Bending the Cost Curve? Preliminary Results from a Risk-Adjusted Payment Model for a Patient-Centered Medical Home

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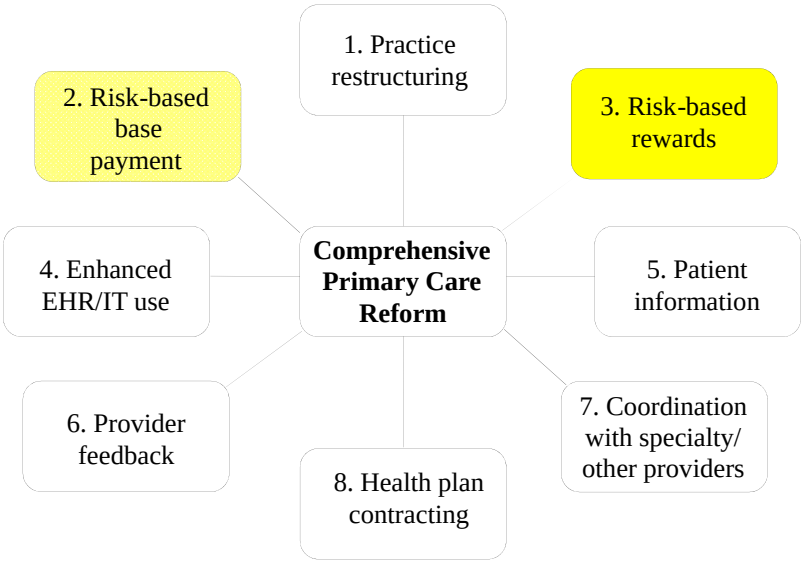
Goals of talk

- Provide an overview of a feasible payment system in support of a PCMH
- Describe how one health plan implemented a payment model with many of these features
- Present preliminary results from the first year of experience in the PCMH

Exhibit 1: Components of Comprehensive Primary Care Reform



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Three components to the primary care payment system

- A risk-adjusted base payment (PCAL)
  - The expected level of activity needed to provide good primary care for a physician's patient panel
- Risk-adjusted bonuses for "better than expected" in three domains
  - Cost and efficiency
  - Quality and clinical outcomes
  - Patient experience
- Start-up funding to finance the transition

"Risk-Based Comprehensive Payment" (RBCP)

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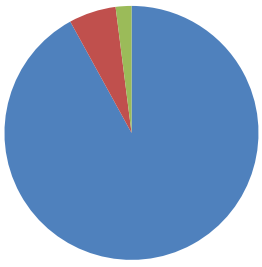
Capital District Physicians Health Plan (CDPHP) medical home project

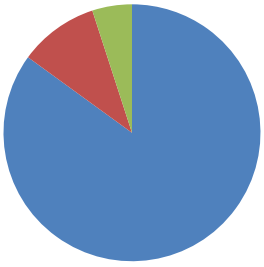
- Not-for-profit independent physicians association (IPA) health plan
- Founded by physicians in 1984 with more then 350,000 members
- Timeline of its Medical Home project
  - January 2008: Board approves virtual all payer model
  - May 2008: Practice Reform begins at three practices
  - January 2009 : Payment Reform begins at three practices
  - December 2010 : Project concludes
  - June 2011: Final report on Phase 1
  - July 2011: Phase 2 Kick Off

Primary care compensation - 2008 vs conventional P4P

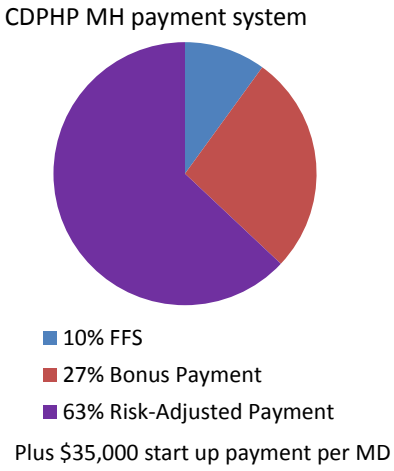
CDPHP before any change



Conventional P4P allocation



Payment Reform - CDPHP MH payment system

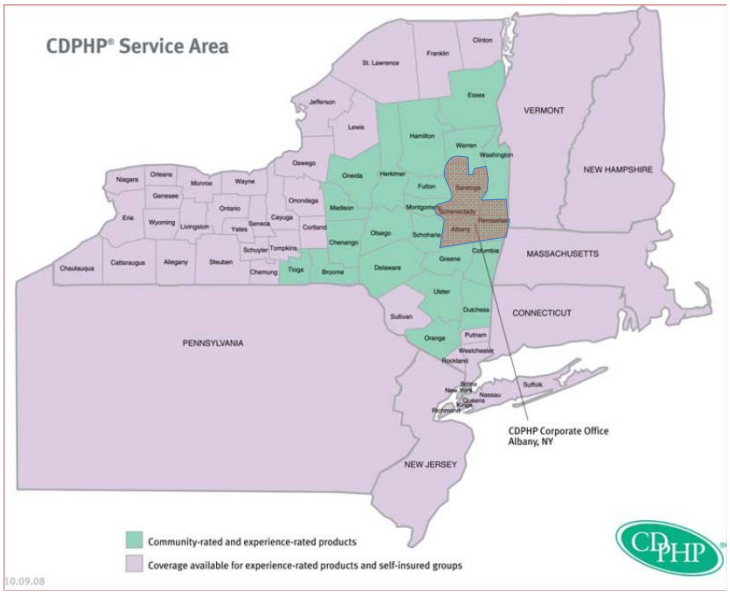


Plus $35,000 start up payment per MD

Unique features of CDPHP

- Very highly-rated health plan
- Serves commercial, Medicare, Medicaid
- Willing to implement PCMH before all of the details were worked out
- Funded practice transformation out of its own funds = its own sponsor
- Is calculating its own base and bonus payments = its own MH administrator

CDPHP Service Area

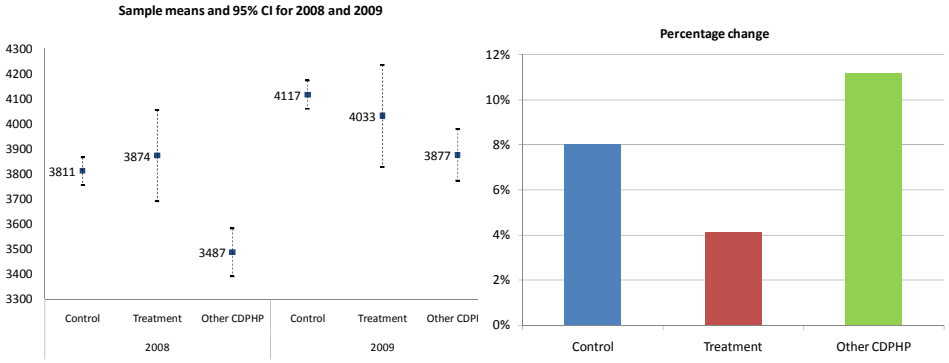


CDPHP Population

	2008	2009
Control	228,476	227,613
Treatment	13,009	12,660
Other CDPHP	85,034	84,783

Notes: Control group consists of patients in the four counties near Albany that contain the majority of the three treatment practice patients.

Mean CDPHP total health spending, 2008-2009



Notes: Means calculated on eligibility-weighted annualized untopcoded total health spending using full samples in each year

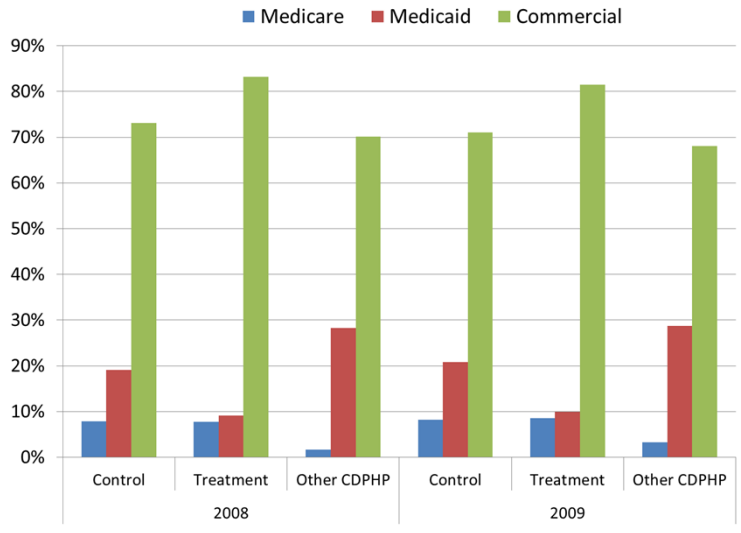
Key Questions

- Are results robust to risk adjustment?
- How much do switchers bias results
- Are the observed changes statistically significant?
- Were patients in all three major payer types equally affected?
- What types of spending did the payment system affect?
- What are implied cost savings?

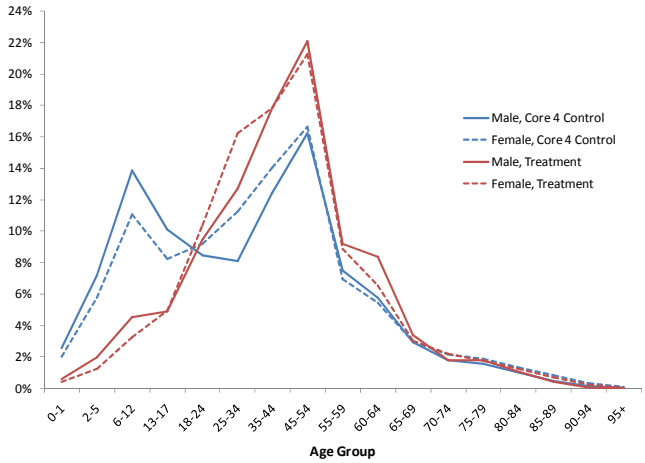
Types of plans in commercial, Medicare, and Medicaid

Commercial	Medicare	Medicaid
EPO_ASO	HMO_MCAREGRP	HMO_CHP
EPO_COMCLNHMO	HMO_MCAREINDV	HMO_FHP
FCTPROC_AS0	HMO_MCARENYSHIP	HMO_MCAID
HDEPO_COMCLNHMO	PPO_MCAREGRP	
HDHMO_HNY	PPO_MCAREINDV	
HDPPO_COMCLNHMO		
HMO_ASO		
HMO_COMCLHMO		
HMO_COMCLNYSHIP		
HMO_DP		
HMO_HNY		
POS_ASO		
POS_COMCLNHMO		
POS_DP		
PPO_ASO		
PPO_COMCLNHMO		
TRAD_ASO		
EPO_FEDS		
HDPPO_FEDS		

Sample percentiles in commercial, Medicare, and Medicaid



Age distributions for controls and treatment point out need for propensity score matching



Multiple types of changes to worry about

Switching into and out of treatment group		2009		
		Treatment	Core 4 Control	Other CDPHP
2008	Treatment	9,923	898	45
	Core 4 Control	958	187,041	1,512
	Other CDPHP	37	1,194	62,877

Switching between payers		2009		
		Commercial	Medicare	Medicaid
2008	Commercial	191,321	1,403	1,721
	Medicare	10	17,700	1
	Medicaid	1,313	41	50,975

Both years	2008 & 2009	264,485
Leavers	2008 only	62,034
Joiners	2009 only	60,571

Research strategy

- Clean spending data to reduce sensitivity to high and low outliers and increase precision
- Use propensity score matching to ensure control sample (in 4 counties) has same distribution as treatment sample
- Use risk adjustment models to control for changes in health status
- Control for people entering and leaving samples
  - Practice switchers, payer switchers, plan switchers, study sample entry and exit
- Use difference-in-difference models to examine differences in spending changes over time
- Conduct sensitivity analysis

Topcoding at $250,000 and bottom-coding to eliminate negative spending had a modest effect on sample means of total health spending but a much larger effect on standard deviations

		Untopcoded		Topcoded		% Changes	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
2008	Control	3,811	41,238	3,701	32,170	-3%	-22%
	Treatment	3,874	31,281	3,838	29,581	-1%	-5%
	Other CDPHP	3,487	42,429	3,340	30,638	-4%	-28%
2009	Control	4,117	42,126	3,997	33,115	-3%	-21%
	Treatment	4,033	34,595	3,983	30,323	-1%	-12%
	Other CDPHP	3,877	46,450	3,707	31,546	-4%	-32%

Propensity score matching of treatment and control samples on age-gender groups, RRS, eligibility, drug coverage and payer category resulted in a good match

	Propensity Score Matched Control		Treatment	
	Mean	Std. Dev.	Mean	Std. Dev.
total spending (I+O+D), topcoded	3,897	29,076	3,968	30,511
Inpatient spending (I), topcoded	734	19,717	762	20,174
Outpatient spending (O), topcoded	2,028	12,797	2,076	13,687
Pharmacy Spending (D), topcoded	1,139	8,527	1,133	8,130
Age	40.6	18.5	41.5	18.5
Female	0.56	0.50	0.56	0.50
RRS	1.92	3.53	1.82	3.84
Payer Category				
COMM	80%	0.40	80%	0.40
MCARE	7%	0.26	8%	0.28
MCAID	13%	0.33	12%	0.33
Plan Type				
HMO	86%	0.35	85%	0.36
PPO	2%	0.15	3%	0.16
POS	2%	0.13	2%	0.13
FFSplusEPO	10%	0.31	10%	0.31
Insurance Type				
ASO	8%	0.27	8%	0.27
Switching into a payer category in 2009				
Into MCARE	0.71%	0.08	0.70%	0.08
Into MCAID	0.57%	0.08	0.54%	0.07
Into COMM	0.24%	0.05	0.37%	0.06
Switching out of a payer category in2008				
Out of MCARE	0.00%	0.00	0.01%	0.01
Out of MCAID	0.24%	0.05	0.36%	0.06
Out of COMM	1.27%	0.11	1.24%	0.11
No. of Obs.	162439		20419	

Results for members with pharmacy data

Key contribution of my previous work: Careful risk adjustment

- Carefully thought-out clinical classification system
- Estimation and validation on monster data sets N > 10 million
- Implemented in practical software
- Widely used in US, Germany, and elsewhere
- Supported by US Medicare and Verisk Health/DxCG

Hierarchical Condition Categories (HCCs) linear regression model

$$\text{PCAL} = \beta_{0agecat} + \beta_1 HCC_1 + \beta_2 HCC_2 + \beta_3 HCC_3 + \ldots + \beta_n HCC_n$$

$$+(Age < 18) * (\beta_{k0} + \beta_{k1} HCC_1 + \ldots + \beta_{kn} HCC_n)$$
$$+(Age > 65) * (\beta_{e0} + \beta_{e1} HCC_1 + \ldots + \beta_{en} HCC_n)$$
$$+(\text{Selected interactions of HCCs})$$

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Sample PCAL regression results (Using N=17 million)

HCC	HCC Label	Rate per 100,000	Beta	Std. Err.	T ratios
1	INF.15 Septicemia/Shock	142	943	4	222.49
2	INF.25 Opportunistic Infections	31	989	8	121.68
3	INF.30 HIV/AIDS	91	611	5	135.71
4	INF.35 Central Nervous System Infection	61	510	6	90.40
5	INF.45 Specific Bacterial Infection In Other Diseases	273	272	3	86.56
6	INF.50 Late-Stage CNS Infection	10	188	14	13.87
7	INF.55 Tuberculosis	18	176	10	17.26
8	INF.60 Other Chronic Infectious Diseases	105	79	4	18.76
9	INF.65 Other Non-Chronic Infectious Diseases	9123	75	1	115.73
40	DMC.20 Diabetes w Acute Complications	169	430	4	119.73
41	DMC.30 Diabetes w Renal Manifestation	105	410	4	92.68
42	DMC.40 Diabetes w Neurologic or Peripheral Circulatory Manifestation	192	388	3	119.82
43	DMC.50 Diabetes w Ophthalmologic Manifestation	291	372	3	144.12
44	DMC.60 Diabetes with No or Unspecified Complications	3669	226	1	287.58
45	DMI.20 Type I Diabetes Mellitus	652	156	2	77.33

Plus 412 more parameters

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Regressions results predicting PCAL

N=1,668,486, Mean = $546

	Age-Sex model	HCC model
R-Square (individual level)	0.048	0.511
Adjusted R-Square (individual level)	0.048	0.511
K-fold Validated R-Square (K=100)	0.048	0.506
Standard Error	1063	762
Mean Absolute Deviation	479	267
Parameters	34	427

Notes: Each regression used weighted least squares of the annualized spending on PCAL (Definition 3) as defined in the main text. The age-sex model used 34 age-sex dummies, while the HCC model used 394 HCC dummy variables for conditions plus the age-sex dummies. The conventional and adjusted R-Squares are calculated within sample at the individual patient level. The K-fold validated R-Square is an outside of sample measure at the individual level.

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Exhibit 1. PCAL payment examples for four patients

Male, Age 16 **PCAL RRS = .134** **Annual PCAL payment = $ 65**

Female, Age 11 **PCAL RRS = .411** **Annual PCAL payment = $ 411**

- Other Non-Chronic Ear, Nose, Throat, and Mouth Disorders
- Other Dermatological Disorders
- Screening/Observation/Special Exams

Male, Age 56 **PCAL RRS = 3.360** **Annual PCAL payment = $1,613**

- Benign Digestive or Urinary Neoplasm
- Diabetes with no complication
- Fluid/Electrolyte/Acid-Base Imbalance
- Ulcer with Perforation/Obstruction
- Screening/Observation
- History of Disease

Female, Age 50 **PCAL RRS = 4.791** **Annual PCAL payment = $2,300**

- Diabetes with Ophthalmologic Manifestation
- Hyperlipidemia
- Endocrine/Metabolic Disorder
- Lower Back Pain
- Pelvic/Uterine Inflammation
- Rehab
- Screening
- Surgical Misadventure or Complication

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Exhibit 2
Possible performance measures for practice bonus payments

Clinical quality

- HbA1c and blood pressure control among diabetes patients
- Cholesterol control among CAD patients
- Ejection fraction among CHF patients
- Blood pressure control among adult patients
- Worsening severity for patients with chronic illness

Patient centeredness

- Patients satisfaction with primary care overall
- Patients rating of quality of medical care received
- Patients report having a usual source of care
- Patients report understanding purpose and correct use of medications
- Patients self-reported health status
- Mean delay in days before receiving regular or routine care
- Women over age 50 receiving mammograms
- Women age 20 to 69 receiving a PAP smear
- Patients over age 50 receiving colorectal cancer screening

Exhibit 2 (continued)
Possible performance measures for practice bonus payments

Efficiency and utilization

# of ambulatory care sensitive emergency department visits*
total ED visits
of total hospital care days*
# of ambulatory care sensitive condition hospital days*
# of hospital readmissions
RVUs of MRIs, CT-scans, PET-scans, other imaging*.
# of same day repeat X-rays or other images
Spending on antibiotics of concern*
Total spending on antibiotics*
Total spending on inpatient/physician specialists/lab tests/imaging /pharmacy*
Total health care spending*
Spending on primary care services outside of the PCMH
Spending on primary care services by specialists and other PCPs

*Risk adjustment models for these measures have been developed by Verisk Health as of November 2010

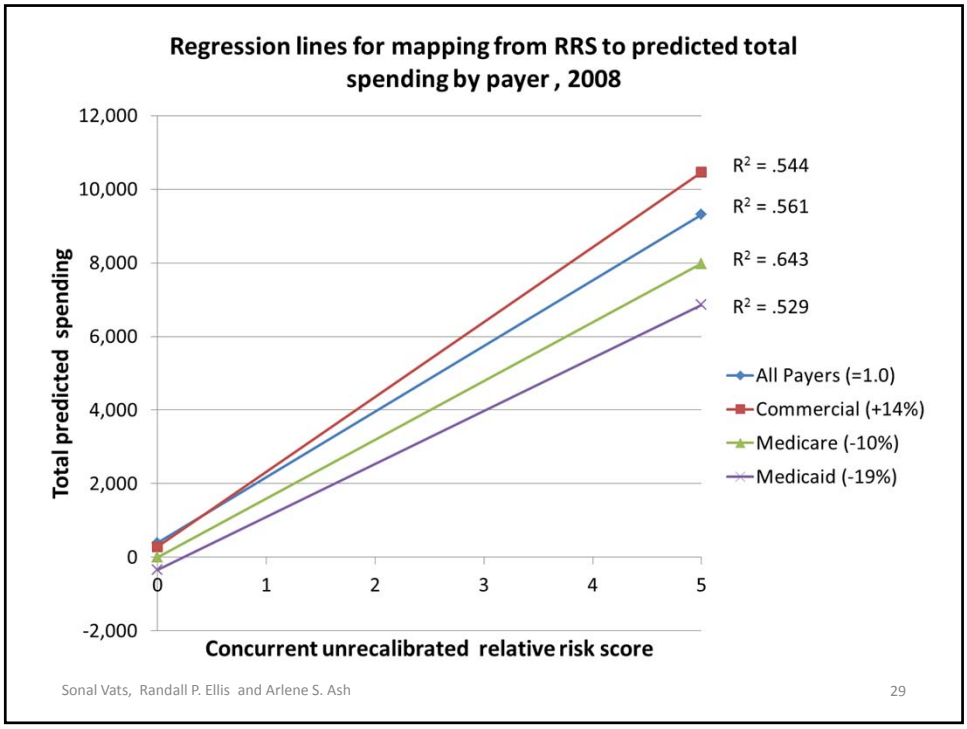
Diagnosis-based risk adjustment

- CDPHP claims data organized by Verisk/DxCG HCC Version 7 Classification system using 384 HCCs
- Software used to generate ONE Relative Risk Score (Model 88)
- Inpatient+Outpatient+Drug spending, topcoded at $250k
- Concurrent model uses one year's diagnoses to predict the same year's spending
- Weighted least squares regression of annualized spending, weights = fraction of year eligible
- Focus is on spending using propensity score matched samples

Risk-adjustment models for total spending, 2008

	(1)		(2)		(3)		(4)	
	coef	tstat	coef	tstat	coef	tstat	coef	tstat
RRS	1783***	344.5	2034***	285.6	2020***	263.0	2020***	271.9
MCARE			-290***	-3.6	-299***	-3.6	-308***	-3.8
MCAID			-632***	-10.0	-638***	-10.0	-648***	-10.2
MCAExRRS			-437***	-37.5	-423***	-35.3	-423***	-35.8
MCAIDxRRS			-595***	-34.7	-580***	-33.4	-581***	-33.6
PPO					-247*	-1.9		
POS					661***	4.3		
FFSplusEPO					-97	-1.4		
PPOxRRS					280***	7.0		
POSxRRS					-317***	-5.8		
FFSplusEPOxRRS					117***	4.7		
ASO							-198***	-2.8
ASOxRRS							173***	6.7
Constant	396***	20.3	291***	13.6	297***	12.7	308***	13.6
Observations	92692		92692		92692		92692	
R-Squared	0.561		0.577		0.578		0.577	

Notes: *** p<0.01, ** p<0.05, * p<0.1. Results are for propensity score matched sample using topcoded total spending pooled for 2008 and 2009. Regressions use weighted annualized spending.


Regression lines for mapping from RRS to predicted total spending by payer , 2008
Total predicted spending
12,000
10,000
8,000
6,000
4,000
2,000
0
-2,000
0
1
2
3
4
5
Concurrent unrecalibrated relative risk score
R² = .544
R² = .561
R² = .643
R² = .529
All Payers (=1.0)
Commercial (+14%)
Medicare (-10%)
Medicaid (-19%)
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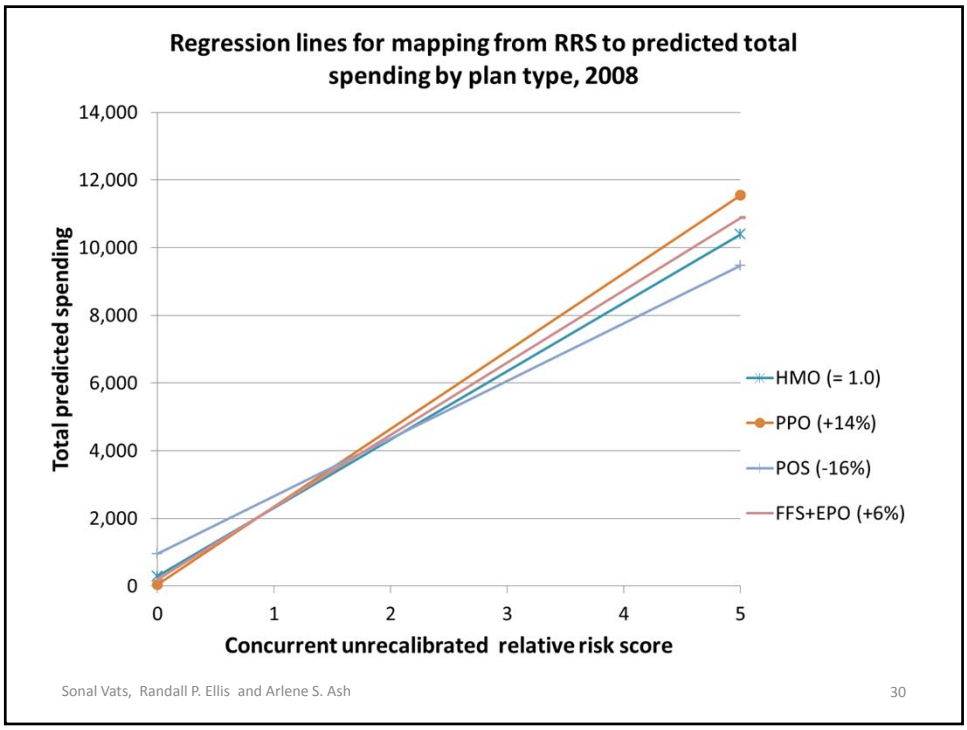
Regression lines for mapping from RRS to predicted total spending by plan type, 2008
Total predicted spending
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
1
2
3
4
5
Concurrent unrecalibrated relative risk score
HMO (= 1.0)
PPO (+14%)
POS (-16%)
FFS+EPO (+6%)
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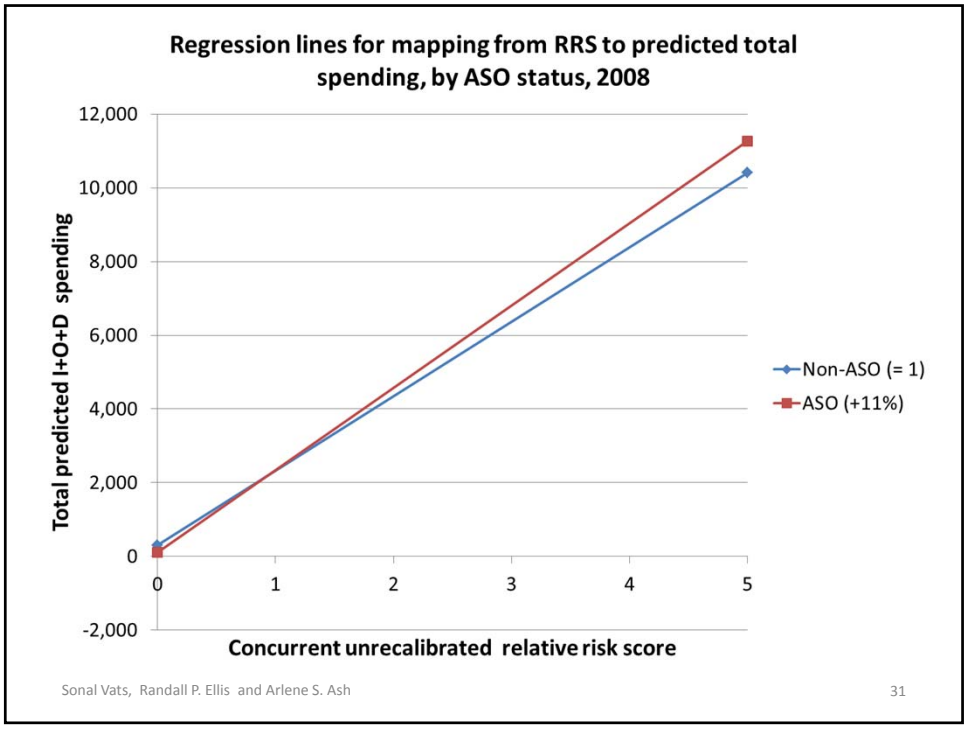
Regression lines for mapping from RRS to predicted total spending, by ASO status, 2008
12,000
10,000
8,000
6,000
4,000
2,000
0
-2,000
Total predicted I+O+D spending
0
1
2
3
4
5
Concurrent unrecalibrated relative risk score
Non-ASO (= 1)
ASO (+11%)
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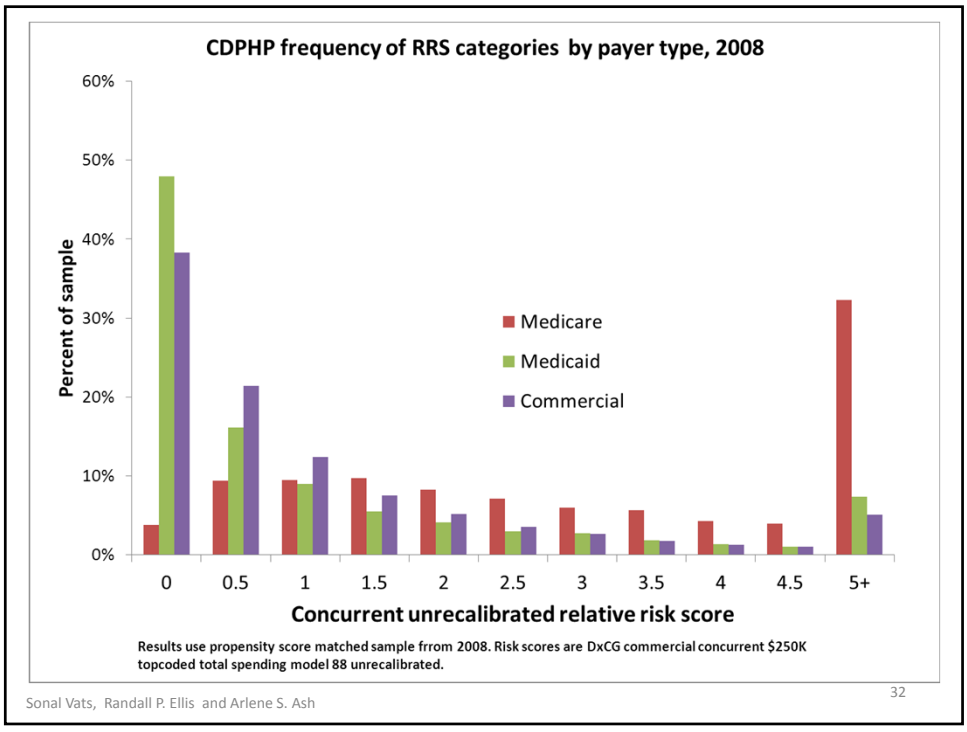
CDPHP frequency of RRS categories by payer type, 2008
60%
50%
40%
30%
20%
10%
0%
Percent of sample
Medicare
Medicaid
Commercial
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5+
Concurrent unrecalibrated relative risk score
Results use propensity score matched sample frrom 2008. Risk scores are DxCG commercial concurrent $250K topcoded total spending model 88 unrecalibrated.
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Difference-in-difference model

- Costs increasing in both control and treatment groups
- Question is how much less rapidly did costs grow in the treatment than the control group
- Diff-in-Diff = (Δcosts in treatment) – (Δ in costs in control)
- Can use regression framework:
  - How different was the change in costs for the treatment group than the control group? (change in intercept)
  - Did treatment change intensity of treatment for high cost people more than low cost people? (change in slope)

Diff-in-Diff results for total spending

	1		2		3		4	
	coef	tstat	coef	tstat	coef	tstat	coef	tstat
YR2xT08	-348 ***	-2.7	-74	-0.9	131	1.4	130	1.4
RRS_{ALL}xYR2xT08					-115 ***	-5.1	-117 ***	-5.2
YR2 = 1 if year=2009	612 ***	14.0	24	0.9	-16	-0.5	-11	-0.3
T08 = 1 if in treatment in 2008	243 ***	2.6	326 ***	5.7	130 **	2.0	127 **	2.0
AGE			-12 ***	-16.7	-12 ***	-16.6	-17 ***	-19.9
FEMALE			125 ***	4.9	126 ***	4.9	121 ***	4.7
RRS_{ALL}			2035 ***	523.4	2016 ***	303.6	1999 ***	266.7
RRS_{ALL}xYR2					22 ***	2.7	21 **	2.6
RRS_{ALL}xT08					110 ***	6.4	112 ***	6.6
MCARE							549 ***	8.3
MCAID							-329 ***	-6.9
RRS_{ALL}xMCARE							-4	-0.4
RRS_{ALL}xMCAID							37 **	2.4
PPO							10	0.1
POS							650 ***	5.1
FFSplusEPO							82 *	1.7
RRS_{ALL}xPPO							79 ***	3.0
RRS_{ALL}xPOS							-173 ***	-5.1
RRS_{ALL}xFFSplusEPO							-66 ***	-4.5
ASO							-490 ***	-8.2
RRS_{ALL}xASO							299 ***	17.3
Constant	3595 ***	117	346 ***	9.3	376 ***	9.9	610 ***	13.8
Observations	182,858		182,858		182,858		182,858	
R-squared	0.001		0.619		0.619		0.62	

Diff-in-Diff results for total spending, standard errors corrected for clustering

	1		2		3		4	
	coef	tstat	coef	tstat	coef	tstat	coef	tstat
YR2xT08	-348 ***	-3.3	-74	-1.0	131	0.8	130	0.8
RRS_{ALL}xYR2xT08					-115	-1.0	-117	-1.0
YR2 = 1 if year=2009	612 ***	15.6	24	1.0	-16	-0.2	-11	-0.1
T08 = 1 if in treatment in 2008	243	1.3	326 ***	7.9	130	0.8	127	0.8
AGE			-12 ***	-7.1	-12 ***	-6.8	-17 ***	-9.3
FEMALE			125 ***	4.2	126 ***	4.2	121 ***	3.9
RRS_{ALL}			2035 ***	73.0	2016 ***	40.8	1999 ***	36.1
RRS_{ALL}xYR2					22	0.4	21	0.4
RRS_{ALL}xT08					110	1.2	112	1.2
MCARE							549 ***	2.6
MCAID							-329 ***	-2.7
RRS_{ALL}xMCARE							-4	-0.1
RRS_{ALL}xMCAID							37	0.3
PPO							10	0.0
POS							650	1.4
FFSplusEPO							82	0.8
RRS_{ALL}xPPO							79	0.5
RRS_{ALL}xPOS							-173	-0.6
RRS_{ALL}xFFSplusEPO							-66	-0.8
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R-squared	0.001		0.619		0.619		0.62	

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Calculating the Average Treatment Effect

- The average treatment effect (the average annual cost savings) for a given sample is easily calculated.
- For non-risk adjusted models, Diff-in-diff coefficient (β_1)
- For risk adjustment models: $\beta_1 + \beta_2 * \overline{RRS_{ALL}}$
- Statistical significance of this is also easily computed, with and without corrections for clustering at the PCP level.

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Sensitivity Analysis of Diff-in-Diff estimates of average treatment effect in various models with risk adjustment

	1	2	3	4	5	6
Average treatment effect	-91	-93	-92	-99	-97	-98
P-values without cluster S.E.	[0.26]	[0.25]	[0.25]	[0.22]	[0.23]	[0.23]
P-values with cluster S.E.	[0.28]	[0.28]	[0.28]	[0.24]	[0.25]	[0.25]
Risk adjustment	Yes	Yes	Yes	Yes	Yes	Yes
Payer interactions	No	Yes	Yes	Yes	Yes	Yes
Plan type interactions	No	No	Yes	No	Yes	Yes
ASO dichotomy	No	No	No	Yes	Yes	Yes
Plan switchers	No	No	No	No	Yes	Yes
New/departing enrollees	No	No	No	No	No	Yes
R-squared	0.619	0.619	0.619	0.62	0.62	0.62
Dependent variable mean	3905	3905	3905	3905	3905	3905
Observations	182,858	182,858	182,858	182,858	182,858	182,858

Notes

Sample is propensity score matched sample, all payers, 2008 and 2009 patients combined. Assignment to treatment group uses 2007 and 2008 data.

Dependent variable is total health spending topcoded at $250,000. PCP practices assigned using 2008 and 2009 claims

Standard errors corrected for clustering at the PCP level using 2008 PCP assignment

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Analysis by MH impact by payer and broad type of service

Propensity Score Matched Sample

	All Services	Inpatient	Outpatient	Pharmacy
No Risk Adjustment				
All Payers	-348 ***	-250 ***	-84	-24
Commercial	-265 *	-130 *	-90 *	-37
Medicare	-1529 **	-1390 ***	-273	-123
Medicaid	-417	-361	-14	-43
With Risk Adjustment				
All Payers	-98	-50	24	-18
Commercial	-26	37	5	-15
Medicare	-763 *	-750 **	139	-34
Medicaid	-154	-159	60	-52

Notes: standard errors not corrected for clustering.

Treament grouped assigned as of 2008

*** p<0.01, ** p<0.05, * p<0.1

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Notes: standard errors corrected for clustering at PCP level as assigned in 2008.
Treament grouped assigned as of 2008 PCP assignment.
*** p<0.01, ** p<0.05, * p<0.1

Why did the treatment group appear to get healthier relative to controls?

Three alternative stories

- Medical home kept people healthier?
- Medical home had less incentive to code as many diagnoses since no longer on FFS?
- Medical home was successful at disenrolling high risk score patients?
  - (Using pre pilot assignment of patients to treatment)
  - Controlling for leavers, joiners, plan switchers

Would it be worthwhile for Medicare and Medicaid to fund the PCMH for all?

	Medicare	Medicaid
Apparent Risk adjusted savings per year	$763***	$154
Percent of practice	9%	10%
Savings per PCMH member	$69	$15
Savings to Medicare and Medicaid	$84 PMPY	
Cost of PCMH for all enrollees	?	

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Parting thoughts

- Private savings to CDPHP ≠ social savings from the PCMH
- Early practices probably better suited for PCMH than later practices
- Looking at subsets of inpatient and outpatient spending
- David Bates et al. funded to evaluate quality and patient satisfaction
- Looking forward to being able to work with selected EHR data

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Currently redoing the analysis

- Inclusion of one-year eligibles biases the analysis: new analysis is focusing on stayers only
- Using risk scores for propensity score match is problematic, since the coding of diagnoses appears to have changed in response to policy change
- More outcomes now available
- Academic paper and presentation not yet written
- New results not yet announced by CDPHP