

Supplementary Material*

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* This supplementary material was provided by the authors to give readers further details on their article. The material was reviewed but not copyedited.

Supplement Table 1. Diagnosis codes used to define comorbid pain, mental health and substance use disorder conditions

INTERNATIONAL CLASSIFICATION OF DISEASES, 9TH REVISION CODES FOR COMORBID CONDITIONS	
Musculoskeletal Pain Conditions	710.xx-739.xx
Depression	293.83,296.2,296.3,296.90,296.99,298.0,300.4,301.12,309.0,309.1,311
Other Mental Disorders	295.0, 295.1, 295.2, 295.3, 295.4, 295.6, 295.7, 295.8, 295.9 296.0,296.1,296.4,296.5,296.6,296.7, 296.8, 297.0, 297.1, 297.2, 297.3, 297.8, 297.9, 298.0, 298.1,298.2, 298.3, 298.4, 298.8, 298.9 290-290.9, 331-331.2
Alcohol Use Disorders	V113.x, V791.x, 291.0-291.9, 303.0-303.9
Drug Dependence (any substance) /Opioid-Related Narcotic Poisoning	Drug Dependence - 304.0-304.93 Poisoning by opiates and related narcotics - 965.00, 965.01, 965.02 and 965.09 Accidental poisoning by opiates and related narcotics - E850.0-E850.2

Notes: International Classification of Diseases, 9th revision Diagnosis codes were extracted from the inpatient electronic health record to create these comorbidities.

Supplement Table 2. Full regression results including all covariates (outcome = opioid use at 90 days post-discharge) corresponding to main effects shown in Table 2.

	Outcome 1: Outpatient use in 90-Day			Outcome 2: 90-Day Mortality			Outcome 3: 90-Day Readmission		
	Relative Risk Ratio	95% CI	P-Value	Relative Risk Ratio	95% CI	P-Value	Relative Risk Ratio	95% CI	P-Value
Hospital Opioids	2.07	1.97, 2.18	<0.001	1.33	1.18, 1.50	<0.001	1.01	0.98, 1.03	0.68
Hospital									
1	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
2	1.43	1.31, 1.57	<0.001	1.90	1.40, 2.57	<0.001	1.45	1.39, 1.51	<0.001
3	1.21	1.09, 1.34	<0.001	1.86	1.36, 2.54	<0.001	1.51	1.43, 1.58	<0.001
4	1.26	1.13, 1.39	<0.001	1.64	1.18, 2.27	0.003	1.35	1.28, 1.42	<0.001
5	1.91	1.73, 2.12	<0.001	1.22	1.62, 3.03	<0.001	1.29	1.23, 1.37	<0.001
6	1.29	1.15, 1.45	<0.001	1.69	1.23, 2.32	0.001	1.45	1.38, 1.54	<0.001
7	1.97	1.76, 2.21	<0.001	1.87	1.30, 2.70	0.001	1.69	1.59, 1.80	<0.001
8	1.10	0.92, 1.33	0.30	2.31	1.64, 3.27	<0.001	1.43	1.33, 1.53	<0.001
9	1.53	1.32, 1.78	<0.001	2.80	1.95, 4.01	<0.001	1.52	1.42, 1.64	<0.001
10	1.57	1.33, 1.86	<0.001	1.73	1.15, 2.61	0.008	1.64	1.52, 1.78	<0.001
11	1.64	1.41, 1.92	<0.001	1.71	1.15, 2.54	0.008	1.64	1.51, 1.79	<0.001
12	1.46	1.09, 1.96	0.012	2.55	1.57, 4.15	<0.001	1.74	1.54, 1.97	<0.001
Age									
18-24	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
25-34	1.18	1.03, 1.34	0.015	1.14	0.34, 3.72	0.83	0.76	0.72, 0.80	<0.001
35-44	1.67	1.46, 1.92	<0.001	3.44	1.18, 10.00	0.024	0.87	0.82, 0.92	<0.001
45-54	2.00	1.74, 2.29	<0.001	6.36	2.29, 17.61	<0.001	0.91	0.86, 0.96	0.001
55-64	1.82	1.58, 2.08	<0.001	8.85	3.22, 24.28	<0.001	0.91	0.86, 0.97	0.002

64-74	1.71	1.48, 1.98	<0.001	15.20	5.52, 41.90	<0.001	0.88	0.83, 0.94	<0.001
75+	1.38	1.19, 1.61	<0.001	43.67	15.91, 120.	<0.001	1.05	0.99, 1.12	0.108
Sex (ref = female)	0.96	0.90, 1.01	0.119	1.19	1.08, 1.31	0.001	1.16	1.13, 1.19	<0.001
Race									
White	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Black	0.90	0.81, 0.99	0.028	1.03	0.86, 1.24	0.76	1.41	1.36, 1.47	<0.001
Other	0.81	0.69, 0.95	0.009	0.67	0.43, 1.03	0.067	1.02	0.95, 1.10	0.51
Year of Admission									
2010	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
2011	1.11	1.02, 1.21	0.014	1.90	1.48, 2.44	<0.001	0.95	0.91, 0.99	0.010
2012	1.16	1.07, 1.26	0.001	2.80	2.21, 3.56	<0.001	1.02	0.98, 1.06	0.38
2013	1.21	1.11, 1.31	<0.001	2.85	2.26, 3.60	<0.001	0.91	0.87, 0.94	<0.001
2014	1.53	1.42, 1.66	<0.001	3.38	2.68, 4.27	<0.001	0.83	0.79, 0.86	<0.001
Source of payment for stay									
Commercial	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Medicare	0.92	0.85, 0.99	0.026	1.27	1.11, 1.45	0.001	1.22	1.17, 1.26	<0.001
Medicaid	1.05	0.96, 1.15	0.25	1.48	1.11, 1.99	0.008	1.49	1.43, 1.55	<0.001
Other	0.97	0.88, 1.07	0.57	1.12	0.79, 1.58	0.52	1.09	1.04, 1.15	0.001
Elixhauser Comorbidity Index	0.96	0.93, 1.00	0.057	1.58	1.51, 1.66	<0.001	1.17	1.15, 1.19	<0.001
Hospitalization Type									
Medical admission only	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Medical w/ ICU	1.01	0.92, 1.12	0.80	1.41	1.23, 1.52	<0.001	0.95	0.91, 1.00	0.033
Surgical admission only	1.31	1.24, 1.38	<0.001	0.55	0.47, 0.64	<0.001	0.92	0.89, 0.95	<0.001
Surgical w/ ICU	1.36	1.23, 1.49	<0.001	0.74	0.62, 0.88	0.001	0.97	0.92, 1.02	0.21
Length of Stay									
1-4 days	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
5-7 days	1.12	1.06, 1.18	<0.001	1.58	1.39, 1.80	<0.001	1.39	1.35, 1.43	<0.001

8+ days	0.91	0.84, 0.99	0.020	2.91	2.53, 3.35	<0.001	1.76	1.70, 1.83	<0.001
HCUP CCS									
Cardiovascular Conditions	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Respiratory Conditions	1.22	1.08, 1.39	0.001	1.68	1.42, 1.98	<0.001	1.15	1.09, 1.21	<0.001
Gastrointestinal Conditions	1.01	0.91, 1.11	0.87	1.04	0.84, 1.27	0.74	1.15	1.10, 1.20	<0.001
Oncologic Conditions	1.35	1.23, 1.48	<0.001	2.96	2.51, 3.48	<0.001	1.23	1.18, 1.29	<0.001
Genitourinary/Maternal Health Conditions	1.02	0.92, 1.13	0.69	1.33	1.07, 1.66	0.011	0.99	0.94, 1.04	0.68
Neurological and Mental Health Conditions	0.95	0.83, 1.09	0.47	1.36	1.06, 1.74	0.015	0.97	0.91, 1.03	0.26
Musculoskeletal, Trauma, and Orthopedic	1.32	1.22, 1.43	<0.001	0.77	0.63, 0.93	0.006	0.80	0.77, 0.83	<0.001
Endocrine & Hematologic Conditions	0.72	0.63, 0.82	<0.001	1.35	1.04, 1.75	0.023	1.08	1.03, 1.14	<0.001
Other	1.09	0.99, 1.20	0.089	1.37	1.13, 1.65	0.001	0.98	0.94, 1.03	0.40
Comorbidities									
Musculoskeletal Pain	1.55	1.47, 1.63	<0.001	1.01	0.91, 1.12	0.83	0.99	0.97, 1.02	0.68
Depression	1.16	1.07, 1.25	<0.001	0.87	0.76, 0.99	0.040	1.00	0.97, 1.04	0.86
Other Mental Disorders	0.72	0.57, 0.89	0.003	2.80	2.43, 3.24	<0.001	1.26	1.18, 1.35	<0.001
Alcohol Use Disorder	0.92	0.69, 1.21	0.54	0.74	0.46, 1.20	0.22	0.92	0.82, 1.02	0.115
Drug Dependence	1.78	1.38, 2.29	<0.001	0.51	0.16, 1.65	0.26	1.28	1.14, 1.43	<0.001
Opioid Poisoning (incl. accidental)	0.68	0.25, 1.85	0.45	4.52	1.24, 16.55	0.023	0.88	0.57, 1.36	0.56
History of Benzodiazepine Use	1.07	1.00, 1.15	0.045	1.88	1.69, 2.10	<0.001	1.29	1.25, 1.33	<0.001

Includes 182,917 cases with complete data from 191,249 inpatient stays of previously opioid-naive patients.

Relative risk ratios estimated against a reference group with no outpatient opioid use, no death, and no readmission within 90 days of discharge.

Supplement Table 3. Full regression results including all covariates (outcome = opioid use at 365 days post-discharge) corresponding to main effects shown in Table 2.

	Outcome 1: Outpatient use in 365-Day			Outcome 2: 365-Day Mortality			Outcome 3: 365-Day Readmission		
	Relative Risk Ratio	95% CI	P-Value	Relative Risk Ratio	95% CI	P-Value	Relative Risk Ratio	95% CI	P-Value
Hospital Opioids	1.84	1.76, 1.92	<0.001	0.98	0.90, 1.07	0.67	0.99	0.97, 1.02	0.500
Hospital									
1	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
2	1.40	1.29, 1.51	<0.001	1.98	1.63, 2.41	<0.001	1.45	1.39, 1.51	<0.001
3	1.30	1.20, 1.42	<0.001	1.76	1.44, 2.15	<0.001	1.69	1.62, 1.76	<0.001
4	1.33	1.22, 1.45	<0.001	1.74	1.41, 2.15	<0.001	1.49	1.42, 1.55	<0.001
5	2.00	1.83, 2.18	<0.001	1.86	1.52, 2.28	<0.001	1.50	1.43, 1.57	<0.001
6	1.52	1.38, 1.68	<0.001	1.60	1.30, 1.98	<0.001	1.73	1.64, 1.81	<0.001
7	2.20	2.00, 2.44	<0.001	1.93	1.52, 2.46	<0.001	2.25	2.12, 2.38	<0.001
8	1.35	1.16, 1.58	<0.001	2.38	1.89, 3.01	<0.001	1.81	1.69, 1.94	<0.001
9	1.83	1.61, 2.07	<0.001	2.58	2.02, 3.30	<0.001	1.91	1.79, 2.03	<0.001
10	1.69	1.46, 1.95	<0.001	2.03	1.55, 2.66	<0.001	2.09	1.94, 2.25	<0.001
11	1.79	1.56, 2.06	<0.001	1.86	1.42, 2.42	<0.001	1.94	1.79, 2.10	<0.001
12	1.74	1.36, 2.23	<0.001	2.60	1.83, 3.68	<0.001	2.45	2.18, 2.74	<0.001
Age									
18-24	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
25-34	1.17	1.05, 1.32	0.007	0.72	0.39, 1.35	0.31	0.66	0.63, 0.69	<0.001
35-44	1.69	1.50, 1.91	<0.001	1.88	1.08, 3.30	0.027	0.72	0.68, 0.76	<0.001
45-54	2.13	1.88, 2.40	<0.001	4.09	2.43, 6.89	<0.001	0.81	0.76, 0.85	<0.001
55-64	1.99	1.76, 2.24	<0.001	5.52	3.30, 9.23	<0.001	0.80	0.76, 0.85	<0.001
64-74	1.89	1.66, 2.15	<0.001	8.67	5.16, 14.59	<0.001	0.80	0.75, 0.84	<0.001

75+	1.59	1.39, 1.82	<0.001	22.87	13.6, 38.4	<0.001	1.01	0.96, 1.07	0.65
Sex (ref = female)	0.97	0.93, 1.02	0.24	1.32	1.23, 1.41	<0.001	1.19	1.15, 1.21	<0.001
Race									
White	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Black	1.04	0.96, 1.13	0.38	1.17	1.02, 1.34	0.021	1.80	1.74, 1.87	<0.001
Other	0.80	0.70, 0.92	0.001	0.78	0.60, 1.02	0.066	0.93	0.87, 1.00	0.039
Year of Admission									
2010	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
2011	1.01	0.94, 1.09	0.76	1.26	1.08, 1.48	0.004	0.96	0.92, 0.99	0.018
2012	1.01	0.94, 1.09	0.77	1.70	1.47, 1.97	<0.001	0.98	0.94, 1.02	0.261
2013	1.01	0.94, 1.08	0.86	1.64	1.42, 1.90	<0.001	0.85	0.82, 0.88	<0.001
2014	1.26	1.18, 1.35	<0.001	2.09	1.82, 2.41	<0.001	0.48	0.46, 0.50	<0.001
Source of payment for stay									
Commercial	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Medicare	0.92	0.86, 0.98	0.009	1.42	1.29, 1.56	<0.001	1.28	1.24, 1.32	<0.001
Medicaid	1.15	1.06, 1.24	0.001	1.58	1.29, 1.92	<0.001	1.71	1.65, 1.77	<0.001
Other	0.91	0.83, 1.00	0.045	1.33	1.08, 1.65	0.008	1.08	1.03, 1.13	0.002
Elixhauser Comorbidity Index	0.98	0.95, 1.02	0.28	1.56	1.51, 1.62	<0.001	1.21	1.19, 1.23	<0.001
Hospitalization Type									
Medical admission only	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Medical w/ ICU	0.95	0.87, 1.04	0.27	1.30	1.18, 1.45	<0.001	0.90	0.87, 0.94	<0.001
Surgical admission only	1.23	1.17, 1.29	<0.001	0.63	0.57, 0.70	<0.001	0.86	0.84, 0.89	<0.001
Surgical w/ ICU	1.13	1.04, 1.24	0.007	0.82	0.72, 0.93	0.002	0.84	0.80, 0.88	<0.001
Length of Stay									
1-4 days	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
5-7 days	1.13	1.08, 1.19	<0.001	1.70	1.56, 1.86	<0.001	1.37	1.33, 1.40	<0.001
8+ days	0.99	0.92, 1.07	0.77	2.97	2.68, 3.28	<0.001	1.69	1.63, 1.75	<0.001
HCUP CCS									

Cardiovascular Conditions	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Respiratory Conditions	1.23	1.10, 1.37	<0.001	1.78	1.57, 2.01	<0.001	1.39	1.32, 1.46	<0.001
Gastrointestinal Conditions	0.99	0.91, 1.08	0.81	1.01	0.87, 1.16	0.94	1.18	1.13, 1.23	<0.001
Oncologic Conditions	1.11	1.03, 1.20	0.010	2.97	2.66, 3.31	<0.001	1.04	1.00, 1.09	0.038
Genitourinary/Maternal Health Conditions	0.91	0.84, 1.00	0.048	1.24	1.07, 1.45	0.005	0.92	0.88, 0.96	<0.001
Neurological and Mental Health Conditions	1.06	0.94, 1.20	0.31	1.23	1.02, 1.47	0.027	1.06	1.00, 1.11	0.052
Musculoskeletal, Trauma, and Orthopedic	1.22	1.14, 1.30	<0.001	0.81	0.71, 0.92	<.01	0.77	0.74, 0.80	<0.001
Endocrine & Hematologic Conditions	0.78	0.70, 0.87	<0.001	1.14	0.94, 1.37	0.179	1.02	0.97, 1.07	0.40
Other	1.02	0.93, 1.11	0.68	1.20	1.05, 1.38	0.009	1.00	0.96, 1.04	0.91
Comorbidities									
Musculoskeletal Pain	1.54	1.47, 1.61	<0.001	1.03	0.95, 1.10	0.51	1.05	1.02, 1.07	0.001
Depression	1.27	1.19, 1.36	<0.001	0.95	0.86, 1.05	0.31	1.05	1.01, 1.09	0.009
Other Mental Disorders	0.67	0.55, 0.82	<0.001	2.83	2.51, 3.19	<0.001	1.42	1.33, 1.53	<0.001
Alcohol Use Disorder	0.87	0.68, 1.11	0.26	1.03	0.74, 1.42	0.86	1.06	0.95, 1.19	0.31
Drug Dependence	1.61	1.26, 2.05	<0.001	0.75	0.38, 1.49	0.41	1.49	1.33, 1.67	<0.001
Opioid Poisoning (incl. accidental)	1.37	0.69, 2.74	0.37	3.38	1.16, 9.91	0.026	0.92	0.60, 1.41	0.70
History of Benzodiazepine Use	1.17	1.11, 1.25	<0.001	1.70	1.56, 1.84	<0.001	1.34	1.30, 1.38	<0.001

Includes 182,917 cases with complete data from 191,249 inpatient stays of previously opioid-naive patients.

Relative risk ratios estimated against a reference group with no outpatient opioid use, no death, and no readmission within 365 days of discharge.

Supplement Table 4. Relative risk ratios from full multinomial model for outpatient reported opioid use at 90 days after discharge, among patients receiving inpatient opioids who were previously opioid naïve

Model - Multinomial Regression, Robust SE Clustered by Patient	Outcome 1: Outpatient use in 90- Day			Outcome 2: 90-Day Mortality			Outcome 3: 90-Day Readmission		
	Relative Risk Ratio	95% CI	P-Value	Relative Risk Ratio	95% CI	P-Value	Relative Risk Ratio	95% CI	P-Value
Covariates of Interest									
Proportion of stay with opiates (days of opiates / length of stay)									
1-25%	ref	ref	ref	ref	ref	ref	ref	ref	ref
26-50%	1.02	0.90, 1.16	0.730	0.67	0.54, 0.84	<0.001	0.92	0.87, 0.98	0.010
51-75%	1.21	1.07, 1.38	0.003	0.5	0.38, 0.65	<0.001	0.94	0.88, 1.00	0.049
76-100%	1.25	1.09, 1.43	0.002	0.44	0.34, 0.59	<0.001	1.13	1.05, 1.21	<0.001
Length of time between last opiate & discharge									
>24 Hours	ref	ref	ref	ref	ref	ref	ref	ref	ref
13-24 Hours	1.43	1.28, 1.60	<0.001	1.90	1.46, 2.49	<0.001	1.06	1.00, 1.12	0.060
0-12 Hours	2.02	1.83, 2.23	<0.001	4.22	3.34, 5.35	<0.001	1.03	0.98, 1.08	0.310
Location of First Opiate									
Stepdown/Ward	ref	ref	ref	ref	ref	ref	ref	ref	ref
ED	1.05	0.96, 1.15	0.280	1.09	0.88, 1.35	0.440	1.18	1.12, 1.24	<0.001
ICU	1.04	0.90, 1.19	0.630	0.58	0.46, 0.74	<0.001	0.9	0.83, 0.98	0.011
PACU/Procedure Unit	0.94	0.87, 1.01	0.084	0.14	0.09, 0.24	<0.001	0.72	0.69, 0.76	<0.001
Inpatient Use of Non-Opioid Painkiller	1.07	1.01, 1.15	0.034	0.92	0.79, 1.07	0.300	1.03	0.99, 1.07	0.147
Additional Covariates Included in Model									
Hospital									
1	ref	ref	ref	ref	ref	ref	ref	ref	ref

2	1.48	1.33, 1.65	<0.001	1.97	1.30, 3.01	0.002	1.46	1.37, 1.55	<0.001
3	1.15	1.02, 1.30	0.024	2.47	1.60, 3.81	<0.001	1.42	1.32, 1.52	<0.001
4	1.25	1.10, 1.40	<0.001	1.77	1.12, 2.80	0.014	1.31	1.22, 1.41	<0.001
5	1.89	1.67, 2.13	<0.001	2.72	1.74, 4.25	<0.001	1.28	1.18, 1.38	<0.001
6	1.12	0.97, 1.29	0.126	1.68	1.08, 2.63	0.023	1.29	1.19, 1.40	<0.001
7	2.01	1.76, 2.30	<0.001	2.00	1.17, 3.43	0.011	1.76	1.60, 1.93	<0.001
8	1.17	0.91, 1.50	0.23	2.90	1.76, 4.80	<0.001	1.28	1.13, 1.45	<0.001
9	1.55	1.30, 1.85	<0.001	3.61	2.16, 6.03	<0.001	1.36	1.21, 1.52	<0.001
10	1.55	1.25, 1.92	<0.001	2.69	1.52, 4.77	0.001	1.38	1.21, 1.57	<0.001
11	1.79	1.48, 2.17	<0.001	2.90	1.68, 5.01	<0.001	1.67	1.46, 1.91	<0.001
12	1.27	0.86, 1.87	0.24	3.90	1.89, 8.05	<0.001	1.82	1.48, 2.23	<0.001
Length of Stay									
1-4 days	ref	ref	ref	ref	ref	ref	ref	ref	ref
5-7 days	1.23	1.14, 1.33	<0.001	1.54	1.23, 1.92	<0.001	1.26	1.20, 1.32	<0.001
8+ days	1.14	1.03, 1.27	0.012	2.83	2.24, 3.57	<0.001	1.75	1.65, 1.86	<0.001
Age									
18-24	ref	ref	ref	ref	ref	ref	ref	ref	ref
25-34	1.15	1.00, 1.33	0.055	0.96	0.17, 5.26	0.96	0.79	0.73, 0.85	<0.001
35-44	1.49	1.27, 1.74	<0.001	3.55	0.80, 15.75	0.095	0.90	0.83, 0.97	0.009
45-54	1.83	1.57, 2.15	<0.001	5.54	1.32, 23.33	0.019	0.91	0.84, 0.99	0.033
55-64	1.69	1.45, 1.98	<0.001	7.40	1.78, 30.82	0.006	0.89	0.82, 0.97	0.006
64-74	1.65	1.40, 1.96	<0.001	14.42	3.44, 60.51	<0.001	0.84	0.77, 0.93	<0.001
75+	1.35	1.13, 1.61	0.001	44.94	10.74, 188.	<0.001	0.92	0.84, 1.01	0.097
Sex (ref = female)	0.93	0.87, 1.00	0.041	1.18	1.02, 1.36	0.029	1.12	1.08, 1.17	<0.001
Race									

White	ref	ref	ref	ref	ref	ref	ref	ref	ref
Black	0.85	0.75, 0.95	0.004	1.04	0.79, 1.38	0.77	1.40	1.32, 1.47	<0.001
Other	0.82	0.68, 0.98	0.032	0.49	0.25, 1.00	0.049	1.04	0.93, 1.15	0.49
Year of Admission									
2010	ref	ref	ref	ref	ref	ref	ref	ref	ref
2011	1.09	0.98, 1.22	0.103	1.90	1.31, 2.74	0.001	0.94	0.88, 1.00	0.048
2012	1.19	1.07, 1.32	0.001	2.73	1.92, 3.86	<0.001	1.05	0.99, 1.11	0.132
2013	1.28	1.15, 1.41	<0.001	2.84	2.01, 4.00	<0.001	0.89	0.84, 0.95	<0.001
2014	1.69	1.53, 1.86	<0.001	3.35	2.38, 4.72	<.01	0.84	0.79, 0.90	<0.001
Source of payment for stay									
Commercial	ref	ref	ref	ref	ref	ref	ref	ref	ref
Medicare	0.91	0.83, 0.99	0.024	1.15	0.95, 1.39	0.164	1.19	1.13, 1.26	<0.001
Medicaid	1.03	0.93, 1.14	0.57	1.49	1.00, 2.21	0.048	1.49	1.41, 1.57	<0.001
Other	0.97	0.86, 1.10	0.66	1.11	0.68, 1.80	0.69	1.10	1.02, 1.19	0.016
Elixhauser Comorbidity Index	0.94	0.89, 0.98	0.006	1.61	1.50, 1.72	<0.001	1.15	1.12, 1.18	<0.001
Hospitalization Type									
Medical admission only	ref	ref	ref	ref	ref	ref	ref	ref	ref
Medical w/ ICU	1.00	0.86, 1.17	0.99	2.16	1.70, 2.74	<0.001	1.02	0.94, 1.11	0.59
Surgical admission only	1.25	1.16, 1.34	<0.001	0.64	0.51, 0.80	<0.001	1.07	1.02, 1.11	0.005
Surgical w/ ICU	1.22	1.07, 1.40	0.004	1.10	0.85, 1.42	0.49	1.11	1.03, 1.20	0.008
HCUP CCS									
Cardiovascular Conditions	ref	ref	ref	ref	ref	ref	ref	ref	ref
Respiratory Conditions	1.24	1.03, 1.48	0.022	2.07	1.59, 2.71	<0.001	1.21	1.10, 1.33	<0.001
Gastrointestinal Conditions	0.97	0.86, 1.11	0.69	1.02	0.76, 1.37	0.89	1.09	1.02, 1.17	0.015
Oncologic Conditions	1.17	1.04, 1.32	0.009	2.83	2.24, 3.57	<0.001	1.28	1.20, 1.37	<0.001
Genitourinary/Maternal Health Conditions	0.95	0.82, 1.09	0.42	1.18	0.80, 1.75	0.40	0.97	0.90, 1.05	0.51
Neurological and Mental Health Conditions	1.11	0.90, 1.38	0.32	1.97	1.25, 3.10	0.004	1.09	0.96, 1.23	0.168

Musculoskeletal, Trauma, and Orthopedic	1.15	1.03, 1.27	0.010	0.70	0.54, 0.92	0.010	0.81	0.76, 0.86	<0.001
Endocrine & Hematologic Conditions	0.57	0.48, 0.69	<0.001	1.61	1.04, 2.50	0.033	1.23	1.12, 1.34	<0.001
Other	1.00	0.88, 1.14	0.96	1.27	0.94, 1.71	0.122	0.97	0.90, 1.05	0.47
Comorbidities									
Musculoskeletal Pain	1.42	1.32, 1.51	<0.001	0.96	0.82, 1.12	0.61	1.02	0.98, 1.06	0.35
Depression	1.19	1.08, 1.31	<0.001	0.91	0.75, 1.11	0.34	1.02	0.97, 1.08	0.44
Other Mental Disorders	0.87	0.64, 1.18	0.37	3.15	2.45, 4.07	<0.001	1.46	1.28, 1.67	<0.001
Alcohol Use Disorder	1.19	0.84, 1.67	0.32	0.58	0.29, 1.17	0.128	0.85	0.70, 1.04	0.107
Drug Dependence	1.49	1.04, 2.14	0.31	0.86	0.19, 3.93	0.85	1.40	1.14, 1.73	0.002
Opioid Poisoning (incl. accidental)	1.01	0.30, 3.43	0.98	4.70	0.68, 32.24	0.115	1.09	0.54, 2.22	0.80
History of Benzodiazepine Use	1.10	1.02, 1.20	0.019	2.19	1.88, 2.55	<0.001	1.30	1.25, 1.37	<0.001

Includes 87,517 cases with complete date among 92,433 stays with inpatient opioid use with a discharge (i.e., no in-hospital death).

Relative risk ratios estimated against a reference group with no outpatient opioid use, no death, and no readmission within 90 days of discharge.

Supplement Table 5. Relative risk ratios from full multinomial for outpatient reported opioid use at 365 days after discharge, among patients receiving inpatient opioids who were previously opioid naïve

Model - Multinomial Regression, Robust SE Clustered by Patient	Outcome 1: Outpatient use in 365-Day			Outcome 2: 365-Day Mortality			Outcome 3: 365-Day Readmission		
	Relative Risk Ratio	95% CI	P-Value	Relative Risk Ratio	95% CI	P-Value	Relative Risk Ratio	95% CI	P-Value
Covariates of Interest									
Proportion of stay with opiates (days of opiates / length of stay)									
1-25%	ref	ref	ref	ref	ref	ref	ref	ref	ref
26-50%	1.08	0.96, 1.21	0.187	0.73	0.62, 0.86	<0.001	0.91	0.86, 0.96	0.001
51-75%	1.27	1.12, 1.43	<0.001	0.64	0.53, 0.77	<0.001	0.94	0.89, 1.00	0.049
76-100%	1.35	1.19, 1.54	<0.001	0.65	0.52, 0.80	<0.001	1.14	1.07, 1.22	<0.001
Length of time between last opiate & discharge									
>24 Hours	ref	ref	ref	ref	ref	ref	ref	ref	ref
13-24 Hours	1.31	1.18, 1.45	<0.001	1.49	1.24, 1.79	<0.001	1.01	0.96, 1.07	0.670
0-12 Hours	1.80	1.65, 1.97	<0.001	2.00	1.69, 2.38	<0.001	0.94	0.90, 0.99	0.019
Location of First Opiate									
Stepdown/Ward	ref	ref	ref	ref	ref	ref	ref	ref	ref
ED	1.13	1.04, 1.22	0.004	1.24	1.06, 1.46	0.007	1.27	1.21, 1.33	<0.001
ICU	0.96	0.84, 1.10	0.540	0.65	0.54, 0.78	<0.001	0.8	0.74, 0.87	<0.001
PACU/Procedure Unit	0.91	0.85, 0.98	0.009	0.37	0.30, 0.47	<0.001	0.74	0.71, 0.77	<0.001
Inpatient Use of Non-Opioid Painkiller	1.04	0.98, 1.11	0.168	0.88	0.79, 0.99	0.029	1	0.96, 1.03	0.880
Additional Covariates Included in Model									
Hospital									
1	ref	ref	ref	ref	ref	ref	ref	ref	ref

2	1.45	1.32, 1.60	<0.001	2.15	1.63, 2.84	<0.001	1.45	1.37, 1.54	<0.001
3	1.25	1.12, 1.40	<0.001	2.39	1.78, 3.19	<0.001	1.60	1.50, 1.70	<0.001
4	1.32	1.18, 1.47	<0.001	1.81	1.33, 2.48	<0.001	1.42	1.34, 1.51	<0.001
5	1.89	1.70, 2.11	<0.001	2.23	1.64, 3.02	<0.001	1.49	1.39, 1.60	<0.001
6	1.31	1.16, 1.48	<0.001	1.49	1.10, 2.03	0.011	1.53	1.43, 1.64	<0.001
7	2.26	1.99, 2.56	<0.001	2.01	1.38, 2.94	<0.001	2.30	2.12, 2.50	<0.001
8	1.44	1.15, 1.78	0.001	2.79	1.94, 4.01	<0.001	1.59	1.42, 1.79	<0.001
9	1.85	1.58, 2.18	<0.001	3.51	2.45, 5.03	<0.001	1.89	1.71, 2.08	<0.001
10	1.64	1.34, 2.00	<0.001	2.72	1.81, 4.10	<0.001	1.73	1.54, 1.94	<0.001
11	1.97	1.65, 2.35	<0.001	2.01	1.31, 3.07	0.001	1.96	1.73, 2.22	<0.001
12	1.46	1.01, 2.10	0.042	3.43	1.92, 6.11	<0.001	2.37	1.97, 2.85	<0.001
Length of Stay									
1-4 days	ref	ref	ref	ref	ref	ref	ref	ref	ref
5-7 days	1.20	1.12, 1.29	<0.001	1.42	1.21, 1.66	<0.001	1.19	1.14, 1.24	<0.001
8+ days	1.20	1.08, 1.32	<0.001	2.79	2.35, 3.31	<0.001	1.65	1.56, 1.74	<0.001
Age									
18-24	ref	ref	ref	ref	ref	ref	ref	ref	ref
25-34	1.16	1.02, 1.33	0.028	0.84	0.32, 2.24	0.73	0.66	0.62, 0.70	<0.001
35-44	1.55	1.34, 1.80	<0.001	2.25	0.93, 5.43	0.072	0.69	0.65, 0.74	<0.001
45-54	1.98	1.71, 2.29	<0.001	4.99	2.16, 11.50	<0.001	0.75	0.69, 0.80	<0.001
55-64	1.83	1.58, 2.11	<0.001	6.27	2.73, 14.38	<0.001	0.73	0.68, 0.78	<0.001
64-74	1.86	1.59, 2.18	<0.001	9.40	4.06, 21.75	<0.001	0.71	0.65, 0.77	<0.001
75+	1.54	1.30, 1.82	<0.001	24.80	10.76, 57.4	<0.001	0.78	0.72, 0.85	<0.001
Sex (ref = female)	0.94	0.89, 1.00	0.067	1.27	1.14, 1.42	<0.001	1.13	1.09, 1.18	<0.001
Race									
White	ref	ref	ref	ref	ref	ref	ref	ref	ref

Black	1.02	0.92, 1.14	0.64	1.22	0.99, 1.50	0.060	1.79	1.70, 1.88	<0.001
Other	0.82	0.69, 0.97	0.019	0.71	0.47, 1.08	0.109	0.96	0.87, 1.05	0.344
Year of Admission									
2010	ref	ref	ref	ref	ref	ref	ref	ref	ref
2011	1.01	0.92, 1.12	0.77	1.46	1.15, 1.86	0.002	0.96	0.91, 1.02	0.164
2012	1.04	0.95, 1.15	0.37	1.77	1.41, 2.23	<0.001	0.95	0.90, 1.00	0.070
2013	1.08	0.99, 1.19	0.087	1.86	1.48, 2.33	<0.001	0.81	0.77, 0.86	<0.001
2014	1.31	1.19, 1.43	<0.001	2.14	1.71, 2.67	<0.001	0.48	0.45, 0.50	<0.001
Source of payment for stay									
Commercial	ref	ref	ref	ref	ref	ref	ref	ref	ref
Medicare	0.91	0.84, 0.98	0.018	1.39	1.21, 1.61	<0.001	1.24	1.18, 1.31	<0.001
Medicaid	1.11	1.01, 1.22	0.031	1.52	1.17, 2.02	0.002	1.68	1.60, 1.77	<0.001
Other	0.92	0.82, 1.03	0.138	1.26	0.93, 1.72	0.139	1.08	1.01, 1.16	0.019
Elixhauser Comorbidity Index	0.96	0.92, 1.01	0.087	1.55	1.47, 1.64	<0.001	1.18	1.15, 1.21	<0.001
Hospitalization Type									
Medical admission only	ref	ref	ref	ref	ref	ref	ref	ref	ref
Medical w/ ICU	0.98	0.85, 1.14	0.81	1.77	1.46, 2.15	<0.001	1.02	0.94, 1.11	0.58
Surgical admission only	1.18	1.10, 1.26	<0.001	0.73	0.62, 0.85	<0.001	0.99	0.95, 1.03	0.64
Surgical w/ ICU	1.07	0.94, 1.22	0.295	1.07	0.88, 1.30	0.48	1.02	0.95, 1.10	0.61
HCUP CCS									
Cardiovascular Conditions	ref	ref	ref	ref	ref	ref	ref	ref	ref
Respiratory Conditions	1.28	1.08, 1.51	0.005	2.34	1.88, 2.92	<0.001	1.49	1.36, 1.64	<0.001
Gastrointestinal Conditions	0.94	0.84, 1.05	0.29	0.94	0.75, 1.17	0.58	1.10	1.03, 1.17	0.004
Oncologic Conditions	1.03	0.93, 1.15	0.56	3.35	2.82, 3.98	<0.001	1.14	1.07, 1.21	<0.001
Genitourinary/Maternal Health Conditions	0.84	0.74, 0.95	0.006	1.29	0.97, 1.72	0.085	0.89	0.83, 0.95	0.001
Neurological and Mental Health Conditions	1.21	0.99, 1.47	0.057	2.02	1.41, 2.89	<0.001	1.20	1.07, 1.35	0.002
Musculoskeletal, Trauma, and Orthopedic	1.12	1.02, 1.23	0.016	0.82	0.68, 1.00	0.050	0.81	0.76, 0.85	<0.001

Endocrine & Hematologic Conditions	0.65	0.55, 0.76	<0.001	1.39	0.99, 1.95	0.059	1.09	1.01, 1.18	0.036
Other	0.98	0.87, 1.10	0.75	1.26	1.00, 1.59	0.049	0.96	0.90, 1.02	0.183
Comorbidities									
Musculoskeletal Pain	1.44	1.35, 1.53	<0.001	1.00	0.89, 1.13	0.94	1.06	1.02, 1.10	0.004
Depression	1.29	1.18, 1.40	<0.001	1.01	0.87, 1.17	0.89	1.06	1.00, 1.12	0.035
Other Mental Disorders	0.75	0.55, 1.04	0.083	2.99	2.39, 3.74	<0.001	1.62	1.41, 1.86	<0.001
Alcohol Use Disorder	1.12	0.80, 1.57	0.51	1.02	0.61, 1.71	0.94	1.05	0.86, 1.28	0.65
Drug Dependence	1.86	1.32, 2.62	<0.001	1.34	0.47, 3.81	0.58	1.80	1.45, 2.23	<0.001
Opioid Poisoning (incl. accidental)	1.59	0.60, 4.24	0.35	2.37	0.41, 13.77	0.34	0.87	0.41, 1.83	0.71
History of Benzodiazepine Use	1.23	1.14, 1.33	<0.001	1.80	1.60, 2.02	<0.001	1.35	1.29, 1.41	<0.001

Includes 87,517 cases with complete date among 92,433 stays with inpatient opioid use with a discharge (i.e., no in-hospital death).

Relative risk ratios estimated against a reference group with no outpatient opioid use, no death, and no readmission within 365 days of discharge.

Supplement Table 6. Sensitivity analysis of the association between any inpatient opioid use and outpatient opioid use, mortality and readmission at 90 and 365 days post-discharge, after removal of stays for trauma/orthopedic, or oncological conditions

Outcomes	Percentages (95% CI) with outcome		Percentage Point Difference in Use (95% CI)
	No Inpatient Use	Inpatient Opioid Use	
At 90 days post-discharge			
Outpatient Reported Use	2.8 (2.6, 2.9)	5.6 (5.4, 5.8)	+2.8 (2.6, 3.0)
No Outpatient Use/Mortality/Readmission	76.0 (75.7, 76.4)	73.3 (72.9, 73.7)	-2.7 (-3.1, -2.3)
Mortality	0.1 (0.1, 0.2)	0.2 (0.2, 0.3)	+0.1 (0.0, 0.1)
Readmission	21.1 (20.8, 21.4)	20.9 (20.6, 21.2)	-0.2 (-0.5, +0.1)
At 365-days post-discharge			
Outpatient Reported Use	4.2 (4.1, 4.4)	7.4 (7.1, 7.6)	+3.2 (2.9, 3.4)
No Outpatient Use/Mortality/Readmission	55.7 (55.3, 56.1)	53.5 (53.1, 54.0)	-2.2 (-2.6, -1.7)
Mortality	0.5 (0.4, 0.5)	0.5 (0.5, 0.6)	+0.0 (-0.1, 0.1)
Readmission	39.7 (39.3, 40.0)	38.6 (38.2, 39.0)	-1.1 (-1.5, -0.7)

Notes:

(B) includes 150,905 previously opioid-naïve patient with 157,963 stays.

Supplement Table 7. Sensitivity analysis of the association between patterns of inpatient opioid administration and outpatient opioid use at 90 and 365 days after discharge among patients receiving inpatient opioids, after removal of stays for trauma/orthopedic, or oncological conditions

Inpatient opioid use patterns	within 90 days of discharge		within 365 days of discharge	
	Percent with outpatient opioid use (95% CI)	Percentage Point Difference in outpatient use (95% CI)	Percent with outpatient opioid use (95% CI)	Percentage Point Difference in outpatient use (95% CI)
Proportion of stay with opioids				
1-25%	5.2 (4.6, 5.8)	Ref	6.4 (5.8, 7.1)	Ref
26-50%	5.1 (4.8, 5.5)	-0.1 (-0.7, 0.5)	7.1 (6.7, 7.5)	+0.7 (0.1, 1.4)
51-75%	6.3 (5.9, 6.6)	+1.1 (0.5, 1.7)	8.3 (7.9, 8.7)	+1.9 (1.3, 2.6)
76-100%	5.9 (5.4, 6.3)	+0.7 (0.1, 1.3)	7.9 (7.3, 8.4)	+1.5 (0.9, 2.2)
Time from last opioid administration to discharge				
>24 Hours	3.7 (3.3, 4.0)	Ref	5.3 (4.9, 5.7)	Ref
13-24 Hours	5.3 (4.8, 5.8)	+1.6 (1.1, 2.1)	6.9 (6.3, 7.4)	+1.6 (1.0, 2.1)
0-12 Hours	7.0 (6.7, 7.4)	+3.3 (2.9, 3.7)	9.1 (8.7, 9.5)	+3.8 (3.4, 4.2)
Setting to first receive opioids				
Stepdown/Ward	5.6 (5.3, 5.9)	Ref	7.4 (7.0, 7.7)	Ref
ED	5.7 (5.2, 6.2)	+0.1 (-0.4, 0.6)	7.7 (7.1, 8.3)	+0.3 (-0.3, 0.9)
ICU	6.1 (5.3, 7.0)	+0.5 (-0.3, 1.4)	8.0 (6.9, 9.1)	+0.6 (-0.5, 1.7)
PACU/Procedure Unit	5.7 (5.3, 6.1)	+0.1 (-0.3, 0.5)	7.7 (7.3, 8.2)	+0.3 (-0.1, 0.8)
Any inpatient use of non-opioid pain medicine				
None	5.6 (5.4, 5.8)	Ref	7.5 (7.2, 7.8)	Ref
Received >= 1 time during stay	6.0 (5.6, 6.4)	+0.4 (0.0, 0.8)	8.0 (7.5, 8.4)	+0.5 (0.0, 0.9)

(B) includes 63,607 patients with 67,356 stays.

Supplement Table 8. Descriptive characteristics of opioid naive inpatient discharges, by hospital

	Overall ; N = 191,249	Hosp 1; N = 42,456 (22.2%)	Hosp 2; N = 38,950 (20.4%)	Hosp 3; N = 27,064 (14.2%)	Hosp 4; N = 19,859 (10.4%)	Hosp 5; N = 16,952 (8.9%)	Hosp 6; N = 15,277 (8.0%)	Hosp 7; N = 8,663 (4.5%)	Hosp 8; N = 6,042 (3.2%)	Hosp 9; N = 5,829 (3.1%)	Hosp 10; N = 4,680 (2.5%)	Hosp 11; N = 3,903 (2.0%)	Hosp 12; N = 1,574 (0.8%)
Years for data		2010- 14	2010- 14	2010- 14	2010- 14	2010- 14	2011- 14	2012- 14	2011- 14	2011- 14	2011- 14	2012- 14	2011- 14
In-Hospital Opioid Use, %	48%	59%	46%	47%	47%	45%	47%	47%	33%	44%	37%	41%	37%
Outpatient Opioid Use, 90 day, %	4.8%	3.7%	5.0%	4.8%	4.3%	7.0%	4.7%	7.2%	3.3%	5.4%	5.0%	6.1%	4.4%
Outpatient Opioid Use, 365 day, %	6.3%	4.9%	6.3%	6.2%	5.7%	9.2%	6.6%	9.3%	4.6%	7.3%	6.1%	8.1%	5.7%
Age, years, med.	58	32	59	67	55	68	68	60	67	61	60	67	69
18-24, %	8%	17%	6%	2%	7%	2%	2%	7%	4%	12%	9%	2%	9%
25-34, %	17%	45%	8%	3%	20%	4%	3%	12%	5%	14%	16%	4%	11%
35-44, %	10%	16%	10%	5%	11%	6%	6%	9%	7%	7%	7%	7%	5%
45-54, %	11%	6%	16%	11%	13%	12%	12%	12%	12%	9%	9%	12%	8%
55-64, %	17%	6%	23%	23%	16%	19%	19%	18%	16%	14%	14%	20%	10%
65-74, %	17%	5%	20%	25%	14%	21%	22%	19%	18%	18%	18%	22%	17%
75+, %	22%	4%	17%	31%	20%	37%	36%	22%	27%	28%	26%	34%	40%
Sex, %													
Male	37%	5%	51%	53%	40%	45%	48%	40%	46%	35%	36%	45%	36%
Female	63%	95%	49%	48%	60%	55%	52%	60%	54%	65%	64%	55%	64%
Race, %													
White	82%	73%	81%	78%	79%	92%	92%	92%	78%	94%	97%	89%	98%
Black	11%	18%	9%	16%	15%	5%	1%	5%	19%	4%	1%	9%	0%
Other	3%	5%	3%	2%	2%	1%	1%	2%	1%	1%	1%	2%	0%
Missing	4%	4%	7%	4%	4%	3%	6%	0%	2%	1%	2%	1%	1%
Type of insurance, %													
Commercial	47%	63%	47%	43%	43%	40%	44%	40%	30%	39%	37%	44%	35%
Medicare	35%	8%	36%	48%	34%	51%	49%	43%	49%	37%	44%	47%	48%

Medicaid	12%	23%	10%	6%	16%	5%	3%	11%	16%	14%	13%	5%	13%
Other	6%	6%	7%	4%	7%	4%	4%	6%	4%	10%	6%	3%	4%
Elixhauser Comorbidity Index, mean	0.6	0.2	0.7	0.8	0.6	0.7	0.6	0.5	0.7	0.5	0.5	0.6	0.4
Hospitalization type, %													
Medical only	63%	69%	63%	49%	62%	71%	65%	59%	58%	55%	70%	67%	66%
Medical w/ICU	7%	2%	13%	6%	10%	5%	9%	6%	16%	7%	6%	10%	10%
Surgical only	24%	26%	14%	34%	23%	22%	21%	30%	20%	31%	21%	20%	22%
Surgical w/ ICU	6%	3%	10%	11%	5%	2%	6%	6%	7%	8%	2%	3%	2%
Hospital LOS, days, median.	4	3	4	4	4	4	4	3	5	3	4	4	3
Mortality, 90 day, %	2%	0%	2%	3%	2%	3%	3%	2%	4%	2%	2%	3%	3%
Mortality, 365 day, %	6%	1%	7%	9%	5%	9%	9%	6%	9%	6%	6%	9%	8%
Readmission, 90 day, %	23%	14%	26%	28%	24%	23%	26%	24%	29%	24%	26%	26%	26%
Readmission, 365 day, %	40%	26%	42%	47%	42%	42%	44%	41%	53%	43%	46%	43%	48%
Modified HCUP CCS Conditions, %													
Cardiovascular	20%	8%	22%	32%	20%	20%	29%	25%	24%	18%	15%	24%	18%
Respiratory	6%	1%	4%	7%	6%	9%	8%	5%	11%	8%	12%	11%	11%
Gastrointestinal	9%	2%	10%	10%	8%	16%	16%	11%	13%	13%	11%	15%	11%
Oncologic	10%	8%	16%	16%	6%	6%	12%	7%	4%	5%	4%	6%	4%
Genitourinary/Maternal Health	11%	22%	3%	5%	12%	6%	8%	15%	7%	16%	16%	6%	24%
Neurological and Mental Health	6%	1%	12%	3%	12%	4%	3%	3%	17%	2%	10%	3%	2%
Musculoskeletal, Trauma, and Orthopedic	22%	34%	21%	17%	21%	23%	15%	18%	10%	17%	15%	18%	9%
Endocrine & Hematologic	5%	8%	6%	4.0%	4%	9%	4%	6%	5%	6%	4%	7%	4%
Other	10%	16%	6%	6%	12%	8%	7%	10%	11%	14%	14%	9%	17%
Comorbidities , %													
Musculoskeletal Pain Conditions	29%	13%	29%	43%	26%	53%	32%	25%	31%	26%	26%	41%	32%

Depression	13%	8.6%	14%	15%	14%	19%	11%	12%	16%	11%	15%	13%	10%
Other Mental Disorders	3%	1%	3%	3%	2%	5%	3%	2%	5%	3%	4%	4%	5%
Alcohol Use Disorder	1%	0%	1%	1%	4%	1%	1%	1%	3%	1%	1%	1%	0%
Drug Dependence/Opioid-Related Poisoning	1%	1%	1%	0%	4%	0%	0%	0%	3%	0%	1%	0%	0%
History of Benzodiazepine Use, %	5%	4%	3%	4%	3%	5%	4%	3%	5%	6%	6%	6%	5%

Supplement Table 9. Examination of effect modification by hospital of the association between any inpatient opioid use and outpatient opioid use, 90 days post-discharge

Outcomes	Percentages (95% CI) with outpatient opioid use		Percentage Point Difference in Use (95% CI)
	No Inpatient Use	Inpatient Opioid Use	
At 90 days post-discharge			
Hospital 1	2.2 (1.9, 2.4)	5.0 (4.7, 5.3)	+2.8 (2.5, 3.1)
Hospital 2	2.8 (2.6, 3.1)	6.6 (6.2, 7.0)	+3.8 (3.4, 4.2)
Hospital 3	3.0 (2.7, 3.4)	5.0 (4.6, 5.4)	+2.0 (1.6, 2.4)
Hospital 4	2.7 (2.3, 3.0)	5.8 (5.3, 6.3)	+3.1 (2.6, 3.6)
Hospital 5	4.5 (4.0, 5.0)	8.3 (7.6, 8.9)	+3.8 (3.1, 4.4)
Hospital 6	3.4 (3.0, 3.9)	5.2 (4.6, 5.7)	+1.8 (1.2, 2.3)
Hospital 7	4.1 (3.5, 4.7)	8.2 (7.4, 9.0)	+4.1 (3.3, 4.9)
Hospital 8	2.4 (1.8, 3.0)	5.1 (4.1, 6.1)	+2.7 (1.7, 3.7)
Hospital 9	3.4 (2.7, 4.1)	6.6 (5.6, 7.5)	+3.2 (2.2, 4.1)
Hospital 10	3.4 (2.7, 4.1)	6.6 (5.4, 7.8)	+3.2 (2.0, 4.4)
Hospital 11	3.1 (2.4, 3.8)	7.4 (6.3, 8.6)	+4.3 (3.2, 5.5)
Hospital 12	3.9 (2.5, 5.4)	4.8 (3.1, 6.5)	+0.9 (-0.8, 2.6)

Supplement Table 10. Examination of effect modification by hospital of the association between any inpatient opioid use and outpatient opioid use, 365 days post-discharge

Outcomes	Percentages (95% CI) with outpatient opioid use		Percentage Point Difference in Use (95% CI)
	No Inpatient Use	Inpatient Opioid Use	
At 365 days post-discharge			
Hospital 1	3.4 (3.1, 3.7)	6.7 (6.3, 7.1)	+3.3 (2.9, 3.7)
Hospital 2	4.0 (3.7, 4.3)	8.2 (7.8, 8.7)	+4.2 (3.8, 4.7)
Hospital 3	4.2 (3.9, 4.6)	6.6 (6.1, 7.0)	+2.4 (1.9, 2.8)
Hospital 4	3.9 (3.5, 4.3)	7.7 (7.1, 8.3)	+3.8 (3.2, 4.4)
Hospital 5	6.6 (6.0, 7.1)	10.2 (9.5, 10.9)	+3.6 (2.9, 4.3)
Hospital 6	5.1 (4.6, 5.6)	7.3 (6.6, 7.9)	+2.2 (1.5, 2.8)
Hospital 7	5.5 (4.9, 6.2)	9.9 (9.0, 10.8)	+4.4 (3.5, 5.3)
Hospital 8	3.8 (3.1, 4.5)	7.1 (5.9, 8.3)	+3.3 (2.1, 4.5)
Hospital 9	5.4 (4.5, 6.2)	8.6 (7.5, 9.7)	+3.2 (2.1, 4.3)
Hospital 10	4.5 (3.7, 5.3)	8.0 (6.7, 9.3)	+3.5 (2.2, 4.8)
Hospital 11	4.4 (3.6, 5.2)	9.3 (8.0, 10.6)	+4.9 (3.6, 6.2)
Hospital 12	5.4 (3.9, 6.9)	5.9 (4.0, 7.8)	+0.5 (-1.4, 2.4)

Supplement Tables 9 and 10 show results from analyses with interaction terms between hospital indicators and any inpatient opioid use (our main predictor variable). We used the margins command in STATA to obtain the predicted risk of outpatient opioid use post-discharge based on the hospital interaction terms.