

Figure S1—Inclusion criteria included for the study design.

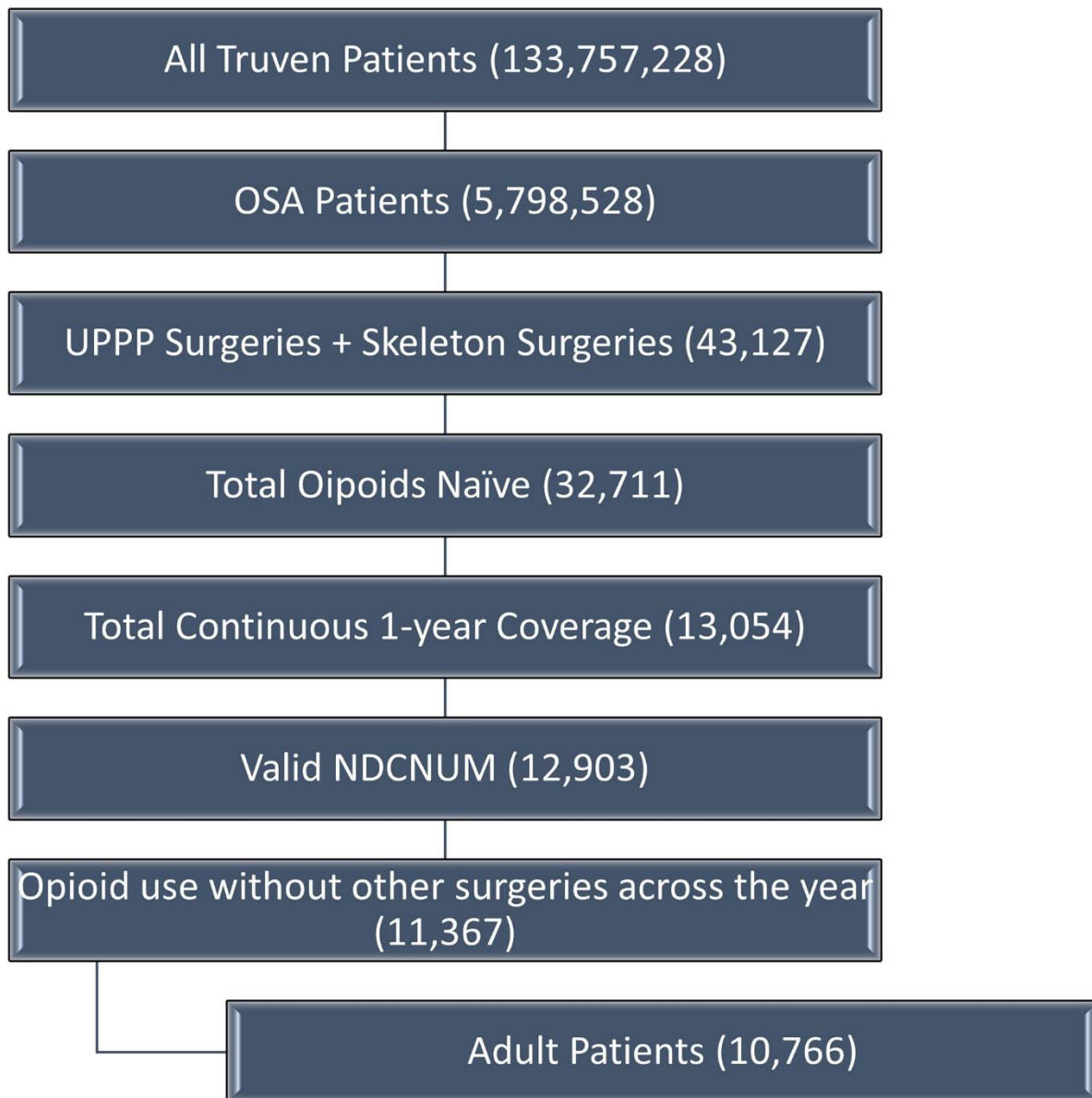


Table S1: ICD and CPT codes used.

Comorbidities	ICD-9 Codes
OSA	327.20, 327.23, 327.29, 780.51, 780.53, 780.57
Tobacco use	305.1, 994.06, 994.07, V1582, G0436
Diabetes	V58.67, 250.0, 250.00, 250.02, 250.1, 250.10, 250.11, 250.12, 250.13, 250.4, 250.40, 250.41, 250.42, 250.43, 250.5, 250.50, 250.51, 250.52, 250.53, 250.6, 250.60, 250.61, 250.62, 250.63, 250.7, 250.70, 250.71, 250.72, 250.73, 250.9, 250.90, 250.91, 250.92, 250.93, 583.81, 362.0
Hypertension	401.1, 401.9, 402.x
Autoimmune disease	135, 245.2, 279.49, 283.0, 446.4, 571.6, 579.0, 696.0, 710.0, 710.1, 710.2, 710.3, 710.9, 711.90, 712.19, 714.0, 714.30, 720.0, 725, 729.1, 795.79, G8859, G8860
Immune Deficiency	V58.65, 042, 279.0, 279.1, 279.2, 279.3, 279.4, 279.5, 279.8, 279.9, 279.00, 279.01, 279.02, 279.03, 279.04, 279.05, 279.06, 279.09, 279.10, 279.11, 279.12, 279.13, 279.19, 279.41, 279.49, 279.50, 279.51, 279.52, 279.53, 203.0, 203.1, 203.8, 203.00, 203.01, 203.02, 203.10, 203.11, 203.12, 203.80, 203.81, 203.82, 204.0, 204.1, 204.2, 204.8, 204.9, 204.00, 204.01, 204.02, 204.10, 204.11, 204.12, 204.20, 204.21, 204.22, 204.80, 204.81, 204.82, 204.90, 204.91, 204.92, 205.0, 205.1, 205.2, 205.3, 205.8, 205.9, 205.00, 205.01, 205.02, 205.10, 205.11, 205.12, 205.20, 205.21, 205.22, 205.30, 205.31, 205.32, 205.80, 205.81, 205.82, 205.90, 205.91, 205.92, 206.0, 206.1, 206.2, 206.8, 206.9, 206.00, 206.01, 206.02, 206.10, 206.11, 206.12, 206.20, 206.21, 206.80, 206.81, 206.82, 206.90, 206.91, 206.92, 207.0, 207.2, 207.8, 207.00, 207.01, 207.10, 207.11, 207.12, 207.20, 207.21, 207.22, 207.80, 207.81, 207.82, 282.60, 282.61, 288.0, 288.1, 288.2, 288.3, 288.4, 288.5, 288.6, 288.8, 288.9, 288.00, 288.01, 288.02, 288.03, 288.04, 288.09, 288.50, 288.51, 288.59, 288.60, 288.61, 288.62, 288.63, 288.64, 288.65, 288.66, 288.69
Depression	29620, 29621, 29622, 29623, 29624, 29625, 29626, 29627, 29628, 29629, 29630, 29631, 29632, 29633, 29634, 29635, 29636, 29637, 29638, 29639
Other mood disorders	2969, 29690, 29699
Opioid dependence	30400, 30401, 30402, 3055, 30550, 30551, 30552, 30553
Substance dependence	3049, 30490, 30491, 30492, 30493, 3056, 30560, 30561, 30562, 30563, 30564, 30565, 30566, 30567, 30568, 30569, 30570, 30571, 30572, 30573, 30574, 30575, 30576, 30577, 30578, 30579, 30580, 30581, 30582, 30583, 30584, 30585, 30586, 30587, 30588, 30589
Schizophrenia	29500, 29501, 29502, 29503, 29504, 29505, 29506, 29507, 29508, 29509, 29510, 29511, 29512, 29513, 29514, 29515, 29516, 29517, 29518, 29519, 29520, 29521, 29522, 29523, 29524, 29525, 29526, 29527, 29528, 29529, 29530, 29531, 29532, 29533, 29534, 29535, 29536, 29537, 29538, 29539, 29540, 29541, 29542, 29543, 29544, 29545, 29546, 29547, 29548, 29549, 29550, 29551, 29552, 29553, 29554, 29555, 29556, 29557, 29558, 29559, 29560, 29561, 29562, 29563, 29564, 29565, 29566, 29567, 29568, 29569, 29570, 29571, 29572, 29573, 29574, 29575, 29576, 29577, 29578, 29579, 29580, 29581, 29582, 29583, 29584, 29585, 29586, 29587, 29588, 29589, 29590, 29591, 29592, 29593, 29594, 29595, 29596, 29597, 29598, 29599
Sleep Surgery	CPT Codes
UPPP	Excision and Destruction Procedures on the Palate and Uvula: 42125 Excision and Destruction Procedures on the Pharynx, Adenoids, and Tonsils: 42826
Nasal procedures	Submucous resection: 30140/30802 Septoplasty: 30520
Tongue base procedures	lingual tonsillectomy: 42870 partial glossectomy: 41120
Genioglossus advancement	Segmental mandible osteotomy with genioglossus advancement: 21199
Skeletal surgery	21110 maxillomandibular fixation

	21141: leFort 1 reconstruction 21145: leFort 1 advancement 21196: bilateral sagittal split osteotomy
Complications	ICD-9 Codes
Bleeding	998.11, 998.12, 998.13, 78.47
Intubation	31500
Tracheostomy	31600, 31601, 31603

Table S2. Clarifying various terms and outcomes based on time interval of opioid use.

Time interval Categories (number)	0 - 3 months opioid prescription	3 - 6 months opioid prescription	6 - 12 months opioid prescription	Total # of Surgeries
Opioid prescription after naive period	5,702			5,702
First opioid prescription at 3 to 6 months		20		20
Persistent opioid prescription	301			301
First opioid prescription at 6 to 12 months			71	71
Non-continuous Prolonged opioid prescription	687		687	687
Continuous Prolonged opioid prescription	115			115
First opioid prescription at 3 months to a year		10		10
Total	6,805	446	883	6,906
This total number is greater than that of surgeries as one surgery can be counted more than once	8,134			

Table S3: The univariate analysis for complications and outcomes. Green shows factors with a p-value <0.05.

Independent Variables	Inappropriate Opioid Use	3 – 6 months Opioid Use	6 – 12 months Opioid Use	Continuous Persistent Opioid Use	Non-Continuous Prolonged Opioid Use	Continuous Prolonged Opioid Use	1ry Bleed	Hosp. Readmission	Intubation
Autoimmune dse	0.021	0.658	0.243	0.650	0.717	0.290	0.994	0.591	0.222
Depression	0.035	0.749	0.024	0.986	0.257	0.383	0.300	0.045	0.994
Diabetes	0.004	0.340	0.010	0.209	0.260	0.275	0.544	0.023	0.994
Hypertension	0.014	0.064	0.656	0.178	0.763	0.886	0.872	0.000	0.390
Immune Deficiency	0.044	0.589	0.756	0.488	0.748	0.763	0.353	0.001	0.993
Male gender	0.515	0.639	0.001	0.944	0.083	0.103	0.000	0.931	0.992
Mood Disorder	0.026	0.585	0.941	0.349	0.541	0.209	0.122	0.035	0.993
Opioid Dependence	0.055	0.702	0.025	0.654	0.651	0.003	0.979	0.398	0.000
Periop. Opioid	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.614	0.883
Schizophrenia	0.726	0.702	0.508	0.654	0.692	0.981	0.950	0.950	0.996
Smoking	0.129	0.550	0.534	0.340	0.983	0.052	0.041	0.005	0.993
Substance Dependence	0.111	0.966	0.583	0.966	0.827	0.212	0.891	0.142	0.000
AGE	0.014	0.581	0.071	0.637	0.383	0.374	0.000	0.000	0.399
UPPP Alone	0.684	0.922	0.634	0.991	0.640	0.505	0.000	0.000	0.692
UPPP Multilevel	0.086	0.923	0.859	0.868	0.202	0.581	0.005	0.000	0.542
Skeletal Surgery	0.001	0.613	0.441	0.644	0.037	0.770	0.004	0.241	0.039

Table S4. Multivariate regression model showing factors associated with each complication with OR, 95% confidence interval and p value.

Inappropriate Opioid Use	Estimate	Std. Error	z value	P-value	95% CI			Interpretation	
					Min	OR	Max	P Value	OR
(Intercept)	-5.6703	0.3157	17.9610	<0.001					
Multilevel surgery with UPPP	-0.1876	0.2262	-0.8290	0.4070	0.6611	0.8290	1.0394	Not significant	No contribution
Skeletal surgery	-0.1586	0.1376	-1.1530	0.2491	0.7436	0.8533	0.9792	Not significant	Protection Factor
Age	-0.0002	0.0037	-0.0430	0.9658	0.9962	0.9998	1.0035	Not significant	No contribution
Smoking	0.3397	0.1415	2.4010	0.0164	1.2192	1.4045	1.6179	Significant	Risk factor
Hypertension	-0.0267	0.0864	-0.3080	0.7578	0.8931	0.9737	1.0616	Not significant	No contribution
Diabetes	-0.1574	0.1400	-1.1240	0.2610	0.7427	0.8544	0.9828	Not significant	Protection Factor
Autoimmune	-0.1123	0.1484	-0.7570	0.4492	0.7705	0.8938	1.0367	Not significant	No contribution
Immune Deficiency	-0.5398	0.2929	-1.8430	0.0654	0.4349	0.5829	0.7813	Not significant	Protection Factor
Depression	0.2568	0.1461	1.7580	0.0788	1.1171	1.2927	1.4960	Not significant	Risk factor
Other Mood Disorders	0.4786	0.2892	1.6550	0.0979	1.2085	1.6138	2.1549	Not significant	Risk factor
Opioid Dependence	0.8364	0.6575	1.2720	0.2033	1.1959	2.3080	4.4544	Not significant	Risk factor
Substance Dependence	0.5309	0.6272	0.8460	0.3973	0.9082	1.7005	3.1839	Not significant	No contribution
Perioperative Opioid	3.4504	0.2623	13.1530	<0.001	24.2427	31.5142	40.9667	Significant	Risk factor

Continuous Persistent Opioid Use	Estimate	Std. Error	z value	P-value	95% CI			Interpretation	
					Min	OR	Max	P Value	OR
(Intercept)	-6.8283	0.4523	15.0960	<0.001					
Hypertension	0.3229	0.1216	2.6550	0.0079	1.2230	1.3811	1.5597	Significant	Risk factor
Diabetes	-0.1615	0.2015	-0.8010	0.4229	0.6956	0.8509	1.0408	No significant	No contribution
Perioperative Opioid	3.6324	0.4516	8.0430	<0.001	24.0660	37.8034	59.3825	Significant	Risk factor

Continuous Prolonged Opioid Use	Estimate	Std. Error	z value	Pr(> z)	95% CI			Interpretation	
					Min	OR	Max	P Value	OR
(Intercept)	-8.5512	1.0035	-8.5220	<0.001					
Male	0.4382	0.2039	2.1490	0.0317	1.2639	1.5499	1.9005	Significant	Risk factor
Smoking	0.6656	0.2956	2.2520	0.0243	1.4478	1.9457	2.6149	Significant	Risk factor
Mood Disorders	0.4218	0.6194	0.6810	0.4959	0.8206	1.5247	2.8326	No significant	No contribution
Opioid Dependence	2.0950	0.9023	2.3220	0.0202	3.2960	8.1254	20.0314	Significant	Risk factor
Substance Dependence	0.0135	1.2593	0.0110	0.9915	0.2877	1.0136	3.5707	No significant	No contribution
Perioperative Opioid	4.2906	1.0039	4.2740	<0.001	26.7523	73.0066	199.2340	Significant	Risk factor

Non-continuous Prolonged Opioid Use	Estimate	Std. Error	z value	Pr(> z)	95% CI			Interpretation	
					Min	OR	Max	P Value	OR
(Intercept)	-6.2567	0.3614	17.3110	<0.001					
Multilevel Surgery	0.1576	0.1933	0.8150	0.4149	0.9649	1.1707	1.4203	No significant	No contribution
Skeletal Surgery	0.0365	0.1206	0.3020	0.7625	0.9193	1.0371	1.1700	No significant	No contribution
Male	0.2717	0.0912	2.9790	0.0029	1.1978	1.3122	1.4376	Significant	Risk factor
Perioperative Opioid	4.0572	0.3565	11.3810	<0.001	40.4752	57.8111	82.5719	Significant	Risk factor

Bleeding	Estimate	Std. Error	z value	Pr(> z)	95% CI			Interpretation	
					Min	OR	Max	P Value	OR
(Intercept)	-1.6182	0.2400	-6.7430	<0.001					
Multilevel Surgery	-0.9653	0.3233	-2.9860	0.0028	0.2757	0.3809	0.5262	Significant	Protection Factor
Skeletal Surgery	-0.3469	0.1957	-1.7730	0.0763	0.5812	0.7069	0.8597	No significant	Protection Factor
AGE	-0.0365	0.0043	-8.4040	<0.001	0.9599	0.9641	0.9683	Significant	Protection Factor
Male	-0.5901	0.1322	-4.4650	<0.001	0.4857	0.5543	0.6326	Significant	Protection Factor

Smoking	0.2504	0.1631	1.5350	0.1248	1.0912	1.2845	1.5121	No significant	Risk factor
Mood Disorders	-1.2725	0.7174	-1.7740	0.0761	0.1367	0.2801	0.5740	No significant	Protection Factor
Perioperative Opioid	-0.4959	0.0974	-5.0890	<0.001	0.5525	0.6090	0.6713	Significant	Protection Factor

Hospital readmission	Estimate	Std. Error	z value	Pr(> z)	95% CI			Interpretation	
					Min	OR	Max	P Value	OR
(Intercept)	-3.5531	0.2043	17.3940	<0.001					
Multilevel Surgery	0.4157	0.1584	2.6250	0.0087	1.2935	1.5155	1.7756	Significant	Risk factor
Skeletal Surgery	-0.2526	0.1019	-2.4780	0.0132	0.7015	0.7768	0.8601	Significant	Protection Factor
AGE	0.0068	0.0043	1.5750	0.1152	1.0025	1.0068	1.0111	Not significant	Risk factor
Smoking	0.3952	0.1493	2.6480	0.0081	1.2788	1.4847	1.7237	Significant	Risk factor
Other Mood Disorders	0.5738	0.3155	1.8190	0.0689	1.2948	1.7751	2.4335	Not significant	Risk factor
Depression	0.2643	0.1645	1.6060	0.1082	1.1049	1.3025	1.5355	Not significant	Risk factor
Diabetes	0.0618	0.1307	0.4730	0.6363	0.9334	1.0638	1.2124	Not significant	No contribution
Hypertension	0.4406	0.0975	4.5200	<0.001	1.4094	1.5537	1.7128	Significant	Risk factor
Immune Deficiency	0.5657	0.2054	2.7540	0.0059	1.4338	1.7608	2.1623	Significant	Risk factor

opioid use after 6 – 12 months	Estimate	Std. Error	z value	Pr(> z)	95% CI			Interpretation	
					Min	OR	Max	P Value	OR
(Intercept)	-4.4891	0.1846	24.3220	<0.001					
AGE	0.0084	0.0032	2.6270	0.0086	1.0052	1.0084	1.0117	Significant	Risk factor
Male	0.3025	0.0804	3.7650	0.0002	1.2488	1.3533	1.4665	Significant	Risk factor
Depression	0.2297	0.1322	1.7380	0.0823	1.1024	1.2582	1.4360	Not significant	Risk factor
Diabetes	0.3588	0.1043	3.4390	<0.001	1.2898	1.4316	1.5891	Significant	Risk factor
Autoimmune	0.2332	0.1169	1.9950	0.0460	1.1233	1.2626	1.4192	Significant	Risk factor
Opioid Dependence	1.1905	0.5427	2.1930	0.0283	1.9112	3.2886	5.6587	Significant	Risk factor
Perioperative Opioid	1.9679	0.1194	16.4740	<0.001	6.3497	7.1553	8.0631	Significant	Risk factor

opioid use after 3 – 6 months	Estimate	Std. Error	z value	Pr(> z)	95% CI			Interpretation	
					Min	OR	Max	P Value	OR
(Intercept)	-5.4715	0.2329	23.4970	<0.001					
Hypertension	0.3355	0.1147	2.9260	0.0034	1.2471	1.3986	1.5686	Significant	Risk factor
Perioperative Opioid	2.2702	0.2321	9.7820	<0.001	7.6760	9.6813	12.2105	Significant	Risk factor

