

Effect of Financial Bonus Size, Loss Aversion, and Increased Social Pressure on Physician Pay-for-Performance

A Randomized Clinical Trial and Cohort Study

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Disclosures

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Background

- Evidence on P4P is mixed
- Though few studies have used randomized trials among physicians in pragmatic settings and fewer have tested behavioral economic principles
- We conducted the first randomized trial to test behavioral economic principles in P4P & compared to increasing bonus sizes

Research Objectives

1. To test whether adding behavioral economic principles can improve the effects of P4P
2. To test whether and to what extent *increasing bonus sizes* improves the effects of P4P

Methods

- **Setting:** Advocate HealthCare, a network of 4000+ physicians in Chicago, IL
- **Design:** Parallel prospective randomized trial and cohort study
- **Context:** A pragmatic design in partnership with network leadership

Interventions

Study Arm	Intervention
Group 1: Larger Bonus Size + Increased Social Pressure (LBS + ISP)	Incentive based on group performance increased from 30% to 50%
Group 2: Larger Bonus Size + Loss Aversion (LBS + LA)	Pre-funded incentive accounts with funds available at start of year
Group 3: Larger Bonus Size Only (LBS) [Control]	Increased bonus by ~\$3,335 with no changes to incentive design

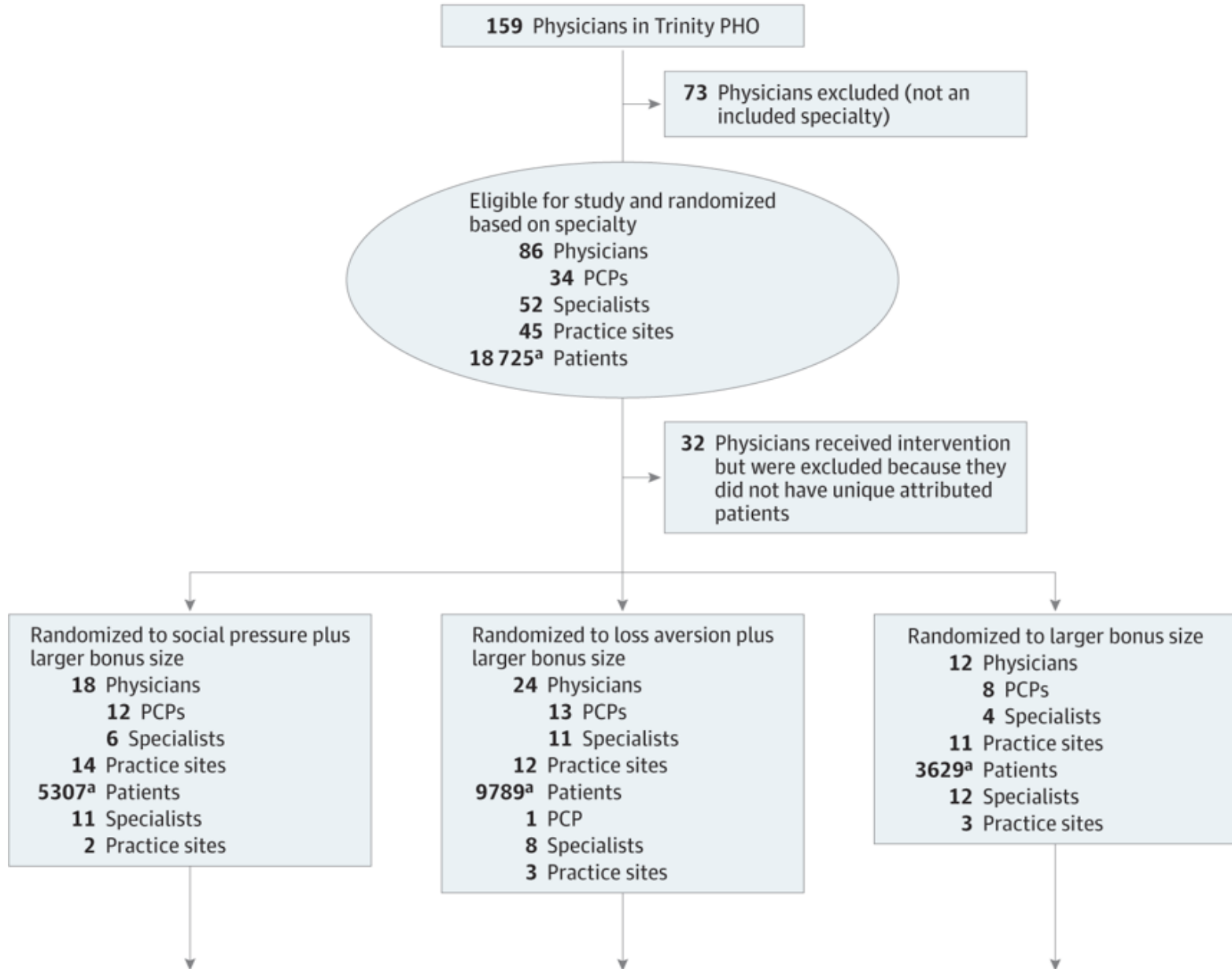
Outcomes

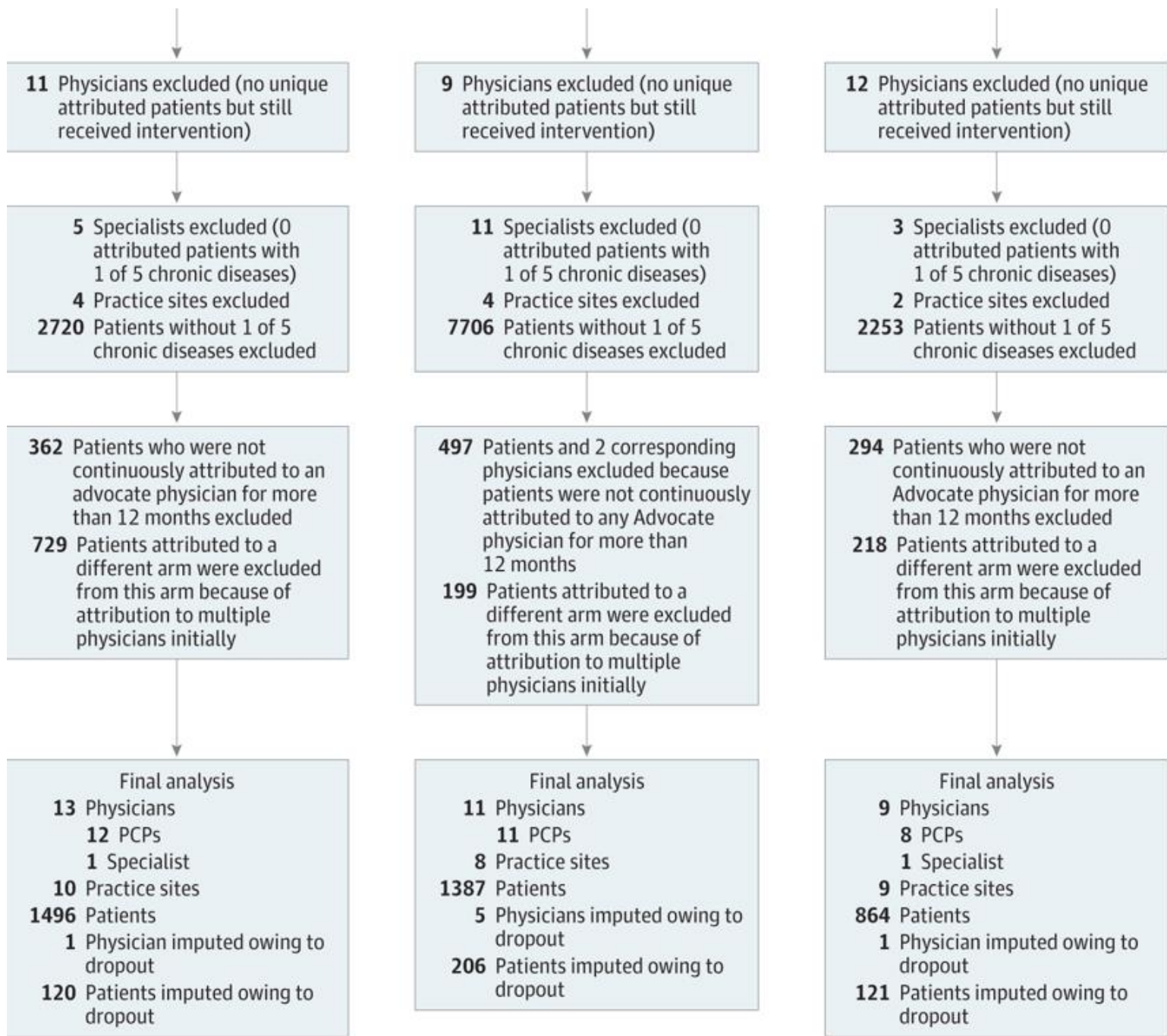
- **Primary Outcome:** the 2015-2016 change in proportion of applicable chronic disease and preventive evidence-based measures meeting or exceeding HEDIS standards at the patient level
 - Pooled 21 individual measures in the P4P program
 - Represented a patient's view of the proportion of evidence-based care received.
- **Secondary Outcomes:** Individual measure achievement

Sample and Randomization

- **Patient Population:** patients with 1 of 5 chronic diseases:
 - Asthma
 - COPD
 - Diabetes
 - Coronary artery disease or ischemic vascular disease
 - Congestive heart failure
- **Randomization:** 1:1:1 ratio, stratified by primary care vs specialist

Trial Design





RCT Testing Increased Social Pressure and Loss Aversion

- Difference-in-differences generalized linear model with binomial distribution and logit link
- Estimates the odds of achieving evidence-based chronic disease measures for each patient, clustered at MD
- Adjusted for:
 - Patient demographics
 - Chronic conditions
 - Physician demographics and characteristics

Sample Characteristics - RCT

- No meaningful differences between physicians by RCT Group
- Demographic and clinical characteristics differences present in patients by RCT Group

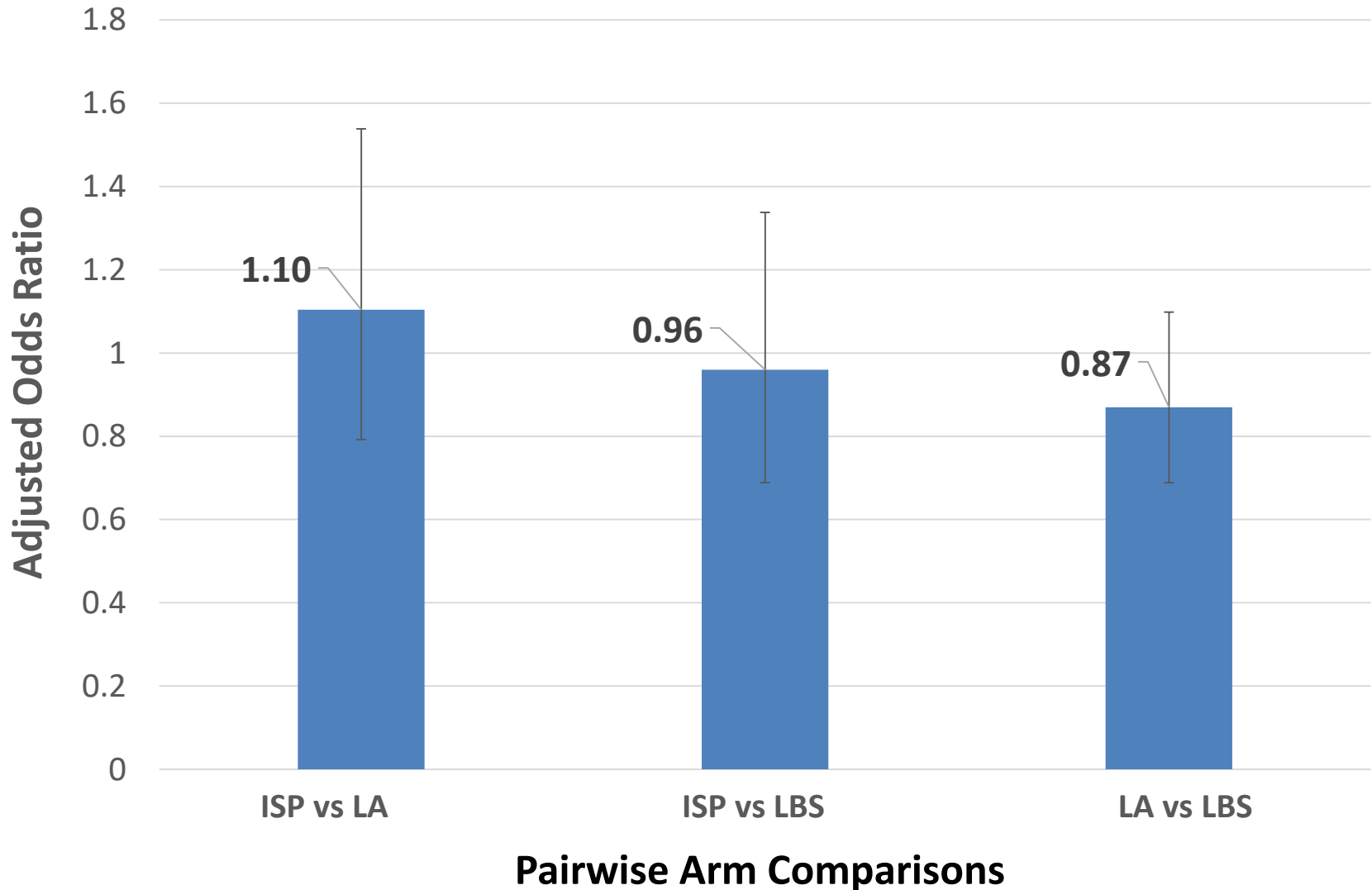
Physician Characteristics – RCT Trial

	Larger Bonus Size plus			P-value
	Increased Social Pressure	Loss Aversion	NA (LBS Only)	
Number of physicians	13	11	9	N/A
Age (year), mean (SD)	56 (9)	(56) 11	59 (9)	.67
Average No. of Advocate Patients, median (IQR)	91 (19-194)	27 (15-243)	80 (63-146)	.84
Female, No. (%)	7 (54)	5 (45)	3 (33)	0.62
Specialty, No. (%)				
Family Medicine	7 (54)	3 (27)	4 (44)	0.54
Internal Medicine	3 (23)	7 (64)	3 (33)	
Pediatrics	2 (15)	1 (9)	1 (11)	
Other Specialties	1 (8)	0 (0)	1 (11)	
Average No. of chronic diseases, mean (SD)	1.61 (0.34)	1.61 (0.29)	1.56 (0.44)	0.72

Patient Characteristics – RCT Trial

	Larger Bonus Size plus			P-Value
	Increased Social Pressure	Loss Aversion	NA (LBS only)	
Number of patients	1,496	1,387	864	N/A
Age (years), median (IQR)	62 (53-71)	66 (57-76)	65 (55-74)	<.001
Female, No. (%)	997 (67)	857 (62)	530 (61)	0.01
Black or African American, No. (%)	1,213 (81)	875 (63)	579 (67)	<.001
Average number of chronic diseases, mean (SD)	1.64 (0.85)	1.64 (0.82)	1.49 (0.75)	<.001
Patients in each chronic disease registry, No. (%)				
Asthma Care	92 (6)	46 (3)	55 (6)	0.00
Congestive Heart Failure	117 (8)	119 (9)	48 (6)	0.03
Chronic Obstructive Pulmonary Disease	239 (16)	200 (14)	248 (29)	<.001
Diabetes	587 (39)	416 (30)	231 (27)	<.001
Ischemic Vascular Disease	247 (17)	300 (22)	124 (14)	<.001

RCT Results



ISP: Larger bonus size + Increased social pressure

LA: Larger bonus size + Loss aversion

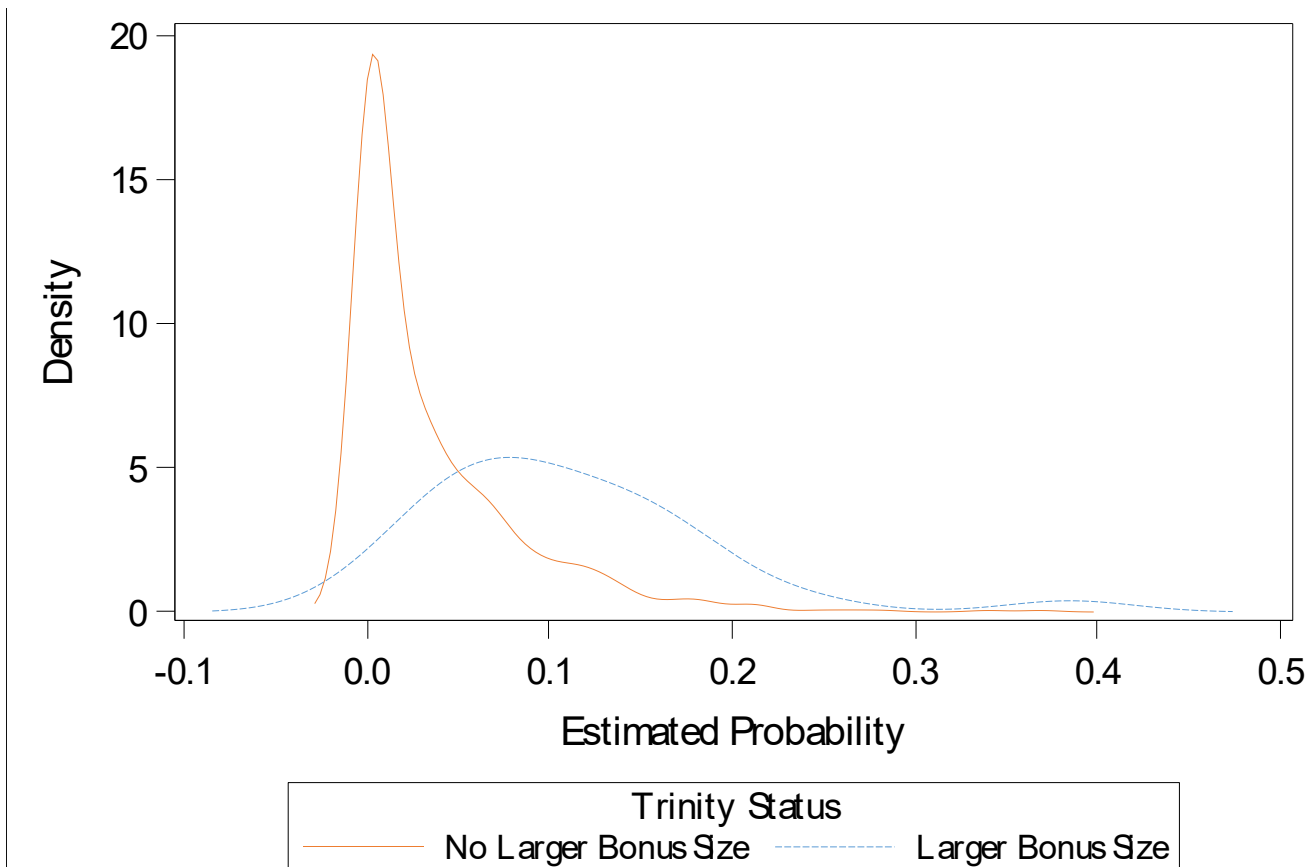
LBS: Larger bonus size only (comparison group)

Cohort Study Design

- **Propensity-matched**
 - Difference-in-difference design comparing Larger Bonus Size groups to patients of propensity-matched physicians using physician fixed-effects
 - Physicians matched based on
 - Pre-intervention (2015) performance level
 - Historic trend

Propensity Score Matching

- Non Trinity MDs matched using baseline 2015 measure met percentages, trend using 2014 data and MD demographics like age, gender, tenure and specialty.
- Area of Common Support:



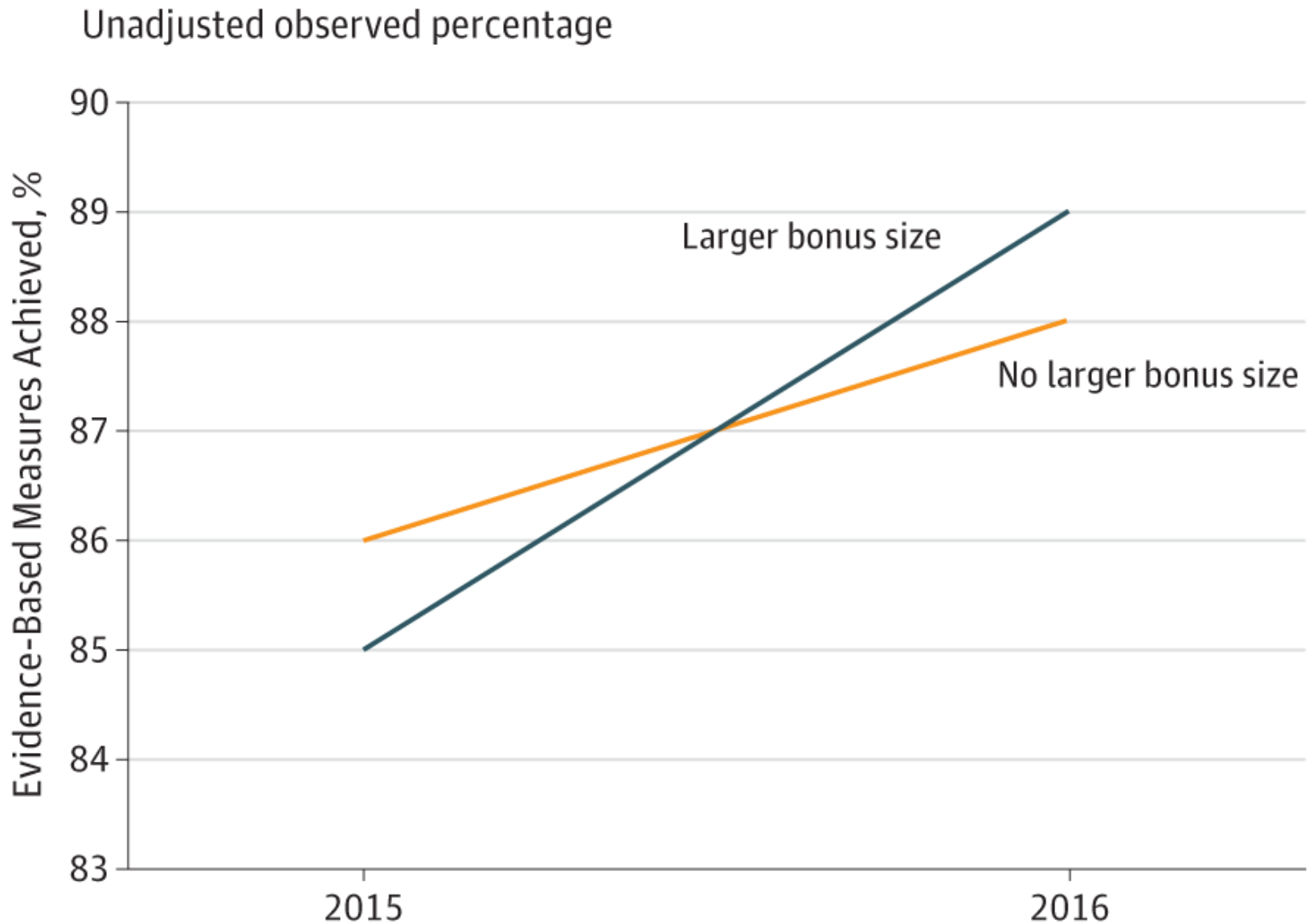
Physician Characteristics: Before & After Matching

	Unmatched			Matched		
	LBS	Non-LBS	P-Value	LBS	Non-LBS	P-Value
Number of physicians	33	801	N/A	33	33	N/A
Age (year), mean (SD)	57 (10)	53 (10)	0.04	57 (10)	55 (8)	0.27
Average No. of Advocate patients in panel, median (IQR)	67 (N/A)	34 (N/A)	0.06	67 (19-157)	135 (28-189)	.36
Female, No. (%)	15 (45)	285 (36)	0.25	15 (45)	13 (39)	.62
Specialty, No. (%)						
Family Medicine	14 (42)	153 (19)	<.001	14 (42)	15 (45)	>.99
Internal Medicine	13 (39)	214 (27)		13 (39)	12 (36)	
Pediatrics	4 (12)	183 (23)		4 (12)	3 (9)	
Other Specialties	2 (6)	251 (31)		2 (6)	3 (9)	
Average No. of chronic diseases, mean (SD)	1.60 (0.34)	1.47 (0.38)	0.05	1.60 (0.34)	1.57 (0.29)	0.65

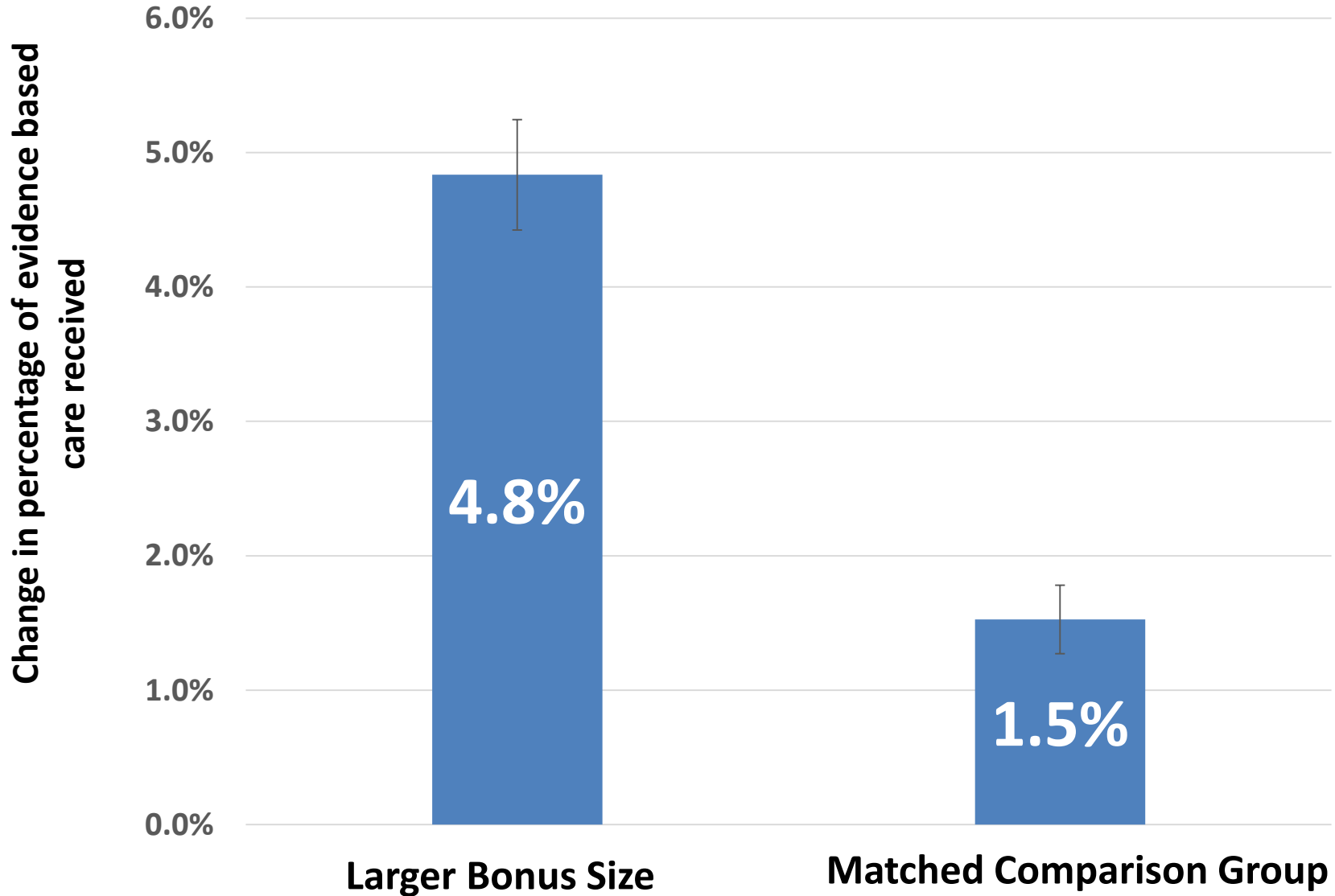
Patient Characteristics: Before & After Matching

	Unmatched			Matched		
	LBS	Non-LBS	P-Value	LBS	Non-LBS	P-Value
Number of patients	3,747	70,818	N/A	3,747	4,371	N/A
Age (years), median (IQR)	64 (N/A)	68 (N/A)	<.001	64 (55-73)	67 (57-75)	<.001
Female, No. (%)	2,384 (64)	36,880 (52)	<.001	2384 (64)	2203 (50)	<.001
Black or African American, No. (%)	2,667 (71)	7,461 (11)	<.001	2667 (71)	831 (19)	<.001
Average number of chronic diseases, mean (SD)	1.6 (0.82)	1.63 (0.83)	0.06	1.6 (0.82)	1.65 (0.86)	0.04

Test of Larger Bonus Size – Unadjusted Results



Test of Larger Bonus Size – Adjusted Results



Qualitative Evaluation

- Physician surveys – pre- and post-trial on domains related to:
 - Perspectives on incentive design
 - Impact of incentives on clinical practice
 - Unintended effects
- Interview of physicians who improved the most and least

Survey and Interview Takeaways

- *Loss Aversion* groups indicated increase in financial salience
- But also increase in concern for negative consequences
- *Increased Social Pressure* group indicated a decrease in teamwork
- Opinions on P4P changed
 - Favorably in the *Social Pressure* and *Increased Bonus Size Only* groups
 - Unfavorably in the *Loss Aversion* group

Limitations

- One institution, small sample size
- Only a limited number incentive designs tested
- Possible confounding from Hawthorne effect (RCT) and unmeasured confounders (Cohort)

Conclusions

- *Larger bonus size* associated with significantly improved quality for chronic care patients relative to a comparison group
- Adding *increased social pressure* and the opportunity for *loss aversion* did not lead to further quality improvement
- Further work needed to evaluate applications of behavioral economics to P4P

Thank you!

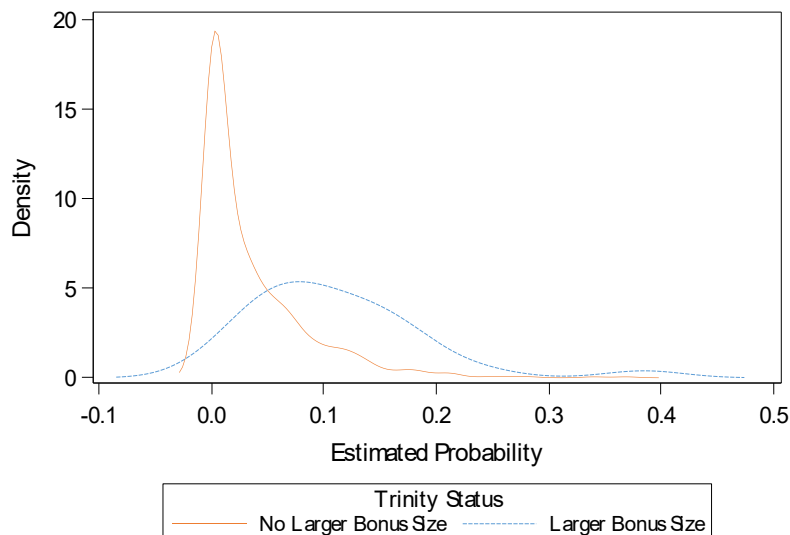
Questions?

Appendix

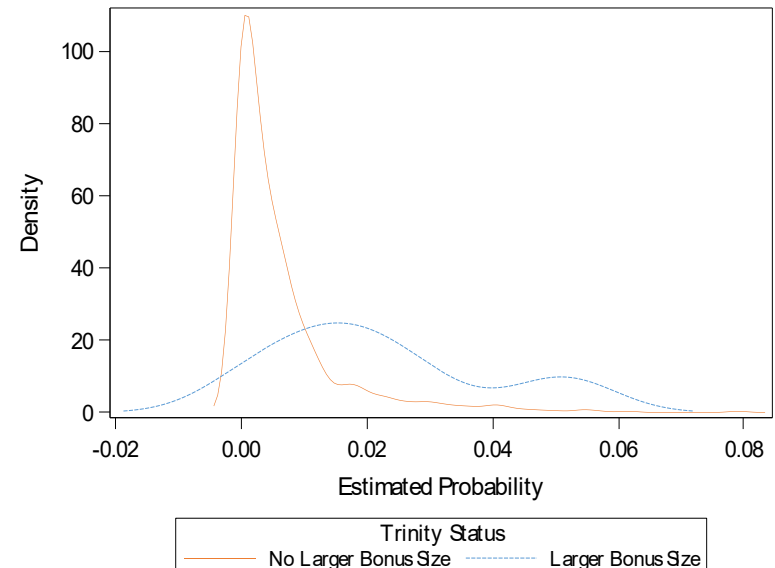
Propensity Score Matching

- Non Trinity MDs matched using baseline 2015 measure met percentages, trend using 2014 data and MD demographics like age, gender, tenure and specialty.
- Area of Common Support:

Common Support Graph for first level of matching with trend data



Common Support Graph for second level of matching



Test of Trends

Coefficient (SE)	All Physicians, Weighted	Stable Set of Physicians, Weighted
Year	-0.007 (0.005)	-0.006 (0.004)
Trinity	-0.013 (0.031)	-0.009 (0.030)
Year x Trinity	-0.011 (0.008)	-0.012 (0.007)
Constant	0.854*** (0.020)	0.851*** (0.019)
Observations	186	165
R ²	0.116	0.112
Unique Trinity MDs	32	18
Unique Non-Trinity MDs	33	23

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Sample Physician Characteristics - Larger Bonus Size vs Matched Comparison Group

	Larger Bonus Size	No Larger Bonus Size	P-value
Number of physicians	33	33	N/A
Age (year), mean (SD)	57 (10)	55 (8)	0.27
Tenure (year), mean (SD)	12 (8)	12 (8)	0.98
Average No. of Patients, median (IQR)	67 (19-157)	135 (28-189)	.36
Gender, No. (%)			
Female	15 (45)	13 (39)	.62
Male	18 (55)	20 (61)	
Specialty, No. (%)			
Family Medicine	14 (42)	15 (45)	>.99
Internal Medicine	13 (39)	12 (36)	
Pediatrics	4 (12)	3 (9)	
Other Specialties	2 (6)	3 (9)	
Average No. of chronic diseases, mean (SD)	1.60 (0.34)	1.57 (0.29)	0.65

Sample Patient Characteristics - Larger Bonus Size vs Matched Comparison Group

	Larger Bonus Size	No Larger Bonus Size	P-Value
Number of patients	3,747	4,371	N/A
Age (years), median (IQR)	64 (55-73)	67 (57-75)	<.001
Gender, No. (%)			
Female	2,384 (64)	2,203 (50)	<.001
Male	1,358 (36)	2,155 (49)	
Race, No. (%)			
Black or African American	2,667 (71)	831 (19)	<.001
Caucasian or White	368 (10)	2,666 (61)	
Other	149 (4)	313 (7)	
Unknown	563 (15)	561 (13)	
Average number of chronic diseases, mean (SD)	1.6 (0.82)	1.65 (0.86)	0.04
Patients in each chronic disease registry, No. (%)			
Asthma Care	193 (5)	165 (4)	<.001
Congestive Heart Failure	284 (8)	333 (8)	.95
Controlling High Blood Pressure	2,936 (78)	3,522 (81)	.01
Chronic Obstructive Pulmonary Disease	687 (18)	747 (17)	.14
Diabetes	1,234 (33)	1,236 (28)	<.001
Ischemic Vascular Disease	671 (18)	1205 (28)	<.001

Supplemental Proforma for Pre-Funded Incentive Account

PHYSICIAN NAME

QUARTER/DATE

SUPPLEMENTAL PRO FORMA for YOUR PRE-FUNDED INCENTIVE ACCOUNT*

The graph below shows the size (in dollars) of your pre-funded 2016 CI Incentive account. Below the graph, you will find the amount of your 2016 CI Incentive that you can access in advance.



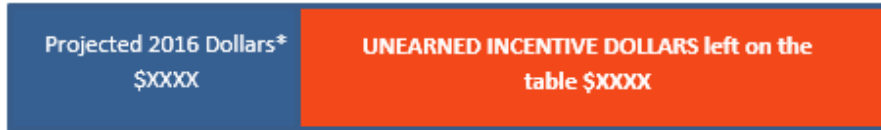
Eligible pre-funded 2016 CI incentive amount for advanced access: \$YYYY

Remaining incentive dollars you may draw out in advance: \$ZZZZ

Supplemental Proforma for Pre-Funded Incentive Account

YOUR PROJECTED 2016 CI INCENTIVE BASED ON YTD PERFORMANCE IS:

Jan 2016



*If you perform the same as last year you will earn this much in 2016 and leave the corresponding amount in red on the table.

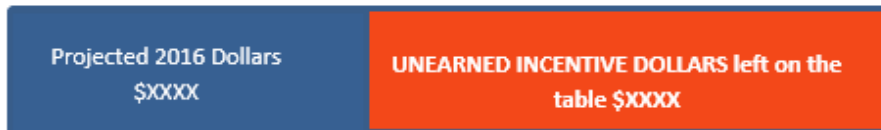
Q1



Q2



Q3



Q4



Supplemental Proforma for Enhanced Group Incentive

PHYSICIAN NAME

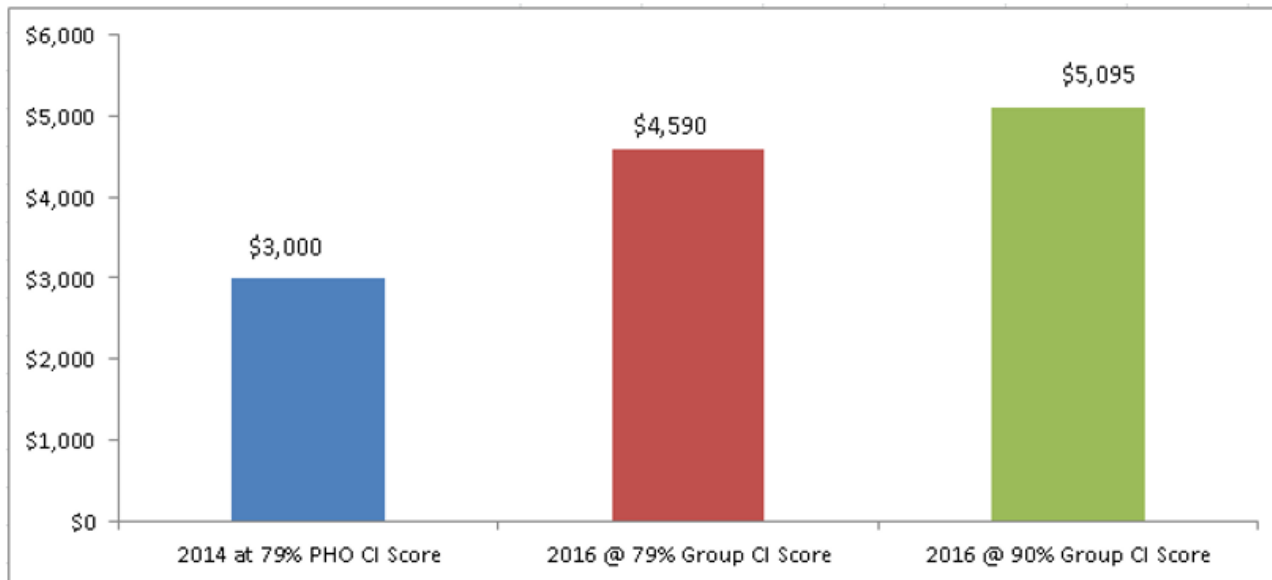
QUARTER/DATE

SUPPLEMENTAL PRO FORMA for ENHANCED GROUP INCENTIVE*

The bar graph below shows the additional incentive dollars you can receive through group performance versus prior years.

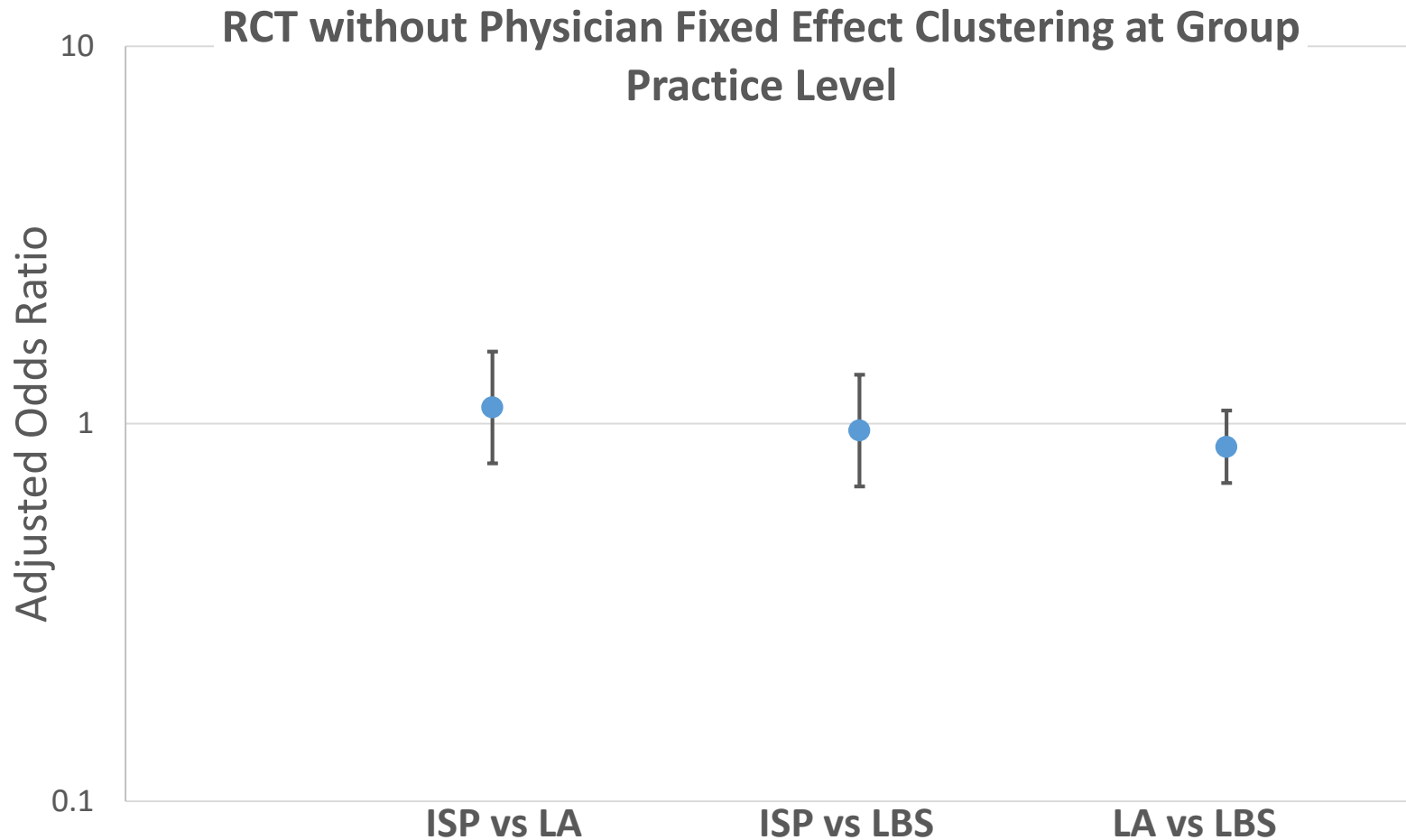
- Blue Bar: In 2014, you earned \$3,000 of your CI incentive from the PHO pool based on the Trinity PHO score of 79%.
 - Red Bar: In the current 2016 year, with the new program design and if your group performs the same as 2014, you would earn \$4,590 of your CI incentive based on your group performance.
 - Green Bar: In the current 2016 year, with the new program design and if the group performance increases to 90%, you would earn \$5,095 of your CI incentive based on your group performance.
- That means, in 2016 if your group performs at 90%, you could earn \$2,095 more than you did in 2014 based on your group performance.

"Group" refers to the performance of the physicians in Arm 3 Enhanced Group Incentive *only*.



The individual component of your 2016 CI opportunity is decreased by \$YYY.

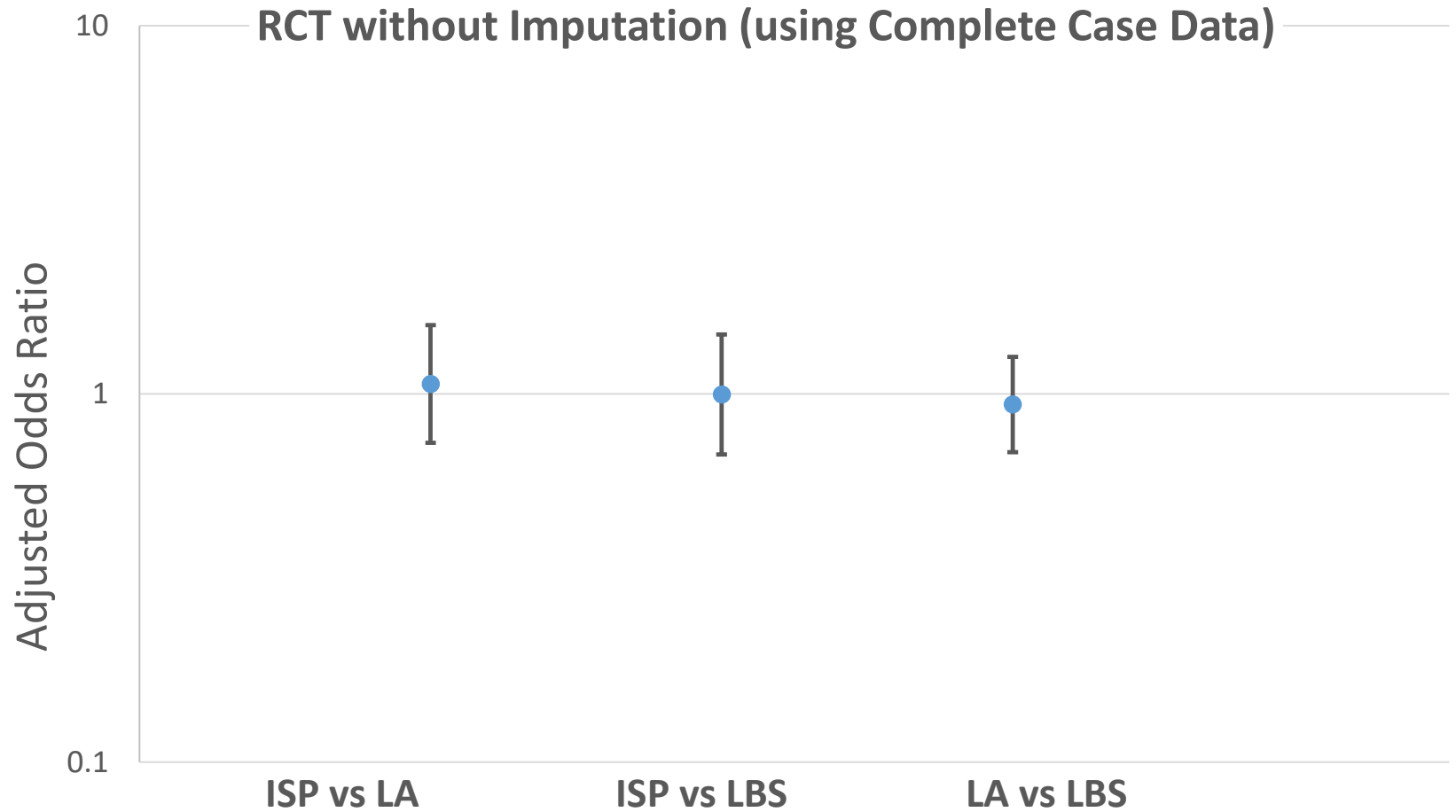
Sensitivity Analyses



ISP: Larger bonus size + Increased social pressure
LBS: Larger bonus size only (comparison group)

LA: Larger bonus size + Loss aversion
*Error bars indicate 95% confidence Intervals

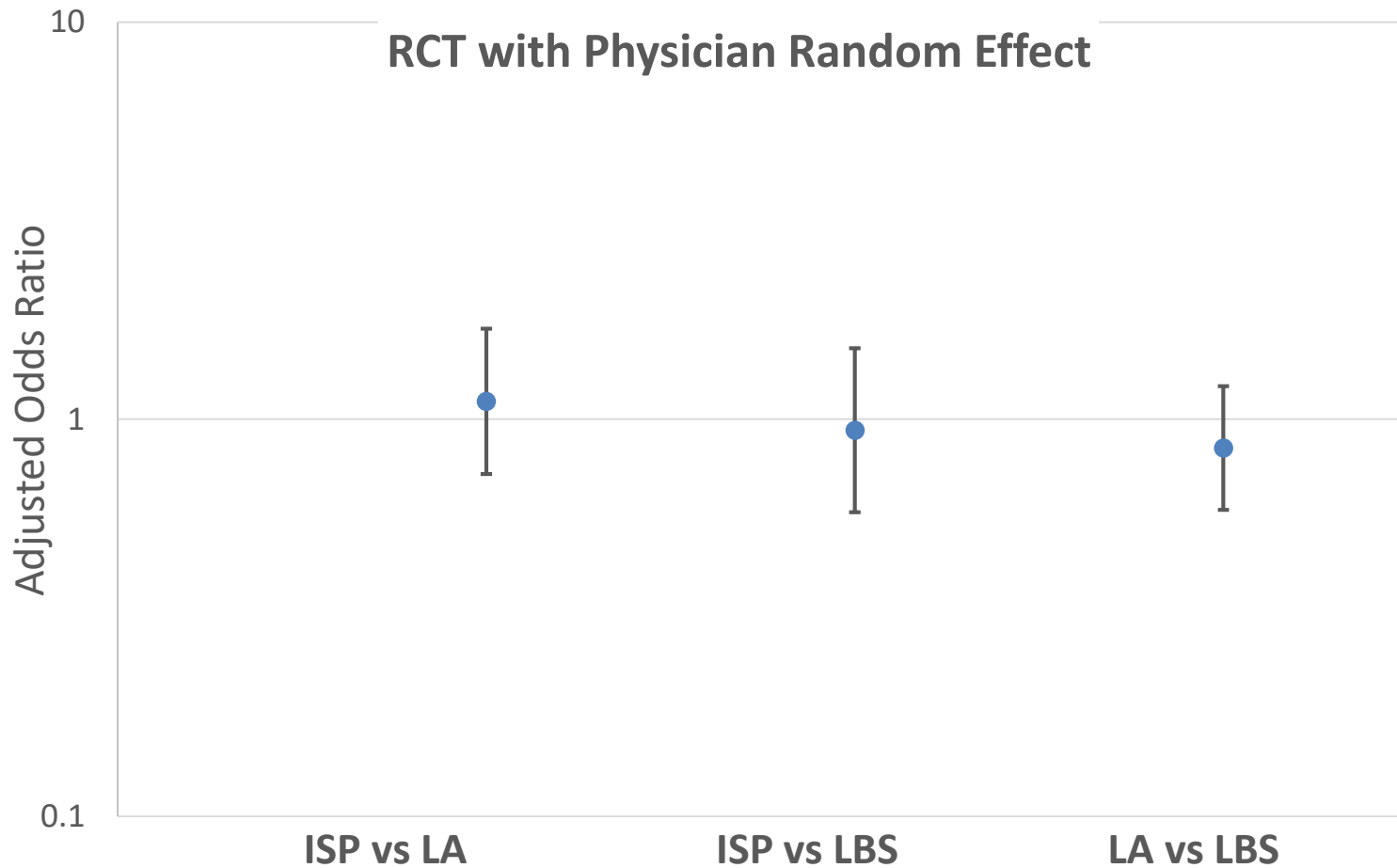
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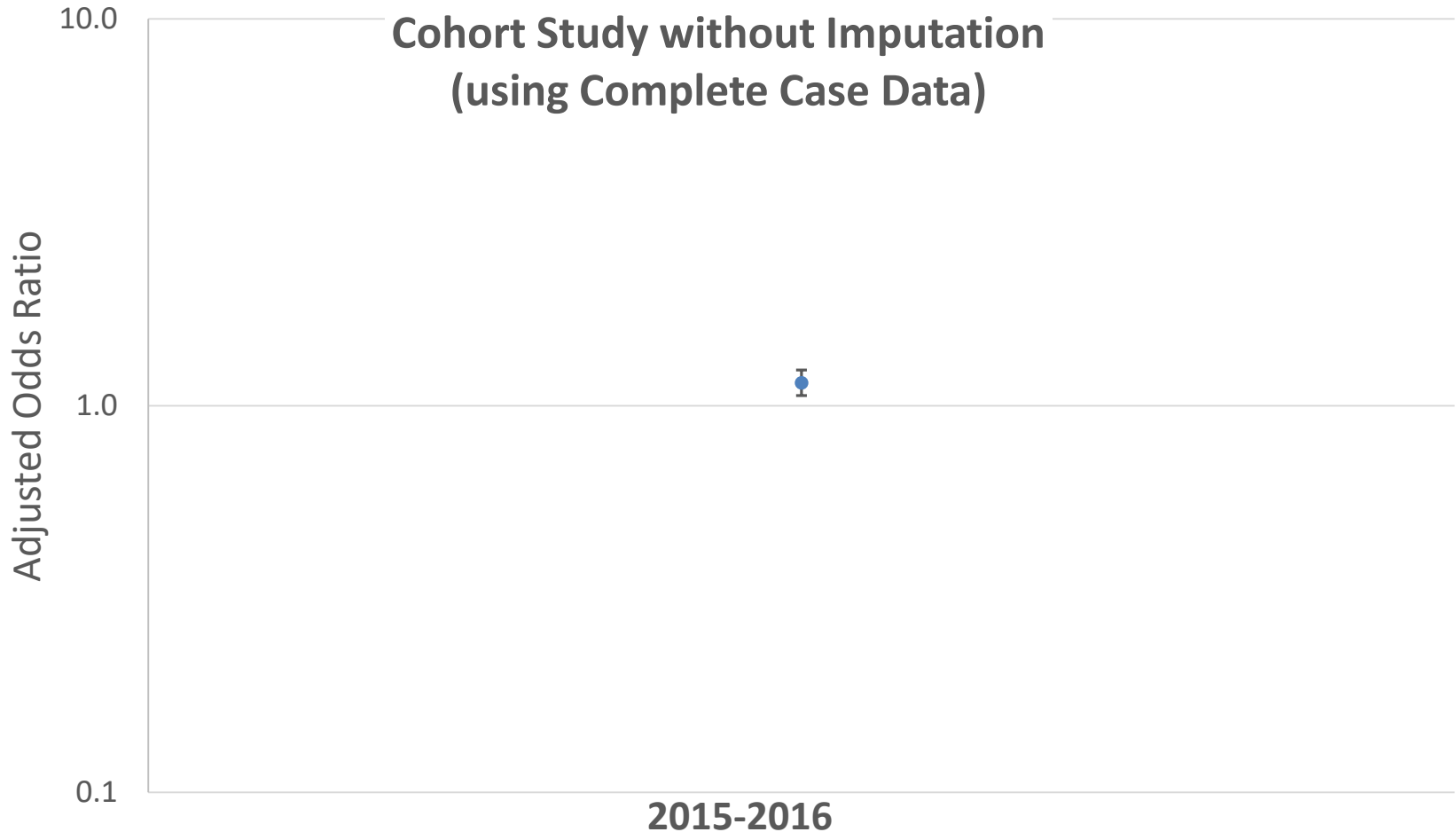
Sensitivity Analyses



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LBS: Larger bonus size only (comparison group)

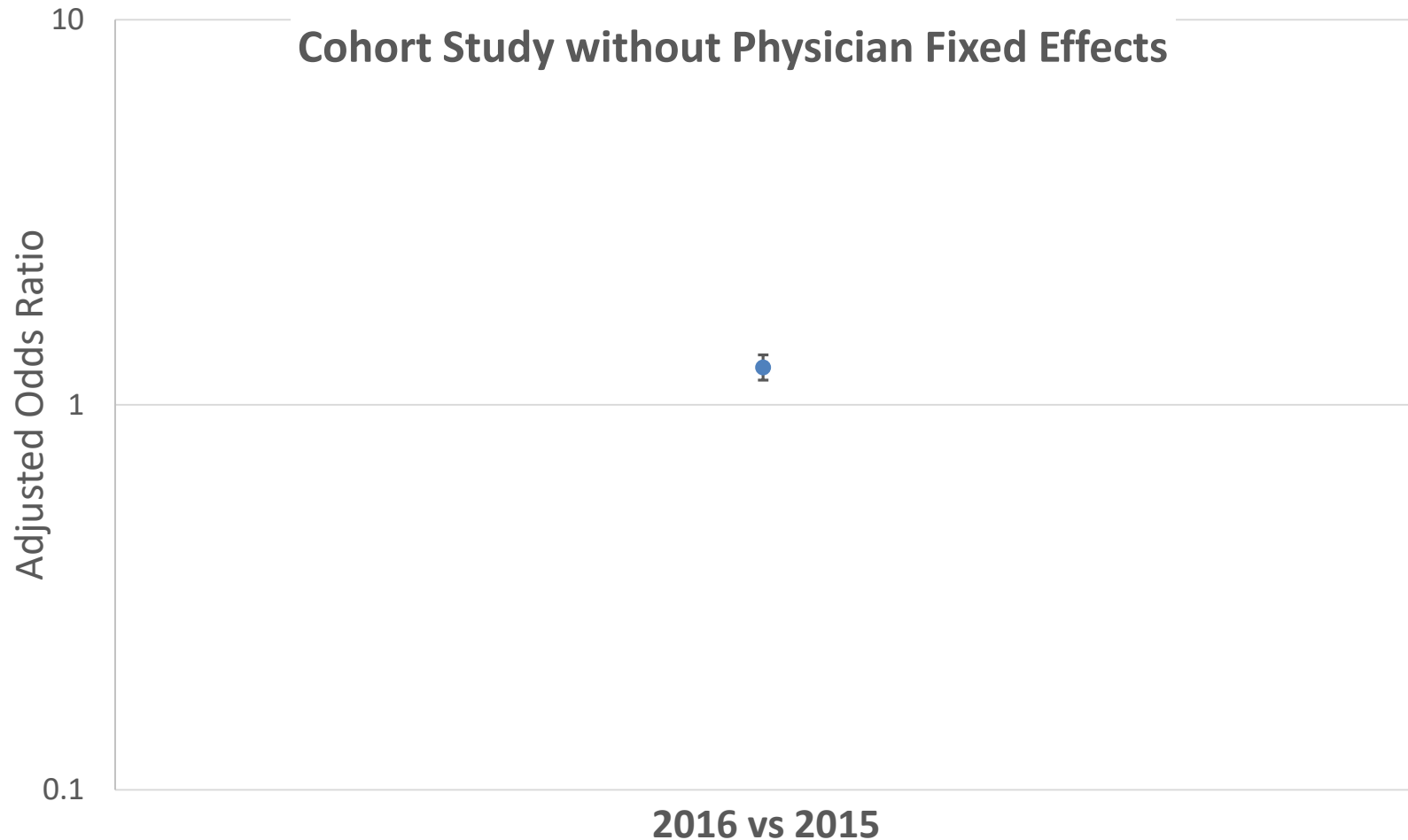
LA: Larger bonus size + Loss aversion
*Error bars indicate 95% confidence Intervals

Sensitivity Analyses



The estimate is the effect of the association between larger bonus size and higher achievement of evidence-based quality measures. The error bars indicate 95% confidence intervals.

Sensitivity Analyses



The estimate is the effect of the association between larger bonus size and higher achievement of evidence-based quality measures. The error bars indicate 95% confidence intervals.

Surveys

- Domains:
 - Baseline attitudes
 - Teamwork
 - Financial salience
 - Practice environment
 - Awareness/understanding
 - Impact on clinical behavior
 - Unintended consequences
- Surveys were administered online

Physician Survey Results

	Larger Bonus Size				Loss Aversion & Larger Bonus Size				Increased Social Pressure & Larger Bonus Size			
	Pre	Post	Change	t-test	Pre	Post	Change	t-test	Pre	Post	Change	t-test
Overall	n=24	n=14			n=26	n=13			n=21	n=7		
Baseline Attitudes	4.21	4.18	-0.04	0.47	3.64	3.69	0.06	0.45	3.98	4.02	0.04	0.44
Teamwork	3.89	3.91	0.03	0.48	4.11	3.93	-0.18	0.30	4.18	3.82	-0.37	0.02
Financial Salience	3.61	3.36	-0.25	0.33	3.03	3.69	0.67	0.04	3.35	3.35	0.01	0.41
Practice Environment	3.69	3.57	-0.12	0.37	4.00	3.80	-0.20	0.04	3.35	3.35	0.01	0.41
Awareness/ Understanding	3.54	3.77	0.23	0.32	3.67	3.67	0.00	0.50	3.40	3.37	-0.03	0.45
Individual Impact on Clinical Behavior	3.48	3.57	0.10	0.43	3.37	3.22	-0.15	0.26	3.47	3.46	-0.01	0.48
Unintended Consequences	2.83	3.10	0.27	0.14	2.85	3.33	0.48	0.01	3.14	3.25	0.11	0.25

Interviews

- 22 physicians selected from highest and lowest performing from each arm
- Interviews conducted in-person by independent research staff from UPenn team
- Recorded and transcribed interviews

Interviews

- Transcribed interviews were read over by several members of UPenn team
- Common nodes were developed to categorize emergent themes
- Two coders independently coded, met every few interviews to discuss coding results and remedy discrepancies
- Calculated reliability score (Kappa)

Physician Interview Results

- All three arms reported **being influenced** by the financial incentive though **no difference** in the salience of the dollar amounts
- There was **mixed feedback** in the social pressure arm, physicians reported increased teamwork but also barriers to success
- There was **mixed feedback** around group motivation, physicians in the social pressure arm reported positive and negative peer pressure
- In the loss aversion arm, physicians reported changing practice behavior to obtain the financial incentive
- There were **no consistent themes** around systematic changes to practices
- No differences in concern for unintended consequences