

## **ATTACHMENT C – HCAHPS MODE EXPERIMENT III**

### **Objectives**

- a. For the new Coordination of Care (CoC) composite measure, analyze Mode Experiment III results for the following:
  - i. Patient-mix adjustment to inform how patient sub-groups respond to the new measure.
  - ii. Potential mode effects for the CoC measure.
  - iii. Describe how CoC relates to other measures using psychometric analyses.
- b. Analyze the potential effectiveness of new patient-mix adjustment survey items related to self-rated mental health and emergency room admission.

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## Table of Contents

### Appendices:

**Appendix A.1** Descriptive statistics for CoC items and composite, overall and by mode

**Appendix A.2** Cross tab of CoC items with Survey Mode

**Appendix A.3** Cross tab of CoC items with Survey Mode, missing included

**Appendix B.1** Cronbach Alpha and inter-item correlation matrix

**Appendix B.2** Correlation of linear coded CoC items and composite with other measures

**Appendix B.3** Correlation of top-box coded CoC items and composite with other measures

**Appendix C.1** Linear regression models predicting linear coded CoC composite from standard PMA, adding ER admission and/or MHP.

**Appendix C.2** Linear regression models predicting top-box coded CoC composite from standard PMA, adding ER admission and/or MHP.

**Appendix D** Mode effects for CoC linear and top-box composite .

**Appendix E** Hospital-level ICC, Spearman correlation and reliability.

**Appendix F.1** PMA adjusted mean scores for linearly and top-box scored measures

**Appendix F.2** Correlation and Informativeness of adjusted mean scores from Model 1 with alternative models

**Appendix G** Difference in adjusted mean scores from standard PMA Model (Base Model) and each of the alternate Models 2, 3 and 4

**Appendix H** Mode effects, with and without PMA adjustment

**Appendix I** Mixed effect models with mode and standard PMA as fixed effects, and hospital

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and hospital by mode as random effects.

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## **APPENDIX A**

### **A. Descriptive Statistics**

#### **a. METHODS**

We produced tables that present descriptive statistics for age, service line, and all survey items for completed surveys overall and by mode. The descriptive statistics include means and simple frequencies. For each survey item, we produced a version of the descriptive statistics that includes percent missing and a version that excludes the missing cases

#### **b. RESULTS**

The mean, standard deviation, and number observed are presented for questions with ordinal response (Appendix A.1). The frequencies, overall and by mode, for the all variables are presented in Appendix A.2 (including percent missing) and A.3 (excluding the missing cases).

After reversing coding, the mean overall health and mental health perceptions on a scale from poor (1) to excellent (5) are 3.15 and 3.77 respectively, which corresponds to good health and very good mental health. More than half (62%) of patients reported having been admitted via the emergency room.

#### **c. CONCLUSIONS**

The distributions of HCAHPS items are as expected, with the exception that self-reported emergency room admission rates notably exceeded the rates seen for the administrative measures of emergency room admission, which was nearer to 40%.

## **APPENDIX B**

### **B. Coordination of Care (CoC)/Transition Items**

#### **a. METHODS**

There are three CoC items on a 4-point scale (strongly agree - strongly disagree), but one of the items has a fifth response value (a tailored not applicable) that we treated as missing. We generated two versions of each CoC item: 1) linear mean scoring on a 0-100 scale and b) top-box scoring (top = strongly agree vs. all other except not applicable/missing). We used both the linear and top-box versions of the three CoC items and the CoC composite in all analyses below.

For each of the three CoC items, we generated an inter-item correlation matrix and Cronbach's Alpha. We also examined the correlation of the CoC composite and each CoC item with each of the 10 reported HCAHPS measures (correlating top-box with top-box and linear with linear).

#### **b. RESULTS**

The mean score for the CoC composite, with 0-100 linear mean scoring, is 80, which is between agree and strongly agree. The top-box proportion (strongly agree) for the CoC composite is 47%.

The inter-item correlations with linear scoring are between 0.50 and 0.65, and the standardized Cronbach's alphas are 0.82 and 0.80 for the linear and top-box CoC composites, respectively (Appendix B.1). The Pearson and Spearman correlations for linear and top-box CoC

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composite and items with other HCAHPS measures are presented in Appendices B.2 and B.3, respectively. The Pearson correlations for the linearly scored CoC composite with other linearly scored HCAHPS measures are between 0.3 and 0.5, and slightly lower for the three individual CoC items (highest for Q23-staff took preferences into account and lowest for Q25-understood medications). The Spearman correlations show a similar pattern, and overall are lower than the Pearson correlations. The highest correlation with the linearly scored CoC composite is for recommending hospital ( $r=0.51$ ) followed by Communication with Nurses ( $r=0.50$ ), Communication about Medicine (0.49) and Rating of Hospital (0.48).

c. CONCLUSIONS

The CoC measure shows no evidence of a ceiling effect. The high Cronbach's alpha suggests that the CoC measure has very good internal consistency reliability. The moderately high association with hospital rating and recommendation are evidence of validity and suggest that patients value good coordination of care. The moderate correlations with other HCAHPS measures indicate that the CoC composite is not redundant with other HCAHPS measures. The strong association of CoC with Communication with Nurses and Communication about Medicine suggests the importance of coordination of care to those domains.

## APPENDIX C

### C. Patient-Mix Adjustment (PMA)

a. METHODS

The purpose of the patient-mix adjustment analyses was to evaluate two new items: ER admission (ERA) and Mental Health Perception (MHP). We compared four sets of models:

- i. Base model that corresponds to current official HCAHPS PMA<sup>1</sup> (hospital intercepts plus current PMAs)
- ii. Alternate model 1: add ERA to base model
- iii. Alternate model 2: add 1df (linear) MHP to the base model
- iv. Alternate model 3: add both ERA and MHP to base model

For each patient mix model we ran four versions (one version corresponding to the base model, and three to Alternate Models 1-3) of 22 linear models (11 total outcomes, including the new CoC composite x linear/top-box scoring). We report the coefficients associated with the patient-mix adjusters for all 4 models. The new (candidate) patient-mix adjusters (ERA and MHP) appear on top of the table. We will also examine shifts in current patient-mix adjusters, including general health perception and service line, from the base model to the alternative models (these coefficients appear just below ERA and MHP).

b. RESULTS

For each linear measure the parameter estimates and significance from the four models are presented side-by-side in Appendix C.1. Similarly, the results for the top-box measures are

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<sup>1</sup>The PMA are indicators for age (18-24, 25-34, 35-44, 45-55, 56-64, 65-74, 75-84 and 85 or older (reference)), linear education, linear overall health, indicators for maternity and surgical service lines, indicator for language other than English spoken at home, response percentile, and interaction of linear age with maternity and surgical.

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presented in Appendix C.2. Regardless of linear or top-box coding, MHP is significant for all measures in both Models 2 and 3. In all instances the MHP coefficient indicates more positive experiences with better MHP. In contrast, ER admission alone or in combination with MHP is significant for only 3 (doctor communication, discharge info, CoC) of the 11 linear measures and 2 (doctor communication and discharge info) of the 11 top-box measures. In all of these instances the coefficient for ERA was negative, indicating less positive experiences for those admitted through the ER.

c. CONCLUSIONS

The associations of MHP and ERA with HCAHPS items are in the direction expected. Future research will inform the advisability of these items as patient-mix adjustors.

## APPENDIX D

### D. Mode Analyses

a. METHODS

We estimated a base series of models. Each model predicted CoC outcomes (linear and top-box) from hospital indicator and the three mode indicators (reference=mail mode). This version is not patient-mix adjusted.

b. RESULTS

The coefficients and significance for three mode indicators (CATI, Mixed, and TT-IVR) versus Mail Only mode are presented in Appendix D.

With respect to the CoC composite, the scores for CATI are significantly higher than Mail Alone mode for both linear and top-box scoring. However, we find no significant differences between IVR and Mixed mode relative to Mail Only mode.

c. CONCLUSIONS

The mode effect results for CoC are similar to what has been observed previously in Mode Experiment 1.

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## APPENDIX E

### A. Coordination of Care (CoC)/Transition Items

#### a. METHODS

We will calculate the interclass correlation coefficient (ICC) at the hospital-level and Spearman-Brown (hospital-level) reliability of the new potential CoC composite and compare these to the ICCs for the 10 currently reported HCAHPS measures (linear mean and top-box versions of each).

#### b. RESULTS

Appendix F presents the ICC and the reliability statistics. ICC measures similarity of patients within a hospital and ranges between 0 and 1 (theoretically negative values are possible). The observed ICC's (linear and top-box coded) across all measures are very low indicating that patients within hospitals are dissimilar with respect to the eleven HCAHPS measures. The reliabilities (at an average 130 completes) range from poor (<0.50) for Pain Management and Communication about Medicines to high (>0.90) for Quiet and Hospital Recommendation. The estimated Spearman-Brown reliabilities (at n=300) are good ranging between 0.71 and 0.92. The ICC and reliability (including Spearman-Brown Reliability) statistics are consistent across scoring methods (i.e., linear scoring and top-box scoring). The new Coordination of Care measure has ICC and reliability (at n=130) above the median for current HCAHPS measures under both linear and top-box scoring.

#### c. CONCLUSIONS

The new CoC measure has psychometric properties as good or better than current HCAHPS measures, having both ICC and reliability (at n=130) above the median with respect to the ten current measures.

## APPENDIX F

### Part II

#### a. METHODS

We will generate patient-mix-adjusted scores for each hospital for each of the 4 models, and calculate  $1-R^2$  where R is the correlation of final adjusted score for the base model with one of the three alternative models. We will do this for linear and top-box coded versions of each measure. We will table these results by measure (for each of 11 measures).

#### b. RESULTS

The results are presented in Appendix H. For all measures, the adjusted means across the four models are very similar for both linear and top-box scoring. The adjusted means correlations between Model 1 and each of the alternate Models are very high. The informativeness ( $1-R^2$ ) is less than 1%, which indicates very small added information resulting from the added PMA (ERA and/or MHP). The Communication with Doctors measure (linear and top-box scoring) and Coordination of Care (top-box) show the biggest

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impact. However, on average the addition of ERA and MHP matter the same amount on measures linearly scored, while MHP matters a little more than ERA on top-box measures.

c. CONCLUSIONS

Overall, ERA and MHP have very little impact on informativeness. Thus, we recommend against addition of either item as a patient-mix adjuster. However, CMS will continue collection of these variables for analysis and oversight purposes.

## APPENDIX G

### Part III

a. METHODS

We will produce difference in hospital-level scores under standard PMA model and each of the alternative PMA models. We will show histograms and univariate descriptive statistics of these differences, and list the five hospitals with the biggest gains and losses for each measure, along with mean patient-mix-adjusters for those hospitals.

b. RESULTS

The results are presented in Appendix I. The alternate models have little impact on hospital-level adjusted means. In general, hospitals are effected by less than 1 point with the exception of top-box score Coordination of Care with 1 point on a 0-100 scale.

c. CONCLUSIONS

Overall, ERA and PMA have little effect on hospital scores. Furthermore, there are concerns about the validity of ERA because it is believed to be over-reported by patients, and MHP is moderately correlated with GHP and varies little from hospital to hospital. For these reasons, we recommend against addition of ERA or MHP as PMA.

## APPENDIX H

### B. Mode Effects

#### Part I

a. METHODS

We will add patient-mix adjusters to the two base models that predict Coordination of Care outcome (in linear mean and top-box form) from hospital indicator and the three assigned mode indicators (with Mail Only mode as the reference mode). The top-box version of these patient-mix adjusted mode estimates would potentially be used for adjustment.

b. RESULTS

The CATI (phone) mode mode effects are larger for the CoC measure, with and without PMA. These mode effects are larger for top-box scored measures, ranging from 3.13 to 3.50 for with and without PMA, respectively. In contrast, the effects for IVR and Mixed mode are small.

c. CONCLUSIONS



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Findings are similar to Mode Experiment I, with CATI having a larger adjustment for the new measure Coordination of Care..

## **APPENDIX I**

### **METHODS**

To evaluate heterogeneity of survey mode affects within hospitals, we will run mixed effect models with mode and standard PMA as fixed effects, hospital and hospital by mode random effects.

### **RESULTS**

Since the interactions of CATI by hospital and Mixed mode by hospital are not significant there is no evidence that modes CATI and Mixed vary much from hospital to hospital with respect to CoC. However, the IVR variance component is significant indicating some variability in IVR mode from hospital to hospital.

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## Appendices

Appendix A.1

		N					Mean					SD				
		Overall	CATI	Mail	IVR	Mixed	Overall	CATI	Mail	IVR	Mixed	Overall	CATI	Mail	IVR	Mixed
q23	Staff took preferences into account in deciding what care needs would be when I left	6098	1661	1478	1060	1899	3.27	3.32	3.25	3.19	3.29	0.71	0.65	0.71	0.78	0.70
q24	When I left the hospital, had good understanding of things I was responsible for managing health	6256	1733	1501	1064	1958	3.41	3.47	3.37	3.35	3.40	0.67	0.62	0.66	0.75	0.67
q25	When I left the hospital, clearly understood the purpose for taking each of my medications	5233	1357	1308	941	1627	3.49	3.54	3.46	3.44	3.49	0.66	0.58	0.67	0.72	0.67
care	Coordination of Care Composite (3)	6304	1742	1510	1071	1981	79.19	80.85	78.45	77.19	79.37	19.78	17.67	20.15	22.11	19.80
care_tb	Coordination of Care top-box (average of top-box items)	6304	1742	1510	1071	1981	47.13	48.82	45.31	45.86	47.72	42.45	41.48	43.22	42.81	42.48

## Appendix A.2

### Table of Q23 by MODE

Q23(Staff took preferences into account in deciding what care needs would be when I left)  
 MODE(Survey Mode (CATI/Telephone only, Mail, MIXED, TT-IVR)

Frequency	Col	Pct	CATI	Mail	TT-IVR	MIXED	Total
.			90	87	52	125	354
			5.14	5.56	4.68	6.18	
1 Strongly disagree			29	44	49	53	175
			1.66	2.81	4.41	2.62	
2 Disagree			88	105	96	113	402
			5.03	6.71	8.63	5.58	
3 Agree			872	773	516	964	3125
			49.80	49.39	46.40	47.63	
4 Strongly agree			672	556	399	769	2396
			38.38	35.53	35.88	37.99	
Total			1751	1565	1112	2024	6452

### Table of Q24 by MODE

Q24(When I left the hospital, had good understanding of things I was responsible for managing health)  
 MODE(Survey Mode (CATI/Telephone only, Mail, MIXED, TT-IVR)

Frequency	Col	Pct	CATI	Mail	TT-IVR	MIXED	Total
.			18	64	48	66	196
			1.03	4.09	4.32	3.26	
1 Strongly disagree			22	25	38	43	128
			1.26	1.60	3.42	2.12	
2 Disagree			46	81	61	75	263
			2.63	5.18	5.49	3.71	
3 Agree			764	706	452	890	2812
			43.63	45.11	40.65	43.97	
4 Strongly agree			901	689	513	950	3053
			51.46	44.03	46.13	46.94	
Total			1751	1565	1112	2024	6452

### Table of Q25 by MODE

Q25(When I left the hospital, clearly understood the purpose for taking each of my medications)  
 MODE(Survey Mode (CATI/Telephone only, Mail, MIXED, TT-IVR)

Frequency	Col	Pct	CATI	Mail	TT-IVR	MIXED	Total
.			38	65	58	64	225
			2.17	4.15	5.22	3.16	

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Not given meds , 356 , 192 , 113 , 333 , 994  
 , 20.33 , 12.27 , 10.16 , 16.45 ,  
 ^  
 1 Strongly , 14 , 26 , 31 , 39 , 110  
 disagree , 0.80 , 1.66 , 2.79 , 1.93 ,  
 ^  
 2 Disagree , 19 , 56 , 37 , 46 , 158  
 , 1.09 , 3.58 , 3.33 , 2.27 ,  
 ^  
 3 Agree , 540 , 513 , 364 , 627 , 2044  
 , 30.84 , 32.78 , 32.73 , 30.98 ,  
 ^  
 4 Strongly agree , 784 , 713 , 509 , 915 , 2921  
 , 44.77 , 45.56 , 45.77 , 45.21 ,  
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 Total 1751 1565 1112 2024 6452

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## Appendix A.3

### Table of Q23 by MODE

Q23(Staff took preferences into account in deciding what care needs would be when I left)  
MODE(Survey Mode (CATI/Telephone only, Mail, MIXED, TT-IVR)

Frequency					
Col Pct	,CATI	,Mail	,TT-IVR	,MIXED	, Total
1 Strongly disagree	29	44	49	53	175
	1.75	2.98	4.62	2.79	
2 Disagree	88	105	96	113	402
	5.30	7.10	9.06	5.95	
3 Agree	872	773	516	964	3125
	52.50	52.30	48.68	50.76	
4 Strongly agree	672	556	399	769	2396
	40.46	37.62	37.64	40.49	
Total	1661	1478	1060	1899	6098

Frequency Missing = 354

### Table of Q24 by MODE

Q24(When I left the hospital, had good understanding of things I was responsible for managing health)  
MODE(Survey Mode (CATI/Telephone only, Mail, MIXED, TT-IVR)

Frequency					
Col Pct	,CATI	,Mail	,TT-IVR	,MIXED	, Total
1 Strongly disagree	22	25	38	43	128
	1.27	1.67	3.57	2.20	
2 Disagree	46	81	61	75	263
	2.65	5.40	5.73	3.83	
3 Agree	764	706	452	890	2812
	44.09	47.04	42.48	45.45	
4 Strongly agree	901	689	513	950	3053
	51.99	45.90	48.21	48.52	
Total	1733	1501	1064	1958	6256

Frequency Missing = 196

### Table of Q25 by MODE

Q25(When I left the hospital, clearly understood the purpose for taking each of my medications)  
MODE(Survey Mode (CATI/Telephone only, Mail, MIXED, TT-IVR)

Frequency					
Col Pct	,CATI	,Mail	,TT-IVR	,MIXED	, Total
1 Strongly disagree	14	26	31	39	110
	1.03	1.99	3.29	2.40	
2 Disagree	19	56	37	46	158
	1.40	4.28	3.93	2.83	

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3 Agree	, 540,	513,	364,	627,	2044
	, 39.79,	39.22,	38.68,	38.54,	
4 Strongly agree	, 784,	713,	509,	915,	2921
	, 57.77,	54.51,	54.09,	56.24,	
Total	1357	1308	941	1627	5233

Frequency Missing = 1219

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## Appendix B.1

### Linear coding

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Cronbach Coefficient Alpha

Variables            Alpha  
Raw                    0.818870  
Standardized        0.819706

Pearson Correlation Coefficients, N = 5064  
Prob > |r| under H0: Rho=0

	Q23	Q24	Q25	
Q23	1.00000	0.64079	0.53106	
Staff took preferences into account in deciding what care needs would be when I left		<.0001	<.0001	
Q24	0.64079	1.00000	0.63554	
When I left the hospital, had good understanding of things I was responsible for managing health		<.0001	<.0001	
Q25	0.53106	0.63554	1.00000	
When I left the hospital, clearly understood the purpose for taking each of my medications		<.0001	<.0001	

### Top-box coding

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Cronbach Coefficient Alpha

Variables            Alpha  
Raw                    0.804103  
Standardized        0.803886

Pearson Correlation Coefficients, N = 5064  
Prob > |r| under H0: Rho=0

	rq23_tb	rq24_tb	rq25_tb	
rq23_tb	1.00000	0.60453	0.50339	
(Top-box) Staff took preferences into account in deciding what care needs would be when I left		<.0001	<.0001	
rq24_tb	0.60453	1.00000	0.62431	
(Top-box) When I left the hospital, had good understanding of things I was responsible for managing health		<.0001	<.0001	
rq25_tb	0.50339	0.62431	1.00000	
(Top-box) When I left the hospital, clearly understood the purpose for taking each of my medications		<.0001	<.0001	

## Appendix B.2

### Linear coding

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**Pearson Correlations:**

	CoC	Q23	Q24	Q25	
Nurse communication Composite	0.49586	0.45955	0.43899	0.39580	
		<.0001	<.0001	<.0001	<.0001
	6292	6088	6246	5223	



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Doctor communication Composite	0.46687	0.40369	0.43257	0.37435		
	6282	6078	6235	5217	<.0001	<.0001
Responsiveness of hospital staff Composite	0.39208	0.37004	0.35160	0.29872	<.0001	<.0001
	5742	5570	5698	4840	<.0001	<.0001
Pain management Composite	0.43102	0.40108	0.38750	0.33000	<.0001	<.0001
	4554	4433	4526	3909	<.0001	<.0001
Communication about medicines Composite	0.49176	0.42734	0.42095	0.44382	<.0001	<.0001
	3572	3474	3544	3142	<.0001	<.0001
Discharge information Composite	0.41069	0.38573	0.36170	0.29870	<.0001	<.0001
	5904	5719	5864	4936	<.0001	<.0001
Quiet	0.30425	0.26776	0.27647	0.24951	<.0001	<.0001
	6263	6062	6217	5199	<.0001	<.0001
Clean	0.32255	0.32193	0.28734	0.22954	<.0001	<.0001
	6261	6060	6213	5199	<.0001	<.0001
Rate hospital	0.48049	0.44864	0.42519	0.36346	<.0001	<.0001
	6233	6035	6187	5174	<.0001	<.0001
Recommend hospital	0.50586	0.47413	0.44763	0.38463	<.0001	<.0001
	6253	6054	6207	5192	<.0001	<.0001

## Appendix B.3

### Top-box coding

#### Spearman Correlations:

	CARE_tb	rq23_tb	rq24_tb	rq25_tb		
Nurse communication top-box (average of top-box items)	0.39736	0.34257	0.36234	0.32614	<.0001	<.0001
	6292	6088	6246	5223		
Doctor communication top-box (average of top-box items)	0.39455	0.32021	0.36502	0.32495	<.0001	<.0001
	6282	6078	6235	5217		
Responsiveness of hospital staff top-box (average of top-box items)	0.31590	0.27899	0.28785	0.24704	<.0001	<.0001
	5742	5570	5698	4840		
Pain management top-box (average of top-box items)	0.34275	0.28059	0.32299	0.28451	<.0001	<.0001
	4554	4433	4526	3909		
Communication about medicines top-box (average of top-box items)	0.43816	0.36459	0.37405	0.40300	<.0001	<.0001
	3572	3474	3544	3142		
Discharge information top-box (average of top-box items)	0.30304	0.26795	0.26319	0.23492	<.0001	<.0001
	5904	5719	5864	4936		
Quiet top-box (Always)	0.24378	0.20341	0.22498	0.20806	<.0001	<.0001
	6263	6062	6217	5199		
Clean top-box (Always)	0.26302	0.24238	0.23428	0.20292	<.0001	<.0001
	6261	6060	6213	5199		
Rate hospital top-box (9 or 10)	0.39271	0.33693	0.35120	0.32085	<.0001	<.0001
	6233	6035	6187	5174		
Recommend hospital top-box (Definitely Yes)	0.40812	0.34280	0.37075	0.33439	<.0001	<.0001
	6253	6054	6207	5192		

Appendix C.1 (linear measures)

	Coordination of Care Composite				*** p<0.001, ** p<0.01 and * p<0.
	Base Model	Model 1	Model 2	Model 3	
ER admit		-1.58 **		-1.49 *	
MHP			-2.33 ***	-2.32 ***	
Maternity	9.82 ***	8.78 ***	9.39 ***	8.41 **	
Surgical	6.66 **	6.08 **	6.67 **	6.12 **	
Age:					
18-24	0.16	0.13	0.11	0.08	
25-34	2.28	2.01	2.34	2.09	
35-44	2.29	2.11	2.5	2.32	
45-54	2.38	2.31	2.38	2.32	
55-64	3.31 **	3.21 **	3.27 **	3.18 **	
65-74	3.93 ***	3.84 ***	3.72 ***	3.64 ***	
75-84	1.42	1.38	1.36	1.32	
Education	-0.02	-0.05	-0.28	-0.31	
GHP	-2.71 ***	-2.67 ***	-1.62 ***	-1.58 ***	
Language other than Response Percentile	-1.08	-0.98	-1.18	-1.09	
Maternity*Age	-2.43 *	-2.3 *	-2.42 *	-2.3 *	
Surgical*Age	-0.77 *	-0.8 *	-0.82 *	-0.85 *	

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Appendix C.2 (top-box measures)

	Coordination of Care Composite				*** p<0.001, ** p<0.01 and * p<0.05
	Base Model	Model 1	Model 2	Model 3	
ER admit		-2.08		-1.86	
MHP			-5.89 ***	-5.88 ***	
Maternity	18.43 ***	17.07 **	17.33 **	16.12 **	
Surgical	8.35	7.59	8.38	7.7	
Age:					
18-24	5.77	5.73	5.64	5.6	
25-34	9.56 **	9.2 **	9.72 **	9.4 **	
35-44	10.4 **	10.16 **	10.91 ***	10.7 ***	
45-54	11.97 ***	11.88 ***	11.98 ***	11.9 ***	
55-64	12.7 ***	12.57 ***	12.6 ***	12.49 ***	
65-74	10.92 ***	10.8 ***	10.39 ***	10.29 ***	
75-84	3.19	3.13	3.04	2.99	
Education	0.89 *	0.84	0.23	0.19	
GHP	-5.55 ***	-5.49 ***	-2.78 ***	-2.73 ***	
Language other than English Response Percentile	-4.82	-4.68	-5.06	-4.94	
Maternity*Age	-4.02 *	-3.95 *	-3.84 *	-3.78 *	
Surgical*Age	-5.31 *	-5.14 *	-5.29 *	-5.14 *	
	-0.68	-0.72	-0.8	-0.83	

Appendix D

Mode (Mail only as reference):	CARE model1	CARE model2	CARE model3	CARE model4	CARE tb model1	CARE tb model2	CARE tb model3	CARE tb model4
CATI	2.14 **	2.17 **	2.07 **	2.1 **	3.33 *	3.37 *	3.16 *	3.19 *
MIXED	1	1	0.97	0.97	2.96 *	2.97 *	2.89 *	2.89 *
IVR	-2.03 **	-2 **	-2.28 **	-2.24 **	-1.05	-1	-1.65	-1.6

\*\*\* p<0.001, \*\* p<0.01 and \* p<0.

(This Table is based on data with all correct exclusions)

## Appendix E

Hospital-level InterClass Correlation (ICC), Spearman Brown Correlation (n=300) and Reliability

Measures	Linear Scoring			Topbox Scoring		
	ICC	Spearman-Brown correlation at n=300	Reliability	ICC	Spearman-Brown correlation at n=300	Reliability
Coordination of Care Composite	0.023	<b>0.88</b>	0.76	0.017	<b>0.84</b>	0.69
Nurse communication Composite	0.019	<b>0.85</b>	0.73	0.017	<b>0.84</b>	0.71
Doctor communication Composite	0.016	<b>0.83</b>	0.69	0.014	<b>0.81</b>	0.66
Responsiveness of hospital staff Composite	0.026	<b>0.89</b>	0.77	0.015	<b>0.82</b>	0.66
Pain management Composite	0.010	<b>0.75</b>	0.49	0.008	<b>0.71</b>	0.45
Communication about medicines Composite	0.015	<b>0.82</b>	0.55	0.011	<b>0.77</b>	0.47
Discharge information Composite	0.018	<b>0.85</b>	0.70			
Quiet	0.033	<b>0.91</b>	0.82	0.026	<b>0.89</b>	0.78
Clean	0.020	<b>0.86</b>	0.74	0.015	<b>0.82</b>	0.67
Rate hospital	0.021	<b>0.87</b>	0.75	0.022	<b>0.87</b>	0.75
Recommend hospital	0.039	<b>0.92</b>	0.85	0.039	<b>0.92</b>	0.85

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## Appendix F.1

### Patient-Mix Adjusted Means Scores for Linearly Scored Measures

PROVID	CARE_1	CARE_2	CARE_3	CARE_4
010024	80.01	80.02	80.05	80.05
030037	75.36	75.24	75.38	75.27
030122	79.82	79.63	79.87	79.69
040014	78.34	78.29	78.37	78.32
040027	79.71	79.61	79.98	79.89
050069	79.28	79.29	79.46	79.47
050104	78.63	78.7	78.87	78.93
050438	84.81	84.72	84.72	84.64
050455	78.56	78.51	78.65	78.61
050506	80	79.93	80.16	80.1
050746	74.93	75.06	74.94	75.06
060030	83.94	83.86	83.89	83.82
100113	81.67	81.52	81.78	81.65
100135	79.9	79.79	80.04	79.94
100187	65.07	65.06	64.87	64.86
100189	76.46	76.69	76.53	76.75
110075	78.88	78.89	78.72	78.73
110198	71.71	71.9	71.69	71.87
120006	85.18	85.46	85.55	85.81
150012	81.24	81.17	81.31	81.25
150150	80.45	80.15	80.47	80.18
190046	79.31	79.3	79.32	79.3
210019	79.69	79.62	79.41	79.35
210040	76.71	76.83	76.92	77.03
230002	78.68	78.7	78.52	78.54
230070	84.43	84.5	84.43	84.49
230236	82.17	82.29	81.92	82.03
240053	79.11	79.02	79.12	79.04
260027	76.23	76.11	76.54	76.43
260094	78.16	78.43	78.19	78.45
290022	68.45	68.71	68.39	68.63
290041	75.07	75.1	75.02	75.05
310081	79.42	79.53	79.08	79.19
360012	81.63	81.6	81.63	81.59
360155	81.8	81.82	81.65	81.67
370008	77.49	77.55	77.51	77.57
370149	81.52	81.66	81.86	81.99
390211	79.47	79.47	79.17	79.18
440034	80.53	80.58	80.64	80.69
440091	83.15	82.96	83.13	82.95
450056	80.47	80.42	80.56	80.51
450424	78.96	79.09	78.58	78.71

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450647	80.46	80.35	80.52	80.42
450675	77.99	78.06	78.21	78.28
450697	73.43	73.42	72.89	72.89
450742	76.27	76.27	76.35	76.34
490075	77.4	77.4	77.22	77.23

Note: Model 1 is composed of the standard patient-mix adjustor; Model 2 adds to Model 1 the indicator for ER admission; Model 3 adds to Model 1 linear MHP; Model 4 adds to Model 1 the indicator for ER admission and linear MHP.



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Patient-Mix Adjusted Means Scores for Top-Box Scored Measures

PROVID	CARE_tb_1	CARE_tb_2	CARE_tb_3	CARE_tb_4
010024	46.38	46.39	46.47	46.48
030037	37.52	37.36	37.56	37.43
030122	50.78	50.54	50.92	50.7
040014	47.53	47.47	47.61	47.55
040027	47.33	47.2	48.02	47.9
050069	48.84	48.86	49.3	49.31
050104	43.2	43.29	43.8	43.88
050438	57.78	57.67	57.56	57.46
050455	46.46	46.4	46.71	46.66
050506	47.79	47.7	48.21	48.13
050746	40.95	41.12	40.97	41.12
060030	55.47	55.37	55.35	55.26
100113	51.85	51.67	52.15	51.98
100135	48.75	48.62	49.12	49
100187	37.87	37.86	37.36	37.35
100189	40.32	40.61	40.5	40.76
110075	44.69	44.7	44.29	44.29
110198	29.14	29.38	29.08	29.29
120006	57.96	58.33	58.9	59.22
150012	51.63	51.54	51.82	51.74
150150	47.98	47.59	48.03	47.68
190046	49.57	49.55	49.58	49.56
210019	47.46	47.38	46.75	46.68
210040	42.02	42.18	42.55	42.69
230002	44.03	44.06	43.63	43.66
230070	57.91	58	57.91	57.99
230236	54.27	54.43	53.63	53.77
240053	45.32	45.21	45.35	45.25
260027	40.74	40.59	41.52	41.38
260094	46.97	47.32	47.04	47.36
290022	30.67	31	30.52	30.81
290041	40.43	40.48	40.32	40.36
310081	47.42	47.57	46.57	46.7
360012	52.63	52.59	52.62	52.58
360155	54.7	54.72	54.32	54.34
370008	41.45	41.53	41.51	41.59
370149	50.89	51.07	51.73	51.89
390211	44.29	44.3	43.54	43.55
440034	51.02	51.09	51.31	51.38
440091	53.87	53.63	53.82	53.6
450056	49.45	49.38	49.66	49.6
450424	45.87	46.03	44.91	45.06
450647	48.61	48.47	48.76	48.63
450675	44.64	44.73	45.21	45.29

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450697	37.17	37.15	35.8	35.79
450742	41.82	41.81	42.01	41.99
490075	43.97	43.98	43.53	43.54

Note: Model 1 is composed of the standard patient-mix adjustor; Model 2 adds to Model 1 the indicator for ER admission; Model 3 adds to Model 1 linear MHP; Model 4 adds to Model 1 the indicator for ER admission and linear MHP.

Appendix F.2

Correlation and Informativeness ( $1 - R^2$ ) of Adjusted Means from Model 1 with Each of the Three Alternative Models.

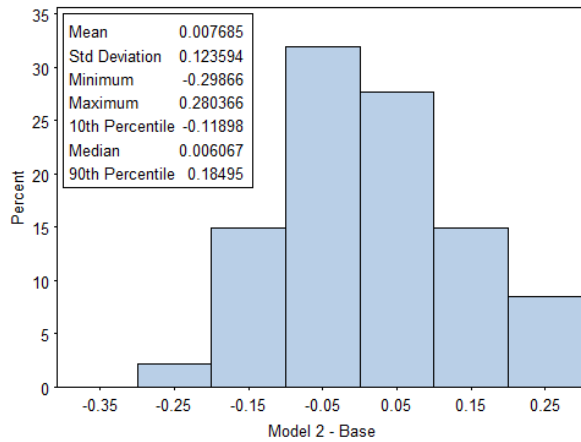
	Correlation			1 - R <sup>2</sup>		
	Model 1 & 2	Model 1 & 3	Model 1 & 4	Model 1 & 2	Model 1 & 3	Model 1 & 4
<b>Linear</b>						
Nurse communication Composite	1.000	0.999	0.999	0.000	0.001	0.001
Doctor communication Composite	0.997	0.998	0.995	0.007	0.003	0.010
Responsiveness of hospital staff Composite	1.000	1.000	1.000	0.000	0.000	0.001
Pain management Composite	1.000	0.999	0.999	0.000	0.002	0.002
Communication about medicines Composite	1.000	0.999	0.999	0.000	0.002	0.002
Discharge information Composite	0.999	1.000	0.999	0.002	0.000	0.002
Quiet	1.000	1.000	1.000	0.000	0.000	0.001
Clean	1.000	1.000	1.000	0.000	0.000	0.000
Rate hospital	1.000	1.000	1.000	0.000	0.000	0.001
Recommend hospital	1.000	1.000	1.000	0.000	0.000	0.000
Coordination of Care Composite	0.999	0.999	0.998	0.001	0.002	0.003
<b>Top-Box</b>						
Nurse communication	1.000	0.999	0.999	0.000	0.003	0.003
Doctor communication Composite	0.996	0.998	0.995	0.007	0.004	0.010
Responsiveness of hospital staff Composite	1.000	0.999	0.999	0.000	0.001	0.001
Pain management Composite	1.000	0.999	0.999	0.000	0.002	0.003
Communication about medicines Composite	1.000	0.998	0.999	0.000	0.003	0.003
Discharge information Composite	0.999	1.000	0.999	0.002	0.000	0.002
Quiet	1.000	1.000	1.000	0.000	0.001	0.001
Clean	1.000	1.000	1.000	0.000	0.001	0.001
Rate hospital	1.000	1.000	0.999	0.000	0.001	0.001
Recommend hospital	1.000	1.000	1.000	0.000	0.001	0.001
Coordination of Care Composite	1.000	0.997	0.997	0.001	0.005	0.006

Note: Model 1 is composed of the standard patient-mix adjustor; Model 2 adds to Model 1 the indicator for ER admission; Model 3 adds to Model 1 linear MHP; Model 4 adds to Model 1 the indicator for ER admission and linear MHP.

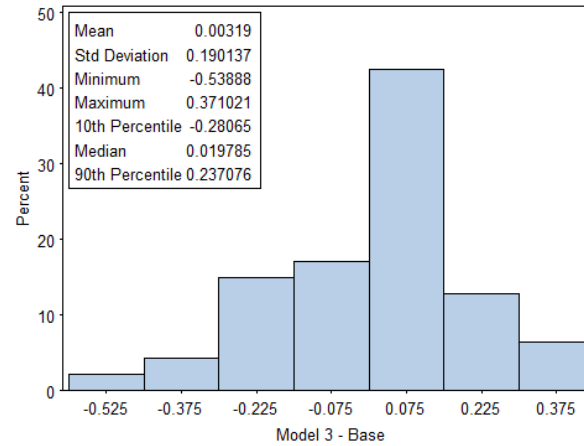
## Appendix G

Difference in adjusted mean scores from standard PMA Model (Base Model) and each of the alternate Models 2, 3 and 4.

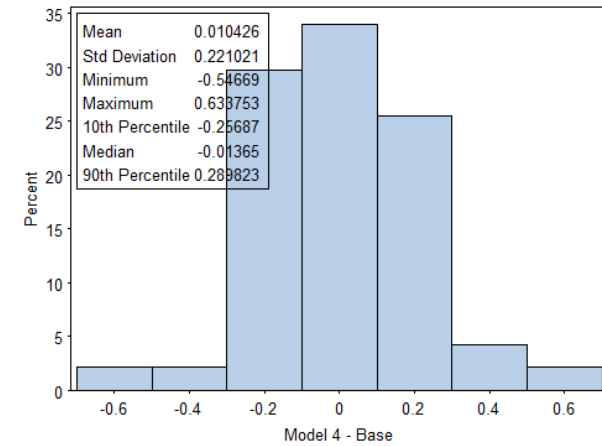
CARE  
Model with ER Admit



CARE  
Model with MHP



CARE  
Model with ER Admit & MHP



DUPONT HOSPITAL LLC (Gain: -0.299)  
 BANNER GATEWAY MEDICAL CENTER (Gain: -0.19)  
 MEMORIAL HOSPITAL, CHATTANOOGA, TN (Gain: -0.187)  
 SHANDS HOSPITAL AT THE UNIVERSITY OF FLORIDA (Gain: -0.143)  
 RESEARCH MEDICAL CENTER (Gain: -0.119)

NORTH FULTON REGIONAL HOSPITAL (Loss: 0.185)  
 NORTHWEST MEDICAL CENTER (Loss: 0.227)  
 DESERT SPRINGS HOSPITAL CENTER (Loss: 0.254)  
 SKAGGS COMMUNITY HEALTH CENTER (Loss: 0.272)  
 CASTLE MEDICAL CENTER (Loss: 0.28)

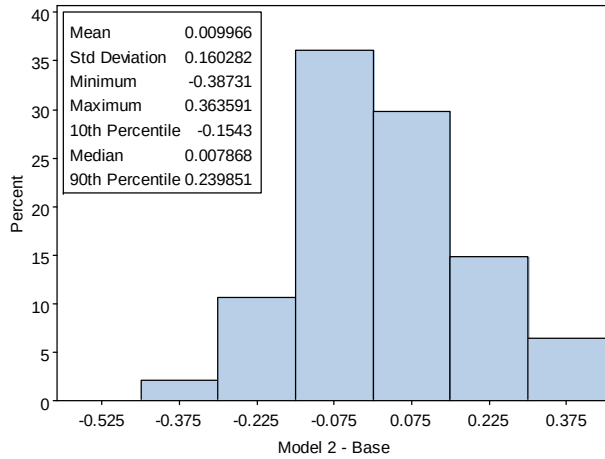
SOUTHWEST GENERAL HOSPITAL (Gain: -0.539)  
 SAN JACINTO METHODIST HOSPITAL (Gain: -0.379)  
 UNDERWOOD - MEMORIAL HOSPITAL (Gain: -0.336)  
 SHARON REGIONAL HEALTH SYSTEM (Gain: -0.299)  
 PENINSULA REGIONAL MEDICAL CENTER (Gain: -0.281)

SAINT FRANCIS MEDICAL CENTER (Loss: 0.237)  
 BAXTER REGIONAL MEDICAL CENTER (Loss: 0.274)  
 RESEARCH MEDICAL CENTER (Loss: 0.307)  
 UNITY HEALTH CENTER (Loss: 0.336)  
 CASTLE MEDICAL CENTER (Loss: 0.371)

SOUTHWEST GENERAL HOSPITAL (Gain: -0.547)  
 PENINSULA REGIONAL MEDICAL CENTER (Gain: -0.339)  
 SHARON REGIONAL HEALTH SYSTEM (Gain: -0.29)  
 DUPONT HOSPITAL LLC (Gain: -0.262)  
 SAN JACINTO METHODIST HOSPITAL (Gain: -0.257)

MEDICAL CENTER OF ARLINGTON (Loss: 0.29)  
 SAINT FRANCIS MEDICAL CENTER (Loss: 0.297)  
 NORTHWEST HOSPITAL CENTER (Loss: 0.325)  
 UNITY HEALTH CENTER (Loss: 0.466)  
 CASTLE MEDICAL CENTER (Loss: 0.634)

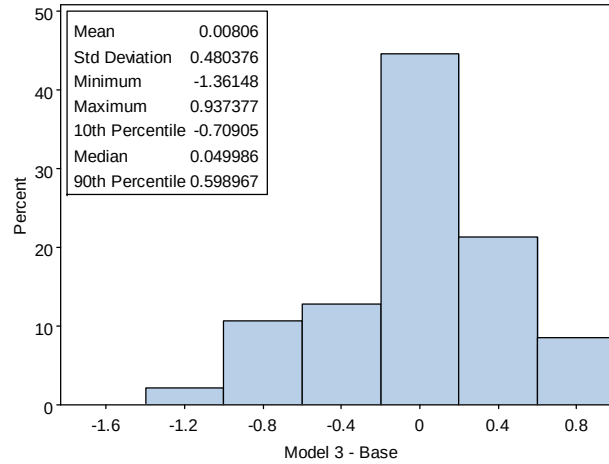
CARE (top-box)  
Model with ER Admit



DUPONT HOSPITAL LLC (Gain: -0.387)  
 BANNER GATEWAY MEDICAL CENTER (Gain: -0.246)  
 MEMORIAL HOSPITAL, CHATTANOOGA, TN (Gain: -0.243)  
 SHANDS HOSPITAL AT THE UNIVERSITY OF FLORIDA (Gain: -0.186)  
 RESEARCH MEDICAL CENTER (Gain: -0.154)

NORTH FULTON REGIONAL HOSPITAL (Loss: 0.24)  
 NORTHWEST MEDICAL CENTER (Loss: 0.294)  
 DESERT SPRINGS HOSPITAL CENTER (Loss: 0.329)  
 SKAGGS COMMUNITY HEALTH CENTER (Loss: 0.352)  
 CASTLE MEDICAL CENTER (Loss: 0.364)

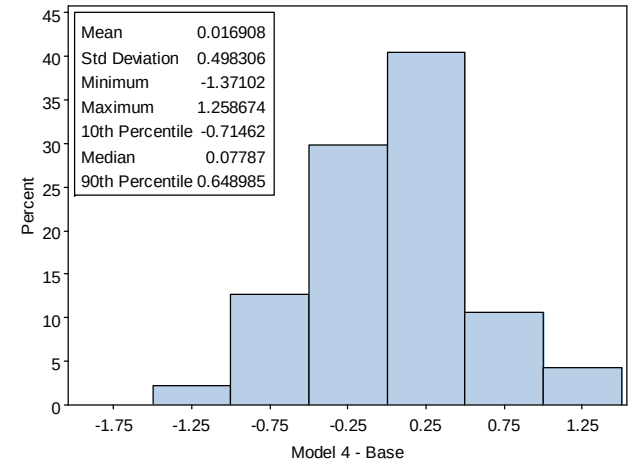
CARE (top-box)  
Model with MHP



SOUTHWEST GENERAL HOSPITAL (Gain: -1.361)  
 SAN JACINTO METHODIST HOSPITAL (Gain: -0.957)  
 UNDERWOOD - MEMORIAL HOSPITAL (Gain: -0.849)  
 SHARON REGIONAL HEALTH SYSTEM (Gain: -0.755)  
 PENINSULA REGIONAL MEDICAL CENTER (Gain: -0.709)

SAINT FRANCIS MEDICAL CENTER (Loss: 0.599)  
 BAXTER REGIONAL MEDICAL CENTER (Loss: 0.692)  
 RESEARCH MEDICAL CENTER (Loss: 0.776)  
 UNITY HEALTH CENTER (Loss: 0.848)  
 CASTLE MEDICAL CENTER (Loss: 0.937)

CARE (top-box)  
Model with ER Admit & MHP



SOUTHWEST GENERAL HOSPITAL (Gain: -1.371)  
 SAN JACINTO METHODIST HOSPITAL (Gain: -0.808)  
 PENINSULA REGIONAL MEDICAL CENTER (Gain: -0.78)  
 SHARON REGIONAL HEALTH SYSTEM (Gain: -0.744)  
 UNDERWOOD - MEMORIAL HOSPITAL (Gain: -0.715)

MEDICAL CENTER OF ARLINGTON (Loss: 0.649)  
 NORTHWEST HOSPITAL CENTER (Loss: 0.671)  
 SAINT FRANCIS MEDICAL CENTER (Loss: 0.672)  
 UNITY HEALTH CENTER (Loss: 1.007)  
 CASTLE MEDICAL CENTER (Loss: 1.259)

## Appendix H

Mode Effects with and without PMA adjustment.

		LINEAR SCORING			TOP-BOX SCORING		
		CATI	IVR	MIXED	CATI	IVR	MIXED
CARE	Without PMA	2.25 **	-1.53	0.89	3.50 *	0.12	2.53
	With PMA	2.10 **	-1.97 *	0.88	3.13 *	-0.77	2.45

## Appendix I

Mixed effect models with mode and standard PMA as fixed effects, and hospital and hospital by mode as random effects.

CARE			
RANDOM EFFECTS:	SE	VAR	
PROVID	2.65	7.01	**
CATI*PROVID	0.00	0.00	
MIXED*PROVID	0.60	0.36	
IVR*PROVID	4.07	16.54	*
Residual	19.06	363.4	***