

Supplemental Figures & Tables

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Table e-1: Top MS DRGs & Representative Diagnoses

Base MS DRG	Base MS DRG	Representative Diagnoses
37	Seizures	Epilepsy, seizure
20	Degenerative disorders	Myasthenia gravis, amyotrophic lateral sclerosis, Parkinson's disease, Alzheimer's dementia, Dementia with Lewy Bodies, Creutzfeldt Jakob Disease, Huntington's, Progressive Multifocal Leukoencephalopathy
36	Nonbacterial CNS infections exc viral meningitis	Viral encephalitis, fungal meningitis, acute disseminated encephalomyelitis, transverse myelitis, other encephalitis
19	Nervous system neoplasms	Primary brain tumor, brain metastases
59	Multiple sclerosis or cerebellar ataxia	Multiple sclerosis, neuromyelitis optica
34	Other diseases of the nervous system	Toxic encephalopathy, myoclonus, vascular myelopathy, intracranial hypotension, stiff person syndrome, paresthesia, aphasia
35	Bacterial Tb of the nervous system	Guillain-barre syndrome, intracranial abscess
43	Neurologic eye disease	Optic neuritis, III and VI nerve palsies
27	Cranial or peripheral nerve disorders	Chronic inflammatory demyelinating polyneuropathy, Zoster encephalitis, other polyneuritis, brachial or lumbosacral plexopathy, trigeminal neuralgia
38	Headache	Migraine, cluster
22	Acute stroke with thrombolytic	Ischemic stroke
23	ICH or stroke	Intracranial hemorrhage, ischemic stroke
25	TIA	Transient ischemic attack

Abbreviations: MS DRG, Medicare-Severity Diagnosis Related Group.

Table e-2: Epilepsy Base MS-DRGs

Base MS DRG	Base MS DRG	Representative Diagnoses
34	OTHER DIS NERV SYS	Encephalopathy, numbness, aphasia
37	SEIZURES	
108	CARD ARRHYTH CONDUCT DIS	Cardiac dysrhythmia
110	SYNCOPE COLLAPSE	
296	ACUTE ADJUST REACT PSYOSOC DYSFUNC	Conversion, delirium, anxiety
298	NEUROSES EXC DEPRESSIVE	Somatoform disorders, post-traumatic stress disorder
300	ORGANIC DISTURB MENT RETARD	Unspecified dementia
301	PSYCHOSES	Major depressive disorder, unspecified psychosis
303	OTHER MENT DIS DX	Other specified psychophysiological malfunction, recurrent hypersomnia
323	SIGNS SYMPTOMS	Disorientation, altered mental status unspecified

Abbreviations: MS DRG, Medicare-Severity Diagnosis Related Group.

Table e-3: Stroke Base MS-DRGs

Base MS DRG	Base MS DRG	Representative Diagnoses
10	INTRACRANIAL VASCULAR PROCS W PDX HEMORRHAGE	
15	CAROTID ARTERY STENT PROCS	Percutaneous carotid angioplasty
16	EXTRACRANIAL PROCS	Extirpation of matter from carotid, open approach
22	ACUTE ISCHEMIC STROKE W THROMBOLYTIC	
23	INTRACRANIAL HEMORRHAGE OR CEREBRAL INFARCTION	
24	NONSPECIFIC CVA OR PRECEREB OCCLUS	Carotid angioplasty
25	TIA	
31	TRAUMATIC COMA GREATER 1 HR	Traumatic subdural hematoma, Traumatic carotid or vertebral dissection
32	TRAUMATIC COMA LESS 1 HR	Traumatic subdural hematoma, Traumatic carotid or vertebral dissection
91	OTHER VASC PROCS	Extirpation of matter from femoral artery, Open Approach
104	PERIPH VASC DIS	Carotid dissection, vertebral dissection

Abbreviations: MSDRG, Medicare-Severity Diagnosis Related Group.

Figure e-1a-e: Difference-in-Difference Modeling – Check for Parallel Trend Assumption

Figure e-1a: Length of Stay. Trends by Year

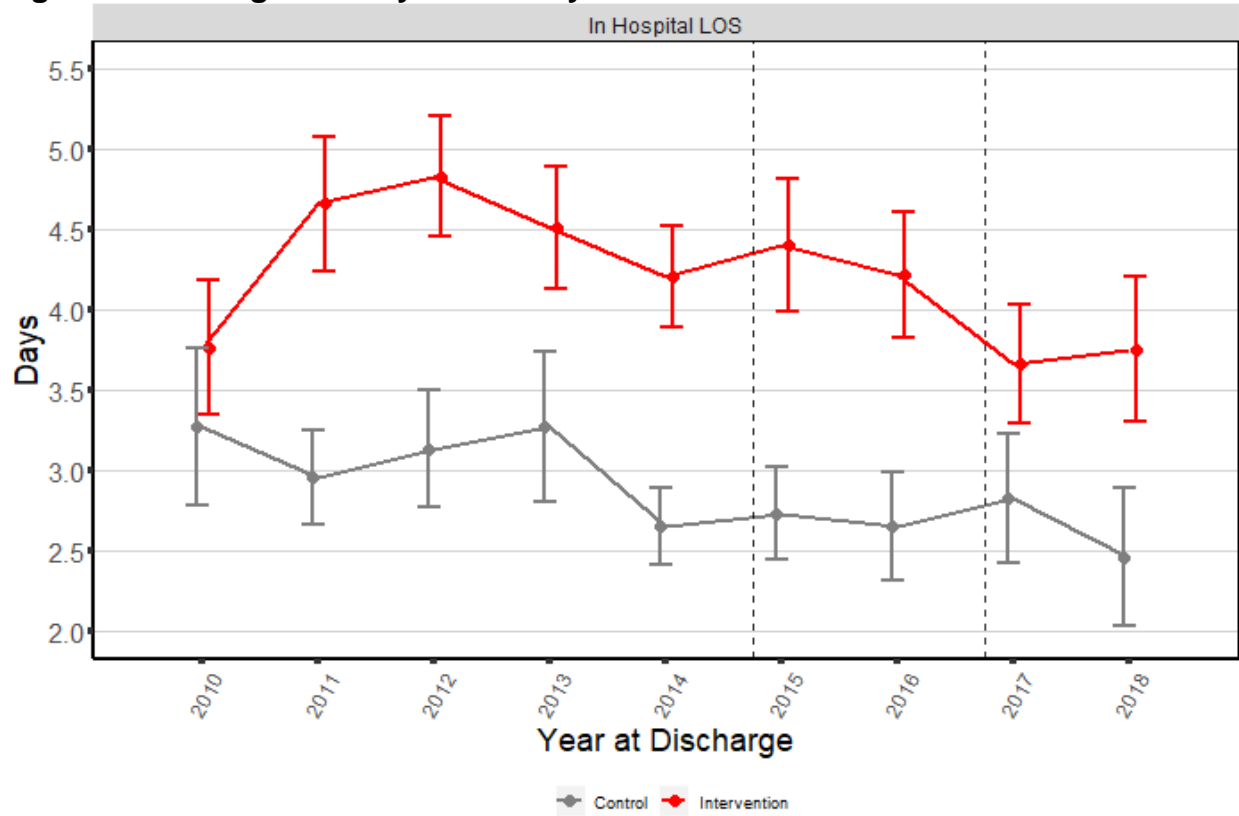


Figure e-1b: Adjusted 30 Day-Readmission Rate, Trends by Year

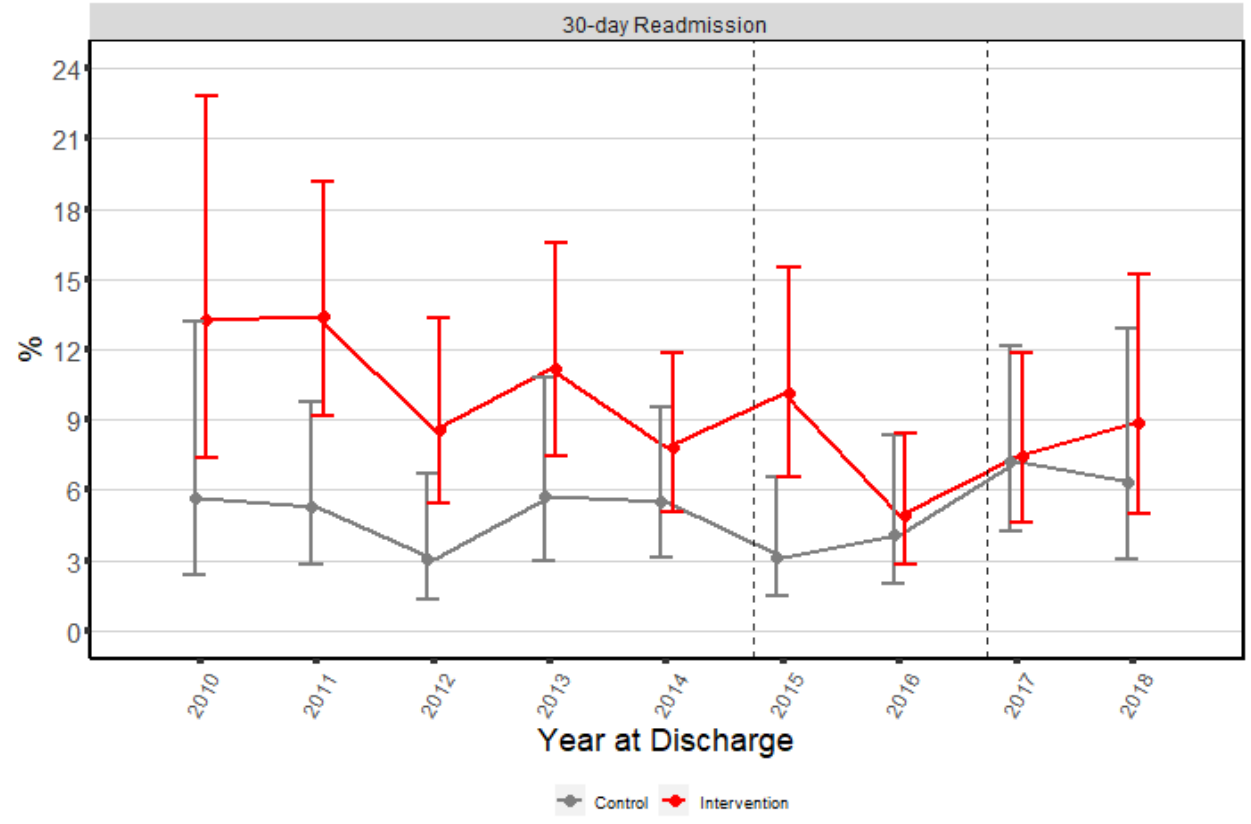


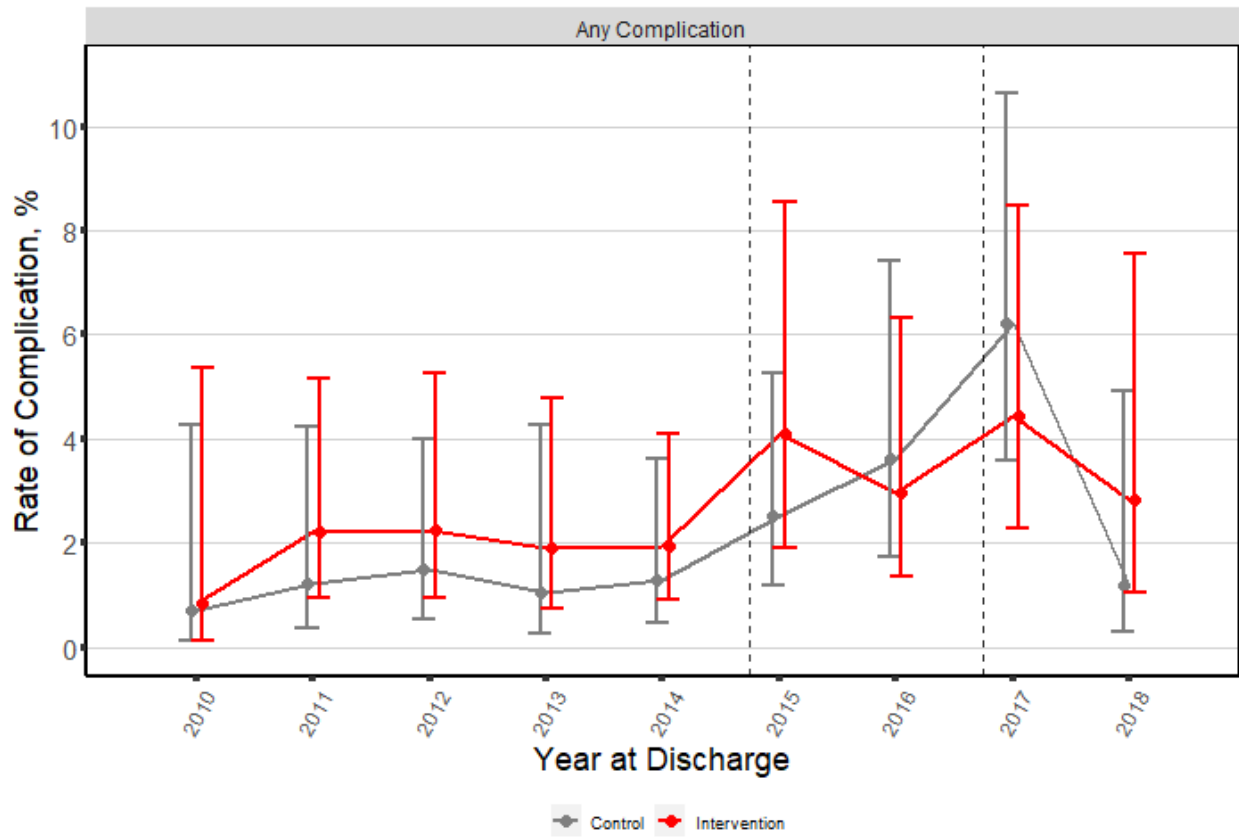
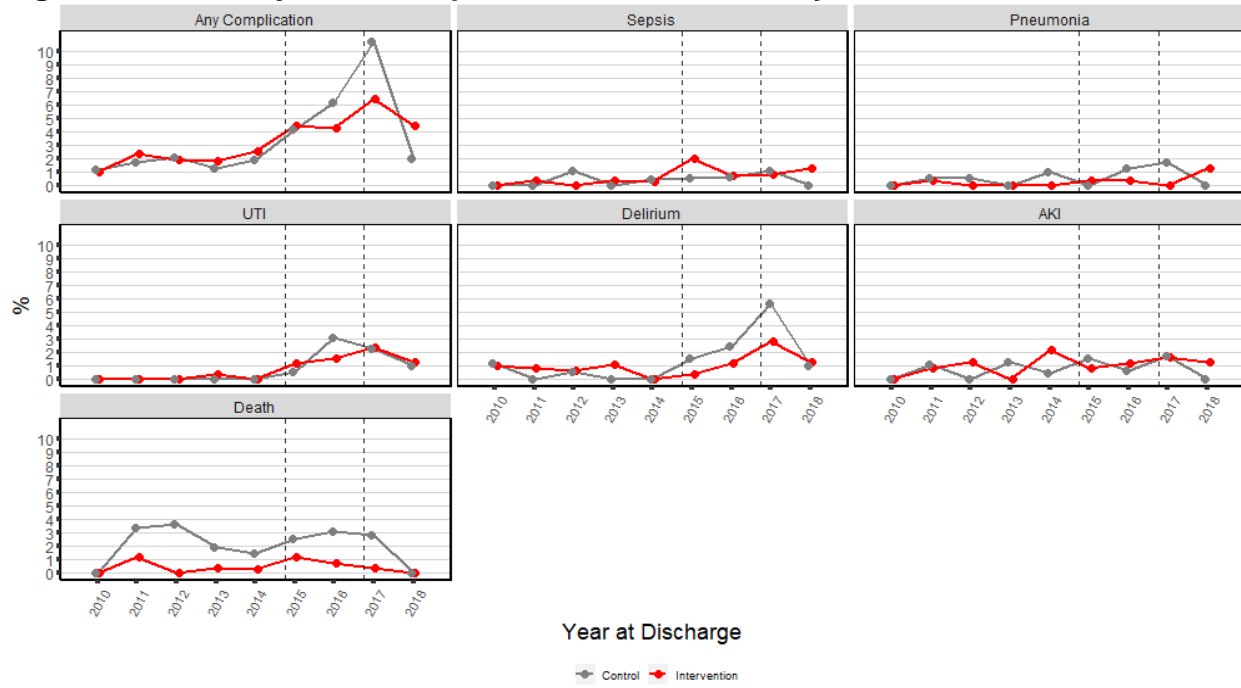
Figure e-1c: Adjusted In-hospital Complication Rate, Trends by Year

Figure e1-d: Unadjusted Complication Rate, Trends by Year



Abbreviations: UTI, urinary tract infection; AKI, acute kidney injury.

Figure e-1e: Consultant Utilization Rate, Trends by Year

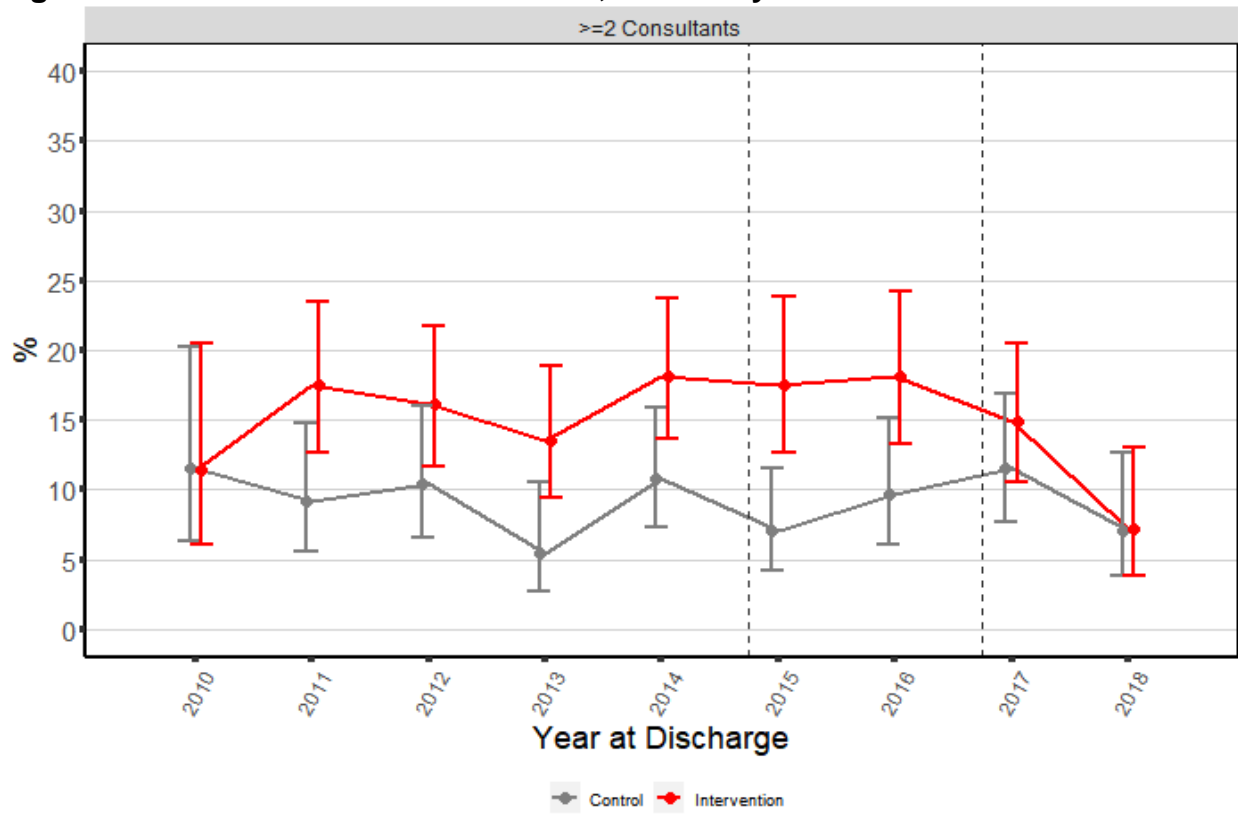


Table e-4: Secondary Clinical Outcomes

	Intervention (Neurohospitalist)			Control (Stroke)		P value
	Pre (n=1121)	Post (n=527)	P value	Pre (n=717)	Post (n=341)	
Clinical						
In-Hospital Death (%)	1 (0.1)	2 (0.4)	0.50	5 (0.7)	7 (2.1)	0.10
In-Hospital Complication (%)						
<i>POA not Yes</i>						
Any	21 (1.9)	24 (4.6)	0.003	11 (1.5)	25 (7.3)	<0.001
Sepsis	2 (0.2)	4 (0.8)	0.16	2 (0.3)	2 (0.6)	0.82
Pneumonia	1 (0.1)	2 (0.4)	0.50	3 (0.4)	3 (0.9)	0.62
UTI	1 (0.1)	9 (1.7)	<0.001	0 (0.0)	6 (1.8)	0.002
Delirium	8 (0.7)	9 (1.7)	0.11	2 (0.3)	13 (3.8)	<0.001
AKI	9 (0.8)	6 (1.1)	0.70	4 (0.6)	3 (0.9)	0.84
Thrombosis (DVT/PE)	0 (0.0)	1 (0.2)	0.70	0 (0.0)	1 (0.3)	0.70

Abbreviations: POA, present on admission; UTI, urinary tract infection; AKI, acute kidney injury; DVT, deep venous thrombosis; PE, pulmonary embolism; Rx/IV, medication and/or intravenous therapy.

Table e-5: Patient satisfaction in intervention and controls

	Intervention (Neurohospitalist)			Control (Stroke)		
	Pre	Post	SMD ^a	Pre	Post	SMD ^a
Number of patient encounters	1121	527		717	341	
Encounters with Patient Satisfaction Surveys n (%)	129 (11.5)	47 (8.9)		72 (10.0)	11 (3.2)	
<i>TopBox Answer, %</i>						
Likelihood of recommending this hospital to others	88 (70.4)	36 (80.0)	0.22	48 (68.6)	8 (72.7)	0.09
How often did doctors treat you with courtesy and respect	94 (79.7)	37 (78.7)	0.02	56 (86.2)	10 (90.9)	0.15
How often did doctors listen carefully to you?	91 (77.1)	35 (74.5)	0.06	50 (76.9)	9 (90.0)	0.36
How often did doctors explain things in a way you could understand?	91 (77.1)	37 (78.7)	0.04	45 (70.3)	8 (72.7)	0.05
Time physician spent with you	75 (60.0)	25 (62.5)	0.05	35 (51.5)	7 (63.6)	0.25
Physician's concern for your questions and worries	86 (69.4)	27 (67.5)	0.04	42 (61.8)	8 (72.7)	0.24
How well physician kept you informed	82 (66.7)	23 (59.0)	0.16	35 (50.7)	7 (63.6)	0.26
Friendliness/courtesy of physician	91 (72.8)	27 (67.5)	0.12	41 (59.4)	9 (81.8)	0.51
Skill of physician	93 (75.6)	28 (70.0)	0.13	51 (77.3)	9 (81.8)	0.11
Total # of Questions Above with Topbox Answers (median [IQR])	8.0 [3.0, 9.0]	8.0 [3.0, 9.0]	0.08	6.0 [3.0, 9.0]	8.0 [5.5, 9.0]	0.40
Percent of Topbox Answers (median [IQR])	80 [40, 90]	80 [45, 90]	0.01	70 [32, 90]	89 [55, 90]	0.32

Topbox answer means the patient rated this question 5/5 on a Likert scale where 1 = “very poor”, 2 = “poor”, 3 = “fair”, 4 = “good”, 5 = “very good”

^aCohen offered the following guidelines for interpreting the magnitude of the SMD:

small, SMD = 0.2; medium, SMD = 0.5; and large, SMD = 0.8.^{17,18}

Abbreviations: SMD, standardized mean difference; IQR, interquartile range

Table e-6: Sensitivity Analysis: 30 Day Readmissions Pre vs Post Including Inpatient and Observation Status Patients

	Intervention (Neurohospitalist)				Control				DID Analysis			
	Pre	Post	p value	SMD	Pre	Post	p value	SMD	Est.	95% CI		p value
<u>Primary Analysis, n</u>	1121	527			717	341						
30 Day Readmissions (%)	100 (8.9)	40 (7.6)	0.42		36 (5.0)	18 (4.7)	0.09		0.52	0.27	0.98	0.044
<u>Sensitivity Analysis^a, n</u>	940	669			427	295						
30 Day Readmissions (%)	92 (9.8)	63 (9.4)	0.87	0.013	36 (8.4)	22 (7.5)	0.74	0.036	1.34	0.55	3.31	0.52

^aIncluding observation and inpatient status patients with intervention group categorized by provider names

Abbreviations: DID, difference-in-difference; SMD, standardized mean difference

Table e-7: Sensitivity Analysis: Length of Stay Pre vs Post Including Inpatient and Observation Status Patients

LOS	Adjusted Mean LOS (Estimate, 95% CI) ^a	Raw LOS, Mean/SD	Raw LOS, Median/IQR
Intervention			
Pre NH	4.3 (4.2 - 4.5)	4.0 (4.3)	3.0 [1.0, 5.0]
Post NH	3.5 (3.3 - 3.7)	3.0 (3.6)	2.0 [0.0, 4.0]
<i>Post NH vs Pre NH (p value)</i>	<0.001	<0.001	<0.001
Control			
Pre NH	3.3 (3.07 - 3.45)	2.3 (3.1)	1.0 [1.0, 3.0]
Post NH	2.8 (2.47 - 3.12)	1.4 (3.0)	0.0 [0.0, 2.0]
<i>Post NH vs Pre NH (p value)</i>	0.056	<0.001	<0.001

^aAdjusted for age, gender, primary insurance type, CMI, Charlson Comorbidity index and discharge quarter

Abbreviations: LOS, length of stay; IQR, interquartile range; NH, neurohospitalist