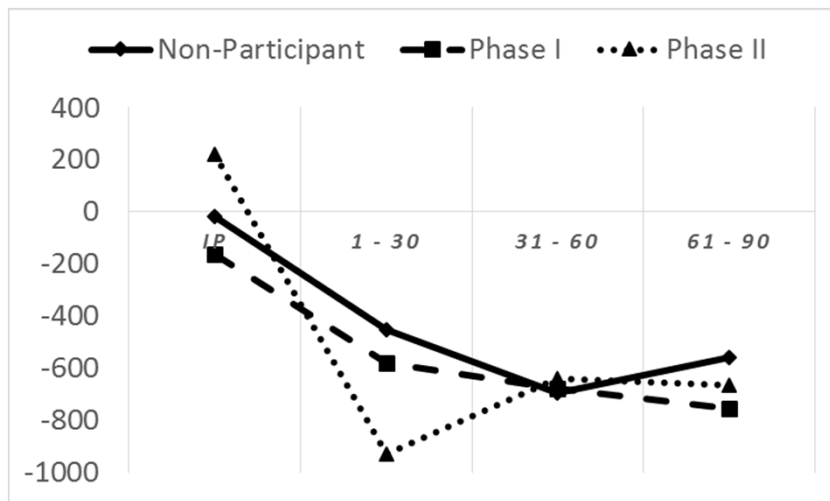
Results – 90-day episode of care costs

	Knee			Hip			Lumbar fusion		
	Non	I	II	Non	I	II	Non	I	II
Mean 2012	20389	20452	22995	28520	28396	30260	36832	36225	39016
% change 2013	-1.8	-2.8	-3.8	-2.9	-2.9	-4.2	-1.2	-0.6	1.6
DID P-value (I/II vs. Non)		0.067	0.058		0.925	0.194		0.549	0.174
P-value (I vs. II)			0.341			0.220			0.297

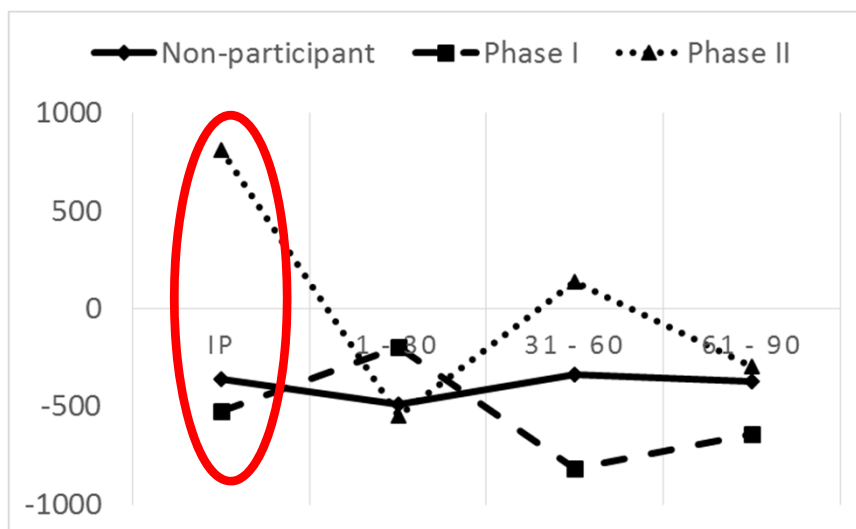
Change in 90-day episode of care reimbursement for total knee replacement (2012 – 2013)



Change in 90-day episode of care reimbursement for total hip replacement (2012-2013)



Change in 90-day episode of care reimbursement for lumbar fusion (2012-2013)

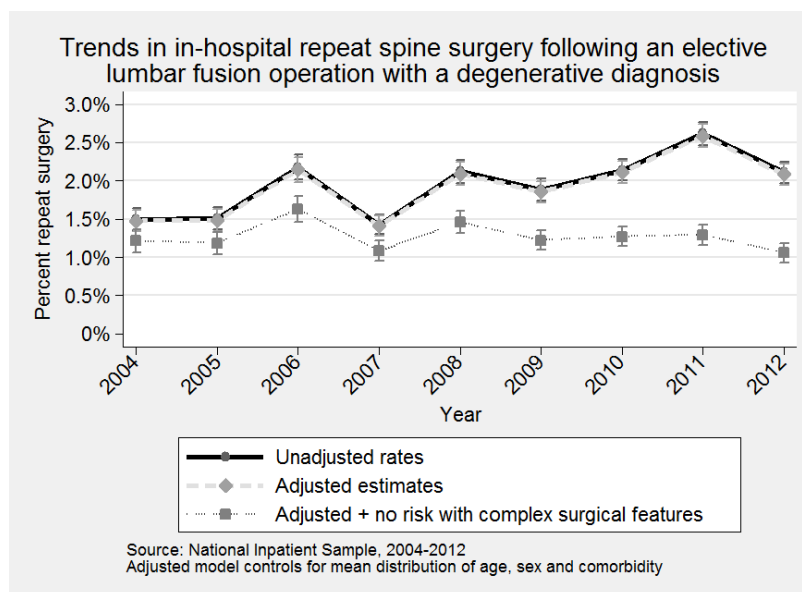


Results – 90 day repeat surgery

	Knee			Hip			Lumbar fusion		
	<i>Non</i>	<i>I</i>	<i>II</i>	<i>Non</i>	<i>I</i>	<i>II</i>	<i>Non</i>	<i>I</i>	<i>II</i>
2012 Rate	1.4	1.5	1.5	2.4	2.5	2.2	4.3	4.9	3.5
% Change (2012-2013)	-1.0	3.6	-4.8	-2.5	-1.2	0.86	7.2	-10.1	32.1
P-value (I/II vs. Non)		0.426	0.792		0.837	0.777		0.011	0.070
P-value (I vs. II)			0.550			0.870			0.001

Results – 90-day readmission

	Knee			Hip			Lumbar fusion		
	<i>Non</i>	<i>I</i>	<i>II</i>	<i>Non</i>	<i>I</i>	<i>II</i>	<i>Non</i>	<i>I</i>	<i>II</i>
2012 rate	8.1	8.2	8.1	14.4	15.0	13.7	12.6	13.4	11.6
% Change (2012 – 2013)	-18.5	-16.5	-15.1	-19.1	-18.6	-21.9	-10.0	-18.6	2.7
DID (I/II vs. Non)		0.309	0.494		0.990	0.283		0.021	0.046
DID (I vs. II)			0.856			0.297			0.001



(Drafted) Engler ID, Martin BI, Lurie JD, Mirza SK. In-hospital Repeat Spine Surgery Following Lumbar Fusion Surgery for Degenerative Conditions and Fractures

Results – Summary of findings

- Participant hospitals were larger and increased volume relative to non-participants.
- 36% of patients treated by a bundle payment hospital.
- Participants met CMMI cost targets (2-3% discount) for joint replacement, but not for lumbar fusion.
- No change in reoperation or all-cause readmission for joint replacement, but increases among Phase II hospitals performing lumbar fusion.

Opportunities

- CMS recently announced mandatory expansion bundle payment program for hip and knee joint replacement.
- Hospitals are poorly equipped to evaluate financial risk in these programs, especially for low-volume procedures.
- Currently developing research to link episode of care to specific strategies that hospital adopt.
- Our expertise may help inform price negotiations, services lines, and best strategies under emerging bundle payment programs.

Strategies

1. Redesign efficient clinical pathways (e.g. GreenCare for joint replacement). Includes reducing LOS and surveillance.
2. Vertical integration with post-acute care providers
3. Implant standardization
4. Risk identification & appropriateness criteria with pre/post operative management.

Which strategy to invest in is likely specific to each system.

Thanks!

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