

Supplemental Appendices

Appendix A: Comparison of OLDW and US under 65 privately insured population, 2015

	US privately insured	OLDW commercial
Race/ethnicity		
White	66%	70%
Asian	7%	6%
Hispanic	15%	14%
Black	11%	11%
American Indian	1%	N/A
Female	50%	49%
Age		
0 to 17	24%	22%
18 to 24	11%	11%
25 to 34	16%	18%
35 to 44	15%	17%
45 to 54	17%	18%
55 to 59	9%	8%
60 to 64	7%	6%
Census Division		
New England	5%	3%
Mid Atlantic	13%	7%
East North Central	15%	16%
West North Central	6%	11%
South Atlantic	20%	22%
East South Central	6%	4%
West South Central	12%	18%
Mountain	7%	10%
Pacific	16%	9%

OLDW commercial includes people with both medical and prescription coverage; excludes people with unknown race/ethnicity, year of birth, or sex

Source: CPS ASEC (Current Population Survey—Annual Social and Economic Supplement), data for 2015, using <https://www.census.gov/cps/data/cpstablecreator.html>; Includes only people listed with a single race. Hispanic includes people of any single race who indicated they were of Hispanic origin

Comparison of OLDW and US Medicare Advantage population, 2015

	US Medicare Advantage	OLDW Medicare Advantage
Race/ethnicity		
White	76%	76%
Black	11%	12%
Hispanic	8%	9%
Other	6%	3%
Female	55%	57%
Census Division		
New England	3%	6%
Mid Atlantic	15%	15%
East North Central	15%	18%
West North Central	6%	12%
South Atlantic	20%	31%
East South Central	6%	5%
West South Central	10%	4%
Mountain	7%	5%
Pacific	18%	3%

OLDW Medicare Advantage includes people with both medical and prescription coverage; excludes people with unknown race/ethnicity or sex
 US Medicare Advantage source: Kaiser Family Foundation, 2015 data
<https://www.kff.org/state-category/medicare/medicare-advantage/>

Appendix B

Anesthesia procedures: All anesthesia CPT codes except codes between 99141 and 99157

(procedural sedation codes)

Included opioids: buprenorphine, butorphanol, codeine, dihydrocodeine, fentanyl, hydrocodone, hydromorphone, levomethadyl, levorphanol, meperidine, methadone, morphine, opium, oxycodone, oxymorphone, pentazocine, tapentadol, tramadol.

Excluded procedures: Includes procedure codes observed on the same date as one of our surgeries and determined to be a separate unrelated procedure beyond the scope of the primary operation. Excluded CPT codes include:

1. **Carpal tunnel release:** 10060, 11010, 11011, 11012, 11043, 11044, 11308, 11311, 11312, 11313, 11400, 11403, 11421, 11422, 11423, 11600, 11602, 11621, 11622, 11624, 11626, 11719, 11740, 11755, 11760, 11762, 11765, 11900, 11960, 12001, 12004, 12005, 12006, 12011, 12013, 12014, 12020, 12032, 12044, 12046, 12052, 13121, 13122, 13131, 14020, 14060, 14350, 15002, 15003, 15004, 15100, 15120, 15130, 15170, 15220, 15221, 15240, 15274, 15430, 15574, 15650, 15736, 15750, 15756, 15821, 15847, 15851, 17000, 17004, 17110, 17272, 17311, 17312, 17999, 19316, 19350, 19357, 19370, 20103, 20527, 20604, 20606, 20650, 20680, 20692, 20693, 20694, 20696, 20805, 20824, 20827, 20900, 20930, 20931, 20936, 20937, 20999, 21011, 21337, 21390, 22220, 22522, 22551, 22552, 22558, 22585, 22610, 22830, 22845, 22846, 22849, 22850, 22851, 22855, 22856, 22858, 23000, 23020, 23076, 23120, 23184, 23190, 23412, 23415, 23430, 23440, 23466, 23472, 23515, 23615, 23630, 23700, 23935, 24000, 24006, 24065, 24066, 24073, 24076, 24079, 24100, 24101, 24102, 24110, 24140, 24147, 24149, 24155, 24201, 24300, 24305, 24310, 24330, 24340, 24342, 24343, 24344, 24345, 24346, 24357, 24360, 24363, 24366, 24400, 24420, 24435, 24495, 24505, 24515, 24535, 24538, 24545, 24546, 24579, 24586, 24600, 24605, 24615, 24620, 24650, 24655, 24665, 24666, 24670, 24999, 25001, 25020, 25023, 25024, 25025, 25028, 25031, 25040, 25065, 25066, 25073, 25075, 25077, 25078, 25085, 25100, 25101, 25105, 25107, 25109, 25110, 25111, 25112, 25116, 25118, 25119, 25120, 25126, 25135, 25136, 25145, 25150, 25151, 25170, 25215, 25240, 25250, 25259, 25260, 25263, 25265, 25270, 25272, 25274, 25275, 25280, 25290, 25295, 25300, 25301, 25310, 25312, 25315, 25332, 25337, 25350, 25355, 25360, 25390, 25391, 25394, 25400, 25405, 25420, 25425, 25430, 25431, 25440, 25441, 25442, 25445, 25446, 25447, 25449, 25490, 25515, 25525, 25526, 25535, 25545, 25565, 25574, 25600, 25606, 25607, 25609, 25622,

25624, 25628, 25630, 25635, 25645, 25650, 25651, 25652, 25660, 25670, 25671, 25675, 25676, 25680, 25685, 25690, 25695, 25805, 25810, 25820, 25825, 25830, 25999, 26010, 26011, 26020, 26025, 26030, 26035, 26037, 26040, 26045, 26070, 26075, 26080, 26100, 26110, 26111, 26113, 26117, 26118, 26123, 26125, 26130, 26135, 26140, 26145, 26170, 26180, 26185, 26230, 26236, 26260, 26320, 26340, 26341, 26350, 26352, 26356, 26357, 26358, 26370, 26372, 26373, 26390, 26412, 26415, 26418, 26420, 26428, 26433, 26440, 26442, 26445, 26449, 26450, 26455, 26460, 26471, 26474, 26476, 26477, 26478, 26479, 26483, 26485, 26489, 26490, 26492, 26494, 26496, 26497, 26498, 26499, 26500, 26502, 26508, 26510, 26516, 26518, 26520, 26525, 26530, 26531, 26535, 26536, 26540, 26541, 26542, 26546, 26548, 26550, 26565, 26567, 26591, 26593, 26600, 26605, 26608, 26615, 26645, 26650, 26665, 26670, 26675, 26676, 26685, 26686, 26706, 26715, 26727, 26735, 26746, 26750, 26756, 26770, 26775, 26776, 26785, 26820, 26841, 26844, 26850, 26852, 26860, 26861, 26910, 26952, 27193, 27228, 27245, 27250, 27266, 27360, 27427, 27506, 27524, 27535, 27600, 27601, 27602, 27632, 27680, 27691, 27696, 27769, 27780, 27786, 27814, 27842, 27880, 28008, 28035, 28041, 28045, 28055, 28060, 28080, 28086, 28120, 28200, 28234, 28270, 28272, 28289, 28299, 28313, 28470, 28475, 28496, 28510, 28525, 28605, 28725, 28750, 28825, 29806, 29828, 29873, 29900, 29901, 29999, 30130, 30901, 34111, 34471, 35045, 35207, 35261, 35458, 35523, 37618, 37765, 38500, 42415, 43999, 44721, 49572, 49587, 50020, 54450, 56740, 57240, 58563, 58670, 61000, 61548, 62368, 62370, 63001, 63015, 63020, 63045, 63046, 63048, 63057, 63075, 63081, 63082, 63685, 64510, 64605, 64704, 64712, 64716, 64719, 64722, 64726, 64782, 64783, 64787, 64790, 64792, 64818, 64820, 64821, 64822, 64823, 64831, 64832, 64834, 64835, 64836, 64837, 64856, 64859, 64874, 64890, 64891, 64893, 64895, 64896, 64897, 64905, 66982, 66984, 67875, 67900, 67950, 69631, 97597, 97810, 99490, G0127,

2. **Knee arthroscopic minesectomy (scope):** 0263T, 10160, 10180, 11401, 11422, 11750, 13120, 14020, 14060, 15040, 15300, 15823, 15833, 15850, 15852, 17004, 19101, 19380, 20225, 20526, 20606, 20611, 20694, 20920, 20922, 21030, 21340, 21899, 22524, 23076, 23105, 23120, 23130, 23420, 23470, 23472, 23515, 23700, 23931, 24075, 24105, 24341, 24342, 24350, 24358, 24359, 24635, 25000, 25076, 25118, 25130, 25210, 25230, 25310, 25320, 25447, 25608, 25628, 25825, 26010, 26116, 26121, 26145, 26160, 26200, 26340, 26341, 26445, 26525, 26540, 26608, 26727, 26755, 26862, 26863, 26951, 27065, 27097, 27137, 27165, 27170, 27244, 27275, 27299, 27303, 27306, 27323, 27326, 27327, 27329, 27331, 27332, 27333, 27334, 27335, 27347, 27350, 27356, 27364, 27372, 27381, 27386, 27390, 27396, 27400, 27403, 27405, 27407, 27409, 27412, 27415, 27416, 27420, 27422, 27424, 27429, 27430, 27435, 27438, 27440, 27441, 27442, 27445, 27446, 27448, 27495, 27497, 27498, 27503, 27509, 27510, 27511, 27513, 27514, 27520, 27530, 27532, 27535, 27540, 27557, 27558, 27566, 27600, 27603, 27605, 27606, 27613, 27614, 27620, 27632, 27634, 27635, 27638, 27647, 27650, 27652, 27658, 27659, 27664, 27675, 27676, 27685,

27695, 27696, 27700, 27704, 27707, 27720, 27724, 27734, 27745, 27756, 27766, 27792, 27832, 27870, 27881, 27882, 27893, 27894, 27899, 28002, 28022, 28024, 28039, 28043, 28045, 28046, 28050, 28060, 28072, 28092, 28100, 28104, 28107, 28112, 28113, 28118, 28119, 28120, 28160, 28190, 28192, 28250, 28285, 28288, 28289, 28290, 28292, 28296, 28297, 28298, 28300, 28304, 28306, 28490, 28740, 28810, 28899, 29805, 29807, 29824, 29828, 29866, 29868, 29905, 30520, 30802, 30930, 36460, 37722, 37765, 38206, 38220, 38232, 38240, 40800, 42821, 49560, 49570, 53447, 56605, 57282, 57285, 58545, 58558, 62362, 64455, 64892, 64910, 66984, 95920, C5272, C5273, G0472,

3. **Lap chole w/ and w/out IOC:** 22902, 38570, 43280, 43644, 43752, 43775, 44204, 44205, 44238, 44979, 47001, 47379, 47490, 47564, 47579, 47605, 47999, 49020, 49080, 49329, 49565, 49572, 49585, 58660,
4. **Lap inguinal hernia repair:** 0249T, 0336T, 10021, 10022, 10160, 11005, 11201, 11302, 11402, 11404, 11406, 11424, 11441, 11442, 11443, 11444, 11446, 11606, 11622, 11643, 11644, 11770, 11771, 12034, 12052, 13101, 14001, 14021, 14301, 15240, 15241, 15360, 15361, 15734, 15830, 15847, 15877, 17003, 17110, 19260, 19300, 19325, 19371, 20680, 21012, 21552, 21554, 21556, 21935, 22905, 24071, 24076, 24201, 25248, 27001, 27006, 27045, 27047, 27048, 27327, 27345, 27347, 27364, 27618, 27632, 27680, 27698, 28110, 28238, 28240, 28308, 30140, 33517, 35206, 35665, 35840, 36478, 37202, 37722, 37765, 38589, 39502, 41112, 41120, 42140, 43246, 43282, 43332, 43450, 43499, 43644, 43651, 43659, 43752, 43770, 43774, 44110, 44180, 44213, 44227, 44320, 44604, 44615, 44799, 44970, 45171, 45905, 45990, 46220, 46221, 46230, 46320, 46505, 46924, 46930, 46945, 46946, 49002, 49204, 49322, 49324, 49326, 49400, 49402, 49435, 49495, 49500, 49507, 49525, 49540, 49550, 49553, 49557, 49580, 49582, 49590, 49600, 50590, 51999, 52630, 52640, 52648, 53500, 53600, 53605, 54055, 54056, 54150, 54162, 54512, 54522, 54530, 54650, 54692, 54699, 54860, 55000, 55040, 55041, 55060, 55110, 55120, 55200, 55450, 55535, 55540, 55550, 55899, 56800, 57210, 57240, 57250, 57260, 57265, 57268, 57280, 57283, 57287, 57295, 57423, 57426, 58260, 58262, 58270, 58410, 58541, 58545, 58546, 58550, 58552, 58555, 58565, 58578, 58600, 58661, 58662, 58671, 58673, 58700, 58825, 58999, 62361, 64761, 64763, 64776, 65222, 69110, 92950, 97813, 97814,
5. **Lap low anterior resection w/o or w/out stoma:** 11008, 12013, 14302, 20926, 21011, 22902, 27339, 32505, 32506, 32556, 32900, 33967, 37617, 38129, 39560, 39599, 43775, 44005, 44110, 44120, 44145, 44146, 44188, 44202, 44203, 44212, 44345, 44602, 44620, 44650, 44660, 44661, 44701, 44799, 44950, 44955, 45111, 45114, 45136, 45171, 45172, 45395, 45397, 45399, 45400, 45800, 45805, 45910, 45915, 45990, 46220, 46710, 46744, 47000, 47122, 47371, 47399, 48000, 49010, 49021, 49203, 49204, 49321, 49322, 49323, 49327, 49557, 49999, 50220, 50230, 50541, 50785, 51500, 53660, 54060, 54700, 55875, 55899, 57106, 57107, 57260, 57305, 57426, 58350, 58353, 58541, 58542, 58544, 58548, 58554, 58611, 58720, 58953, 93460,

6. **Lap nephrectomy partial or total:** 15830, 23078, 32320, 32608, 34151, 34802, 34812, 34825, 34826, 35122, 35471, 35761, 36248, 37242, 38101, 38115, 38120, 39501, 43282, 43611, 43775, 44020, 44205, 44213, 44899, 47100, 47120, 47370, 47785, 47900, 49205, 49320, 49321, 49402, 50010, 50060, 50080, 50130, 50135, 50200, 50205, 50225, 50234, 50236, 50240, 50250, 50280, 50325, 50328, 50360, 50380, 50389, 50400, 50435, 50540, 50547, 50590, 50650, 50706, 50780, 50830, 51040, 51555, 51570, 52356, 52400, 52601, 53500, 53899, 54161, 55550, 57107, 57283, 58661, 58740, 58940, 58957, 60540, 62223, 88037, 93455, G0269,
7. **Lap prostate w/ or w/out robot:** 11626, 12045, 15115, 15275, 27045, 27049, 35840, 36246, 37211, 38542, 38700, 38765, 44137, 44150, 44238, 44310, 44603, 44800, 44955, 45562, 48999, 49000, 49323, 49325, 49326, 49400, 49402, 49585, 49606, 49651, 49659, 50393, 50432, 50525, 50544, 50605, 50800, 50815, 50820, 50860, 50940, 50947, 50948, 51050, 51101, 51520, 51530, 51555, 51575, 51590, 51595, 51596, 51597, 51800, 51820, 51980, 51992, 51999, 52649, 53020, 53215, 53400, 53410, 53431, 53440, 53449, 53899, 54057, 54405, 55600, 55650, 55810, 55812, 55815, 55840, 55842, 55845, 55865, 55876, 64581, 64590, 64910, 92950, 93454,
8. **Lap/Robotic hysterectomy:** 0171T, 0249T, 11042, 11056, 111, 11100, 112, 11200, 11301, 11302, 11307, 11400, 11402, 11403, 11404, 11406, 11420, 11423, 11470, 11623, 11624, 11721, 11730, 11954, 11976, 11980, 12015, 12041, 121, 13101, 14001, 14041, 14302, 15101, 15274, 15430, 15757, 15777, 15879, 17000, 17003, 19000, 19285, 19286, 19290, 19302, 19307, 19318, 19328, 19330, 19340, 19342, 19370, 20206, 20696, 20920, 22900, 22901, 23410, 24200, 27045, 27301, 28055, 28293, 28485, 28715, 33320, 35571, 35870, 36260, 36830, 37242, 37660, 38900, 38999, 43659, 43772, 43840, 44025, 44111, 44130, 44187, 44202, 44206, 44210, 44212, 44602, 44605, 44615, 44680, 44700, 44979, 45130, 45395, 45397, 45400, 45402, 45499, 45505, 45540, 45541, 45560, 45562, 45999, 46220, 46230, 46250, 46260, 46750, 46761, 46946, 46999, 47001, 47579, 49215, 49322, 49323, 49324, 49329, 49402, 49406, 49418, 49421, 49425, 49560, 49566, 49570, 49587, 49610, 49651, 49905, 50020, 50386, 50390, 50392, 50405, 50549, 50600, 50660, 50700, 50722, 50900, 50945, 50948, 51010, 51020, 51040, 51525, 51535, 51565, 51585, 51725, 51840, 51841, 51845, 51865, 51900, 51990, 52500, 52700, 53200, 53210, 53230, 53265, 53275, 53430, 53460, 53500, 53502, 53661, 53665, 55980, 56420, 56440, 56442, 56501, 56515, 56625, 56630, 56631, 56700, 56740, 56820, 56821, 57000, 57010, 57023, 57061, 57065, 57130, 57230, 57250, 57265, 57267, 57270, 57284, 57287, 57288, 57289, 57296, 57308, 57320, 57335, 57420, 57421, 57423, 57455, 57461, 57520, 57522, 57530, 57558, 57720, 58120, 58145, 58146, 58263, 58270, 58275, 58280, 58285, 58290, 58291, 58345, 58353, 58356, 58400, 58520, 58559, 58560, 58561, 58562, 58565, 58578, 58579, 58671, 58673, 58679, 58750, 58770, 58800, 58805, 58825, 58920, 58943, 58951, 58952, 58954,

58956, 58957, 58958, 58960, 58970, 59300, 59812, 59871, 60260, 60650, 62365, 64581, 64590, 64630, 64858, 64862, 64874, 97810, G0269, G0339, G0436,

9. **Lumbar laminotomy/laminectomy (posterior):** 0171T, 0172T, 0195T, 0274T, 0275T, 0334T, 10022, 10121, 10140, 111, 11200, 11400, 12021, 13102, 13133, 13152, 13160, 14301, 15271, 15731, 15770, 15933, 17003, 20220, 20251, 20661, 20665, 20900, 20957, 20975, 20985, 21210, 21600, 22015, 22100, 22101, 22103, 22110, 22112, 22116, 22206, 22207, 22208, 22212, 22214, 22216, 22224, 22226, 22305, 22315, 22325, 22326, 22327, 22328, 22505, 22510, 22511, 22512, 22513, 22514, 22515, 22521, 22522, 22524, 22525, 22526, 22532, 22533, 22534, 22551, 22554, 22556, 22586, 22600, 22612, 22614, 22630, 22632, 22633, 22634, 22800, 22802, 22804, 22808, 22810, 22812, 22818, 22840, 22841, 22842, 22843, 22844, 22846, 22848, 22852, 22855, 22856, 22857, 22861, 22862, 22899, 23930, 24120, 24358, 27279, 27280, 27830, 27840, 28220, 28496, 29999, 30903, 31500, 31603, 33405, 33533, 35184, 35221, 38206, 38220, 38221, 38230, 38241, 39220, 40831, 45520, 51102, 51710, 53601, 57461, 61510, 61795, 62230, 62272, 62280, 62282, 62287, 62305, 62351, 62360, 62362, 63001, 63003, 63012, 63015, 63016, 63017, 63035, 63040, 63043, 63044, 63050, 63051, 63055, 63056, 63057, 63064, 63076, 63077, 63078, 63081, 63082, 63087, 63088, 63090, 63091, 63101, 63102, 63103, 63173, 63185, 63190, 63200, 63250, 63252, 63265, 63266, 63267, 63268, 63270, 63271, 63272, 63273, 63276, 63277, 63278, 63281, 63282, 63287, 63650, 63655, 63661, 63662, 63685, 63688, 63702, 63707, 63709, 63710, 64595, 64622, 64623, 64626, 64627, 64635, 64636, 64714, 64718, 64719, 64911, 69930, 90870, 92973, 92982, 93567, 95961, 95962, G0283, G0436,
10. **Lumpectomy w/ and w/out SLNB:** 0239T, 10120, 10140, 11000, 11300, 11301, 11306, 11403, 11404, 11406, 11421, 11426, 11450, 11622, 11642, 11900, 11952, 11954, 11970, 11971, 11976, 12031, 12037, 13102, 13151, 14020, 14021, 14041, 14060, 14301, 15003, 15130, 15170, 15200, 15260, 15272, 15273, 15330, 15570, 15650, 15734, 15740, 15777, 15879, 19000, 19081, 19082, 19083, 19084, 19085, 19086, 19100, 19126, 19271, 19282, 19284, 19296, 19297, 19298, 19305, 19306, 19324, 19325, 19328, 19330, 19340, 19355, 19361, 19366, 19371, 19499, 20660, 20926, 21012, 21014, 21501, 21550, 21552, 21554, 21557, 21558, 21630, 21930, 21931, 22900, 22901, 22903, 23071, 23076, 25075, 26990, 27337, 27610, 28515, 28525, 30465, 30930, 31720, 33284, 35216, 35246, 35800, 35820, 37182, 37766, 38300, 38305, 38308, 38700, 38724, 38746, 39220, 42410, 44005, 46270, 46288, 46922, 49320, 49555, 50389, 55876, 56405, 58120, 58262, 58561, 58562, 58563, 58660, 59820, 60220, 60240, 60252, 60512, 61108, 61592, 62350, 64492, 64633, 67028, 67210, 67840, 68525, 77785, 77786, 79005, 92920, 92950, 97811, 97813, 97814, 99183, C9728, G0300,
11. **Open inguinal hernia repair:** 0078T, 0079T, 0080T, 0081T, 11005, 11008, 11042, 11046, 11055, 11201, 11300, 11306, 11307, 11310, 11421, 11422, 11424, 11426, 11443, 11444, 11446, 11463, 11471, 11601, 11604, 11606, 11640, 11641, 11642, 11643, 11771, 12001,

12002, 12013, 12031, 12044, 13121, 14301, 15220, 15221, 15271, 15400, 15431, 15736, 15738, 15877, 17262, 19101, 19300, 19307, 19342, 19364, 19371, 19380, 20000, 20005, 20102, 20922, 21012, 21615, 21920, 21931, 21932, 21933, 22900, 22905, 23071, 23397, 23412, 24071, 24075, 24200, 25065, 25071, 25111, 25115, 26055, 26105, 26160, 26235, 26426, 26990, 27035, 27041, 27043, 27059, 27065, 27087, 27098, 27245, 27324, 27326, 27328, 27337, 27339, 27599, 27614, 27618, 27899, 28001, 28039, 28047, 30140, 32555, 33210, 33234, 33249, 33967, 34803, 34812, 35226, 35286, 35301, 35302, 35371, 35565, 35583, 35585, 35646, 35656, 35665, 35860, 35883, 36005, 36247, 36475, 36821, 36832, 37202, 37204, 37212, 37236, 37766, 37785, 38221, 38505, 38510, 38564, 38571, 38745, 38760, 39540, 42804, 43107, 43335, 43458, 43610, 43659, 43752, 43773, 44010, 44050, 44121, 44155, 44180, 44340, 44626, 44820, 44850, 45395, 45505, 45905, 46030, 46040, 46080, 46200, 46221, 46255, 46505, 46700, 46754, 46917, 46922, 46947, 47379, 47380, 47505, 47560, 47780, 48120, 49010, 49082, 49083, 49204, 49205, 49255, 49325, 49400, 49421, 49422, 49435, 49491, 49492, 49495, 49500, 49501, 49507, 49520, 49521, 49525, 49550, 49555, 49582, 49590, 49659, 49900, 49905, 50040, 50220, 50325, 50360, 50385, 50393, 50395, 50398, 50728, 51045, 51597, 51999, 52647, 52648, 52649, 53410, 53440, 53445, 53447, 53449, 53450, 53500, 53852, 54055, 54057, 54060, 54100, 54150, 54161, 54162, 54163, 54235, 54300, 54360, 54401, 54406, 54408, 54410, 54415, 54416, 54500, 54505, 54512, 54520, 54535, 54550, 54620, 54640, 54660, 54690, 54800, 54830, 54840, 54861, 55100, 55150, 55175, 55180, 55400, 55500, 55530, 55540, 55559, 55810, 55815, 55821, 55831, 55845, 55875, 56810, 57065, 57120, 57135, 57200, 57220, 57267, 57282, 57284, 57296, 57540, 57550, 58140, 58152, 58540, 58559, 58565, 58578, 58600, 58662, 58954, 59514, 59515, 62270, 62361, 64520, 64702, 64708, 64740, 64752, 64755, 64766, 64771, 64772, 64786, 64795, 64999, 68815, 69100, 69110, 92928, 92973, 92980, 96567, C1300, G0283,

12. **Open Lung Lobectomy:** 11721, 19260, 19272, 20101, 21556, 21632, 21811, 31600, 31805, 31899, 32095, 32096, 32098, 32100, 32120, 32124, 32141, 32220, 32225, 32310, 32405, 32421, 32440, 32488, 32500, 32501, 32503, 32504, 32505, 32506, 32507, 32555, 32608, 32609, 32667, 32668, 32669, 32670, 32674, 32900, 32940, 32997, 32998, 32999, 33020, 33025, 33030, 33050, 33335, 33518, 33530, 33572, 33724, 33917, 33925, 33999, 34201, 35201, 35211, 35271, 37620, 38381, 38542, 42826, 43101, 43335, 43640, 49203, 49568, 53620, 58150, 60521, 60522, 62281, 63085, 64492, 93503,

13. **Parathyroidectomy:** 11101, 11305, 11403, 11420, 11440, 11643, 11644, 11720, 12051, 13132, 13133, 15175, 15576, 15740, 20100, 20926, 21016, 21453, 21501, 30117, 31365, 31367, 31750, 31780, 31786, 31800, 32673, 35201, 35701, 36011, 36522, 36625, 37700, 37761, 37785, 38500, 38525, 38720, 38724, 39000, 39010, 41100, 42104, 42106, 42182, 42420, 42500, 42505, 42699, 43450, 46261, 46922, 49561, 57283, 58552, 60100, 60200,

60210, 60212, 60225, 60254, 60270, 60271, 60280, 60281, 60300, 60502, 60520, 60600, 60659, 60699, 64553, 64555, 64716, 64788, 69205, 69505, 69540, 99490,

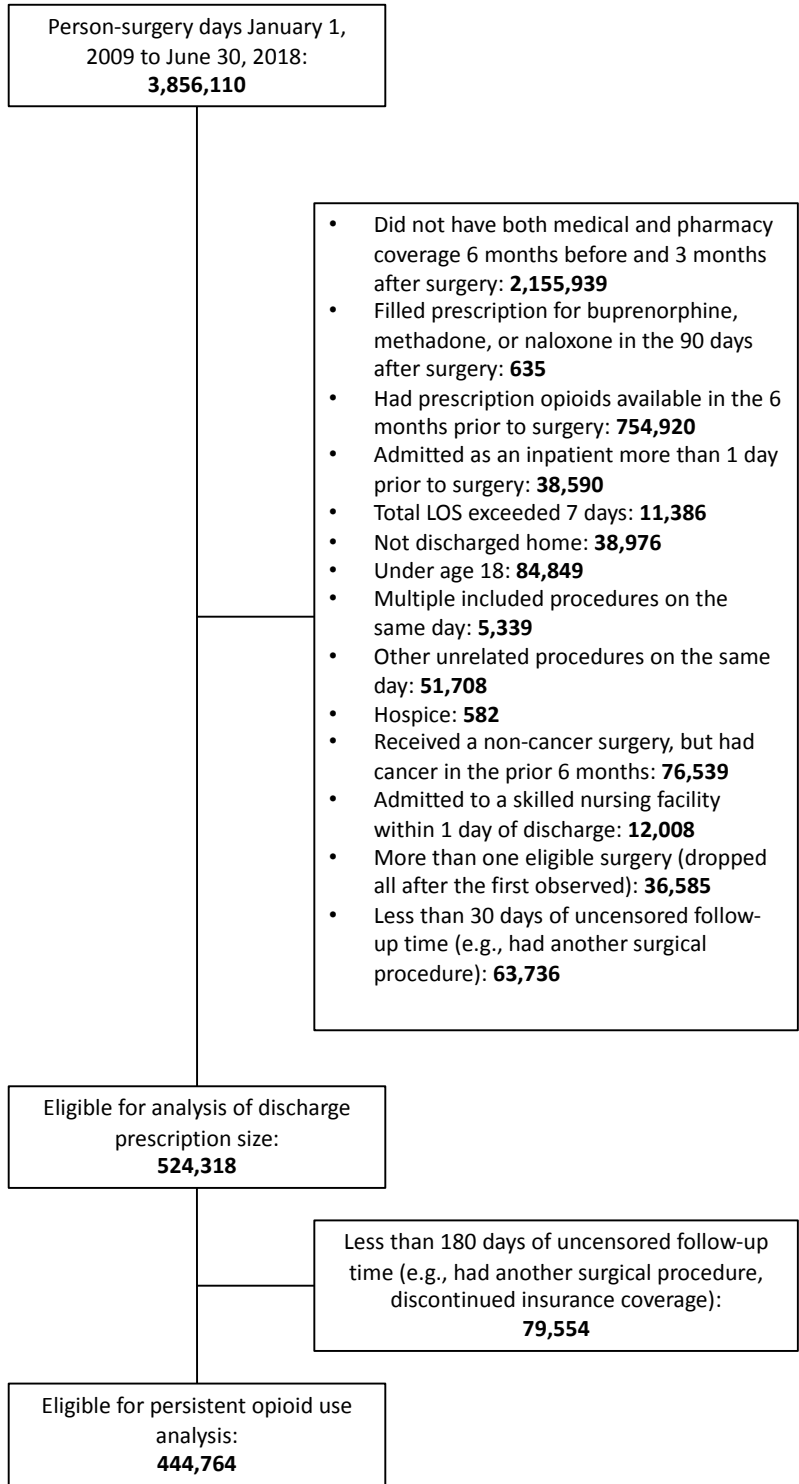
14. **Partial colectomy w/ or w/out stoma:** 11006, 11043, 11401, 11404, 11601, 12006, 12014, 12051, 12054, 14302, 15170, 15171, 15274, 15830, 15920, 19020, 19307, 20102, 20525, 20690, 21620, 22904, 22905, 22999, 23500, 25020, 25575, 25605, 25609, 25670, 25676, 26765, 26990, 27086, 27220, 27766, 27810, 32110, 33213, 33315, 33910, 34401, 34502, 35226, 35236, 35572, 35654, 35661, 36148, 36248, 36251, 36253, 36260, 36299, 36800, 37191, 37236, 37243, 37244, 37617, 37799, 38101, 38102, 38115, 38120, 38999, 39541, 39545, 43122, 43282, 43327, 43332, 43415, 43500, 43605, 43610, 43611, 43620, 43621, 43631, 43632, 43633, 43634, 43635, 43653, 43760, 43774, 43800, 43830, 43848, 43860, 43880, 44010, 44020, 44021, 44025, 44055, 44125, 44126, 44135, 44137, 44147, 44151, 44155, 44204, 44227, 44300, 44314, 44340, 44345, 44346, 44603, 44604, 44625, 44626, 44640, 44661, 44680, 44700, 44701, 44799, 44820, 44850, 44900, 44960, 45020, 45100, 45110, 45111, 45112, 45113, 45123, 45126, 45171, 45172, 45399, 45402, 45550, 45800, 45915, 46050, 46060, 46320, 46740, 47010, 47122, 47125, 47300, 47350, 47360, 47361, 47370, 47380, 47382, 47399, 47480, 47490, 47510, 47610, 47630, 47760, 48120, 48140, 48145, 48155, 48500, 48545, 49002, 49021, 49040, 49060, 49061, 49080, 49083, 49084, 49203, 49250, 49321, 49405, 49419, 49420, 49421, 49440, 49521, 49566, 49585, 49606, 49659, 49904, 49999, 50075, 50500, 50605, 50715, 50727, 50760, 50825, 50840, 50947, 51040, 51550, 51565, 51590, 51800, 51900, 51960, 53502, 53899, 55250, 56606, 56620, 57105, 57110, 57267, 57282, 57283, 57295, 57300, 57305, 57307, 58140, 58180, 58200, 58210, 58240, 58542, 58558, 58611, 58672, 58700, 58760, 58805, 58823, 58900, 58925, 58950, 58951, 58952, 58953, 58954, 58956, 58958, 58960, 58999, 59510, 60545, 840, 96910, 99183,
15. **Rotator Cuff Surgery:** 0263T, 10040, 11047, 11055, 11403, 11623, 12002, 12011, 15330, 15777, 15879, 19125, 19290, 19291, 20103, 20205, 20206, 20245, 20526, 20611, 20827, 20902, 20924, 20975, 21320, 21330, 21555, 21899, 21931, 22903, 23000, 23020, 23030, 23031, 23040, 23044, 23065, 23066, 23073, 23075, 23077, 23078, 23101, 23105, 23106, 23107, 23125, 23130, 23140, 23150, 23156, 23170, 23180, 23182, 23200, 23210, 23330, 23331, 23333, 23334, 23395, 23405, 23406, 23415, 23450, 23455, 23460, 23462, 23465, 23466, 23470, 23480, 23485, 23491, 23530, 23550, 23552, 23585, 23600, 23615, 23616, 23625, 23655, 23660, 23665, 23670, 23800, 24065, 24066, 24116, 24301, 24340, 24341, 24343, 24357, 24359, 24430, 24515, 24999, 25071, 25116, 25215, 25295, 25320, 25420, 25530, 26055, 26060, 26080, 26115, 26145, 26210, 26410, 26432, 26480, 26842, 27236, 27337, 27380, 27418, 27570, 27630, 27698, 27781, 27823, 27824, 27826, 27827, 27828, 27829, 27899, 28086, 28090, 28108, 28297, 28298, 28299, 28310, 28600, 28730, 29824, 29828, 29866, 29873, 29999, 32405, 33967, 35302, 35372, 36475, 38220, 38232, 38243,

42900, 47362, 49587, 57106, 62350, 62360, 64510, 66821, 69436, 93458, 95920, 96910, G0460,

16. **Simple Mastectomy w/out reconstruction:** 0239T, 0245T, 10160, 10180, 11045, 11046, 11100, 11101, 11303, 11311, 11402, 11420, 11440, 11450, 11601, 11603, 11640, 11900, 11901, 11921, 11971, 12007, 12011, 12031, 12036, 12037, 12042, 12047, 12057, 13100, 13102, 13133, 14001, 14021, 15003, 15004, 15005, 15100, 15110, 15111, 15130, 15131, 15150, 15151, 15170, 15171, 15175, 15200, 15201, 15272, 15277, 15278, 15300, 15301, 15330, 15331, 15335, 15340, 15341, 15361, 15400, 15401, 15570, 15600, 15732, 15757, 15758, 15839, 15850, 15877, 17111, 19020, 19100, 19102, 19103, 19120, 19125, 19126, 19281, 19283, 19285, 19286, 19287, 19288, 19295, 19297, 19298, 19305, 19306, 19318, 19324, 19361, 19367, 19368, 19369, 19370, 20102, 20200, 20240, 20910, 21026, 21557, 21700, 21899, 21932, 22899, 22902, 22903, 23395, 27645, 27759, 31599, 32422, 32550, 32820, 33284, 34051, 34520, 34530, 35236, 35246, 35251, 35875, 35876, 36262, 37202, 37616, 38308, 3852, 38520, 38530, 38550, 38555, 38720, 38745, 42962, 44139, 49010, 49561, 49904, 58291, 58925, 62230, 64633, 64713, 64722, 64727, 64784, 64857, 64893, 64898, 64911, 67314, 67917, 69145, 75756, 88037, 92240, 97597, 97598, 97811, C5271, C5274, C9728,
17. **TKA:** 0054T, 11056, 11300, 11406, 11719, 11720, 11721, 11952, 120, 12032, 12034, 12035, 12037, 13120, 13152, 15331, 15738, 20240, 20245, 20520, 20690, 20902, 20930, 20938, 20983, 21930, 22840, 22851, 24101, 25000, 25607, 25800, 26116, 26437, 26517, 26548, 27090, 27100, 27137, 27147, 27170, 27200, 27240, 27266, 27305, 27310, 27324, 27329, 27330, 27331, 27332, 27333, 27339, 27350, 27355, 27356, 27358, 27364, 27385, 27386, 27391, 27392, 27393, 27394, 27409, 27412, 27418, 27422, 27425, 27428, 27429, 27430, 27438, 27440, 27442, 27443, 27445, 27454, 27455, 27457, 27465, 27470, 27472, 27477, 27486, 27487, 27488, 27497, 27511, 27514, 27524, 27536, 27556, 27558, 27599, 27605, 27619, 27632, 27637, 27640, 27645, 27687, 27709, 27720, 27740, 27745, 27810, 28010, 28041, 28122, 28232, 28270, 28307, 28755, 30560, 33210, 34203, 35151, 35256, 35303, 35305, 35556, 35741, 36012, 37191, 37226, 38240, 42410, 51102, 54001, 60000, 62273, 63700, 64455, 64774, 67500, 68761, 92980, 93454, G0299,
18. **Total hip:** 0055T, 0263T, 10061, 11401, 12001, 12004, 12034, 12035, 12052, 121, 15852, 20900, 20936, 24130, 24332, 24545, 24685, 25545, 25600, 25905, 26992, 27000, 27005, 27025, 27027, 27033, 27036, 27048, 27054, 27060, 27062, 27066, 27070, 27071, 27076, 27090, 27100, 27110, 27120, 27125, 27132, 27134, 27138, 27140, 27146, 27147, 27151, 27156, 27161, 27165, 27187, 27216, 27217, 27220, 27226, 27227, 27230, 27235, 27238, 27244, 27248, 27252, 27254, 27259, 27265, 27269, 27275, 27305, 27357, 27360, 27365, 27397, 27437, 27450, 27466, 27487, 27495, 27506, 27507, 27570, 27619, 27705, 27786, 28116, 28400, 31720, 35721, 36246, 37618, 46210, 5371, 58615, 62282, 64415, 64520, 64712, 64718, 66761, 68750, 8028, 92941, 92973, 93455, 97810, 97811, G0299, G0415,

19. **VATS Wedge:** 15732, 21558, 21810, 21811, 30100, 31899, 32096, 32097, 32100, 32124, 32141, 32215, 32405, 32482, 32484, 32507, 32550, 32555, 32607, 32609, 32669, 32670, 32672, 32673, 32815, 33030, 33322, 33533, 35022, 35276, 39200, 39501, 39540, 39545, 39560, 39561, 39599, 42415, 43101, 47130, 49406, 49422, 58662, 60659, 62355, 64746, 79005,
20. **Whipple, open:** 17999, 35221, 35231, 35251, 35281, 35341, 35521, 35572, 37565, 38100, 38102, 42000, 43246, 43332, 43520, 43820, 43832, 43860, 43870, 44120, 44130, 4465, 44970, 45800, 47420, 47460, 47700, 47711, 47715, 47741, 47760, 47765, 47785, 47801, 47999, 48100, 48140, 48152, 48400, 48510, 48999, 49020, 49327, 49440, 50230, 50240, 77786,

Appendix C: Cohort flow chart.



Appendix D: Complete cohort characteristics for main study cohort (patients with at least 180 days of uncensored follow-up)

	All patients		No opioid fill		Tramadol only		Other short-acting		Tramadol + other short-acting		Any long-acting	
	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N
Category Total	100.0	444,764	19.5	86,880	3.0	13,519	74.9	333,289	1.2	5,457	1.3	5,619
Sex												
Male	51.0	226,909	47.9	41,624	37.9	5,130	52.3	174,368	46.6	2,543	57.7	3,244
Female	49.0	217,855	52.1	45,256	62.1	8,389	47.7	158,921	53.4	2,914	42.3	2,375
Age												
18-24	3.7	16,282	3.1	2,695	2.1	281	3.9	13,007	1.9	105	3.5	194
25-34	7.0	30,914	4.9	4,237	5.5	741	7.7	25,553	3.4	184	3.5	199
35-44	13.0	57,936	9.7	8,437	9.8	1,329	14.2	47,371	6.8	369	7.7	430
45-54	21.5	95,802	18.6	16,180	17.5	2,366	22.6	75,207	15.4	839	21.5	1,210
55-64	25.4	112,956	23.8	20,690	24.8	3,349	25.6	85,400	28.1	1,532	35.3	1,985
65-74	19.4	86,476	23.6	20,479	24.7	3,340	17.9	59,696	30.5	1,666	23.1	1,295
75+	10.0	44,398	16.3	14,162	15.6	2,113	8.1	27,055	14.0	762	5.5	306
Race/ethnicity												
White	78.3	348,275	77.5	67,365	76.4	10,325	78.4	261,329	83.1	4,533	84.1	4,723
Black	7.8	34,758	7.9	6,873	6.9	931	7.9	26,270	6.1	334	6.2	350
Hispanic	8.4	37,474	8.7	7,535	11.7	1,577	8.3	27,801	5.8	316	4.4	245
Asian	2.3	10,043	2.3	2,030	1.8	245	2.3	7,589	1.4	74	1.9	105
Unknown/Other	3.2	14,214	3.5	3,077	3.3	441	3.1	10,300	3.7	200	3.5	196
Census Division												
New England	4.0	17,696	4.8	4,139	2.5	343	3.9	12,929	1.7	92	3.4	193
Mid Atlantic	6.6	29,330	7.3	6,378	5.5	737	6.5	21,798	4.3	235	3.2	182
East North Central	18.7	83,253	18.0	15,657	19.0	2,562	18.7	62,201	25.0	1,364	26.1	1,469
West North Central	14.7	65,309	18.3	15,921	12.6	1,706	13.7	45,658	17.4	948	19.2	1,076
South Atlantic	25.4	112,763	23.9	20,769	23.5	3,172	26.1	86,811	19.2	1,047	17.2	964

	All patients		No opioid fill		Tramadol only		Other short-acting		Tramadol + other short-acting		Any long-acting	
	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N
East South Central	3.9	17,369	3.7	3,193	1.9	256	4.1	13,664	2.3	127	2.3	129
West South Central	11.8	52,518	10.0	8,642	23.3	3,153	11.9	39,682	14.3	781	4.6	260
Mountain	9.3	41,421	8.5	7,344	8.2	1,103	9.4	31,397	11.8	642	16.6	935
Pacific/Unk/Other	5.6	25,105	5.6	4,837	3.6	487	5.8	19,149	4.1	221	7.3	411
Coverage type												
Commercial	72.3	321,365	61.6	53,479	61.8	8,348	75.7	252,186	58.5	3,194	74.0	4,158
Medicare—aged	25.9	115,000	36.2	31,441	36.4	4,915	22.5	75,138	39.8	2,172	23.7	1,334
Medicare—disabled	1.9	8,399	2.3	1,960	1.9	256	1.8	5,965	1.7	91	2.3	127
Surgery												
Carpal tunnel release	7.6	33,730	10.9	9,475	8.6	1,167	6.9	22,984	1.5	84	0.4	20
Knee arthroscopic minesectiony (scope)	20.3	90,064	17.5	15,229	13.8	1,869	21.5	71,764	9.5	516	12.2	686
Lap chole w/ and w/out IOC	23.7	105,346	24.5	21,264	22.7	3,068	24.2	80,598	7.0	380	0.6	36
Lap inguinal hernia repair	5.6	24,806	5.1	4,463	3.4	453	5.9	19,800	1.4	75	0.3	15
Lap low anterior resection w/o or w/out stoma	0.3	1,132	0.4	368	0.4	48	0.2	710	–	–	–	–
Lap nephrectomy partial or total	0.4	1,733	0.5	429	0.5	68	0.4	1,217	–	–	–	–
Lap prostate w/ or w/out robot	2.0	8,804	1.8	1,561	4.5	608	2.0	6,601	–	–	–	–
Lap/Robotic hysterectomy	0.7	3,042	1.0	845	0.8	103	0.6	2,069	–	–	–	–
Lumbar laminotomy/laminectomy (posterior)	3.8	16,695	4.2	3,653	4.7	635	3.7	12,159	2.3	126	2.2	122
Lumpectomy w/ and w/out SLNB	3.9	17,181	5.4	4,673	6.3	846	3.5	11,593	1.0	57	0.2	12
Open Lung Lobectomy	0.2	767	0.2	153	0.2	31	0.2	553	0.2	13	0.3	17
Open inguinal hernia	9.7	43,052	8.5	7,345	5.4	734	10.4	34,779	3.1	171	0.4	23

	All patients		No opioid fill		Tramadol only		Other short-acting		Tramadol + other short-acting		Any long-acting	
	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent	N
repair												
Parathyroidectomy	1.3	5,872	2.9	2,532	1.2	156	1.0	3,176	–	–	–	–
Partial colectomy w/ or w/out stoma	0.4	1,694	0.7	636	0.4	53	0.3	1,000	–	–	–	–
Rotator Cuff Surgery	5.1	22,587	3.4	2,920	2.0	274	5.3	17,811	5.3	291	23.0	1,291
Simple Mastectomy w/out reconstruction	1.0	4,317	1.5	1,336	1.1	145	0.8	2,807	–	–	–	–
TKA	9.1	40,250	6.5	5,621	13.2	1,786	8.4	28,061	43.6	2,379	42.8	2,403
Total hip	5.2	23,068	4.8	4,190	10.7	1,441	4.6	15,213	23.0	1,255	17.3	969
Other	0.1	624	0.2	187	0.3	34	0.1	394	–	–	–	–
Depression comorbidity	2.8	12,349	2.7	2,331	3.4	460	2.7	9,074	4.7	255	4.1	229
Obesity	4.3	18,897	4.0	3,438	5.4	725	4.1	13,571	11.7	637	9.4	526
Diagnosis of Rheumatoid Arthritis or other collagen disorder	1.3	5,607	1.5	1,298	2.0	272	1.1	3,804	2.2	121	2.0	112

– Cell value suppressed to preserve patient deidentification; IOC: intraoperative cholangiogram; chole: cholecystectomy TKA: Total Knee Arthroplasty; w/: with; SNLB: sentinel lymph node biopsy; Lap: laparoscopic

Appendix E: Cohort characteristics for all patients with at least 30 days of uncensored follow-up

	All patients		No opioid fill		Tramadol only		Other short-acting		Tramadol + other short-acting		Any long-acting	
	col%	N	col%	N	col%	N	col%	N	col%	N	col%	N
Total (Row% / N)	100	524,318	19.7	103,117	3.1	16,059	74.7	391,922	1.2	6,483	1.3	6,737
Sex												
Female	49.4	258,956	52.4	54,017	62.4	10,014	48.1	188,585	53.4	3,459	42.8	2,881
Age												
18-24	3.5	18,582	3.0	3,121	2.0	323	3.8	14,800	1.9	121	3.2	217
25-34	7.0	36,426	4.9	5,055	5.6	893	7.7	30,028	3.3	213	3.5	237
35-44	12.8	67,230	9.6	9,919	9.7	1,549	14.0	54,807	6.7	434	7.7	521
45-54	21.4	112,326	18.5	19,039	17.6	2,829	22.5	88,025	15.5	1,006	21.2	1,427
55-64	25.7	134,826	24.0	24,718	25.3	4,063	26.0	101,756	28.9	1,873	35.9	2,416
65-74	19.7	103,177	23.9	24,602	24.6	3,943	18.1	71,101	30.5	1,975	23.1	1,556
75+	9.9	51,751	16.2	16,663	15.3	2,459	8.0	31,405	13.3	861	5.4	363
Race/ethnicity												
White	78.3	410,567	77.6	79,975	76.7	12,315	78.4	307,267	82.7	5,359	83.9	5,651
Black	7.9	41,344	7.9	8,185	6.9	1,103	8.0	31,222	6.3	406	6.4	428
Hispanic	8.4	43,983	8.6	8,893	11.4	1,836	8.3	32,558	6.2	400	4.4	296
Asian	2.3	11,799	2.4	2,426	1.8	287	2.3	8,875	1.3	85	1.9	126
Unknown/Other	3.2	16,625	3.5	3,638	3.2	518	3.1	12,000	3.6	233	3.5	236
Census Division												
New England	3.9	20,638	4.7	4,843	2.5	402	3.8	15,047	1.6	105	3.6	241
Mid Atlantic	6.5	34,304	7.4	7,586	5.3	853	6.5	25,360	4.4	285	3.3	220
East North Central	18.5	97,078	17.7	18,206	18.7	3,006	18.5	72,542	24.8	1,606	25.5	1,718
West North Central	14.8	77,441	18.8	19,384	12.7	2,039	13.7	53,619	17.5	1,136	18.8	1,263
South Atlantic	25.4	133,346	23.9	24,637	23.4	3,761	26.2	102,570	18.8	1,219	17.2	1,159
East South Central	4.0	20,864	3.7	3,816	2.0	327	4.2	16,413	2.4	153	2.3	155

	All patients		No opioid fill		Tramadol only		Other short-acting		Tramadol + other short-acting		Any long-acting	
	col%	N	col%	N	col%	N	col%	N	col%	N	col%	N
West South Central	12.0	62,728	10.1	10,384	23.6	3,797	12.1	47,272	14.9	968	4.6	307
Mountain	9.3	48,676	8.4	8,648	8.0	1,291	9.4	36,807	11.6	751	17.5	1,179
Pacific/Unk/Other	5.6	29,243	5.4	5,613	3.6	583	5.7	22,292	4.0	260	7.4	495
Coverage type												
Commercial	72.5	380,125	61.8	63,735	62.6	10,047	75.9	297,419	59.9	3,886	74.8	5,038
Medicare—aged	25.6	134,194	35.9	37,048	35.5	5,705	22.3	87,411	38.3	2,484	23.0	1,546
Medicare—disabled	1.9	9,999	2.3	2,334	1.9	307	1.8	7,092	1.7	113	2.3	153
Surgery												
Carpal tunnel release	8.1	42,264	11.3	11,631	9.2	1,480	7.4	29,023	1.7	108	0.3	22
Knee arthroscopic minesectomy (scope)	19.9	104,125	17.1	17,661	13.7	2,194	21.2	82,879	9.2	595	11.8	796
Lap chole w/ and w/out IOC	23.5	123,262	24.4	25,182	22.7	3,650	24.0	93,928	7.1	458	0.7	44
Lap inguinal hernia repair	5.4	28,401	4.9	5,075	3.3	528	5.8	22,701	1.3	81	0.2	16
Lap low anterior resection w/o or w/out stoma	0.3	1,525	0.5	476	0.4	70	0.3	972				
Lap nephrectomy partial or total	0.4	2,166	0.5	530	0.5	84	0.4	1,532				
Lap prostate w/ or w/out robot	1.9	10,042	1.7	1,798	4.3	696	1.9	7,509				
Lap/Robotic hysterectomy	0.7	3,642	1.0	1,010	0.7	115	0.6	2,489				
Lumbar laminotomy/ laminectomy (posterior)	3.8	19,916	4.3	4,452	4.6	742	3.7	14,425	2.3	150	2.2	147
Lumpectomy w/ and w/out SLNB	4.0	20,958	5.5	5,680	6.3	1,003	3.6	14,191	1.1	71	0.2	13
Open Lung Lobectomy	0.2	983	0.2	198	0.2	38	0.2	707	0.3	17	0.3	23
Open inguinal hernia repair	9.4	49,209	8.3	8,511	5.3	851	10.1	39,626	3.0	192	0.4	29

	All patients		No opioid fill		Tramadol only		Other short-acting		Tramadol + other short-acting		Any long-acting	
	col%	N	col%	N	col%	N	col%	N	col%	N	col%	N
Parathyroidectomy	1.3	6,817	2.8	2,929	1.1	177	0.9	3,702				
Partial colectomy w/ or w/out stoma	0.4	2,250	0.8	835	0.4	62	0.3	1,344				
Rotator Cuff Surgery	5.0	26,185	3.3	3,407	2.0	323	5.3	20,634	5.2	336	22.0	1,485
Simple Mastectomy w/out reconstruction	1.1	5,595	1.6	1,658	1.2	197	0.9	3,699	0.4	28	0.2	13
TKA	9.4	49,064	6.7	6,894	13.3	2,130	8.7	34,176	44.4	2,876	44.4	2,988
Total hip	5.2	27,104	4.8	4,949	10.4	1,673	4.6	17,873	22.6	1,466	17.0	1,143
Other	0.2	810	0.2	241	0.3	46	0.1	512				
Depression comorbidity	2.9	15,106	2.8	2,836	3.6	576	2.8	11,099	4.7	305	4.3	290
Obesity	4.4	22,918	4.1	4,203	5.4	867	4.2	16,423	11.9	773	9.7	652
Diagnosis of Rheumatoid Arthritis or other collagen disorder	1.3	6,844	1.5	1,591	2.0	322	1.2	4,641	2.3	148	2.1	142

Appendix F: Complete regression results

	CONSORT chronic opioid dependence	Persistent opioid use after surgery	Additional opioid use after surgery
Post-surgery opioid category			
Any long-acting opioid	1.709 [1.397,2.090]	1.191 [1.029,1.377]	0.945 [0.861,1.036]
Tramadol only	1.424 [1.120,1.811]	1.499 [1.283,1.751]	1.071 [1.002,1.144]
Tramadol plus another short-acting opioid	1.408 [1.094,1.813]	1.038 [0.870,1.238]	1.057 [0.962,1.162]
Non-tramadol short-acting opioid only	Ref	Ref	Ref
Year			
YR=2009	Ref	Ref	Ref
YR=2010	0.985 [0.843,1.152]	0.952 [0.850,1.067]	0.934 [0.893,0.977]
YR=2011	0.615 [0.512,0.739]	0.738 [0.651,0.837]	0.626 [0.595,0.658]
YR=2012	0.605 [0.504,0.726]	0.665 [0.585,0.755]	0.621 [0.590,0.653]
YR=2013	0.604 [0.503,0.725]	0.634 [0.557,0.721]	0.586 [0.557,0.617]
YR=2014	0.509 [0.418,0.620]	0.638 [0.560,0.728]	0.532 [0.504,0.562]
YR=2015	0.415 [0.338,0.509]	0.496 [0.433,0.568]	0.493 [0.467,0.520]
YR=2016	0.365 [0.299,0.446]	0.43 [0.376,0.492]	0.466 [0.442,0.491]
YR=2017	0.273 [0.224,0.332]	0.357 [0.314,0.406]	0.524 [0.500,0.550]
Surgery			
Carpal tunnel release	Ref	Ref	Ref
Knee arthroscopic	0.489	0.602	0.689

	CONSORT		
	chronic opioid dependence	Persistent opioid use after surgery	Additional opioid use after surgery
minesectomy (scope)			
	[0.382,0.626]	[0.504,0.718]	[0.653,0.727]
Lap chole w/ and w/out IOC	0.504	0.456	0.639
	[0.399,0.637]	[0.382,0.545]	[0.607,0.674]
Lap inguinal hernia repair	0.444	0.347	0.535
	[0.301,0.653]	[0.251,0.480]	[0.494,0.581]
Lap low anterior resection w/o or w/out stoma	1.953	2.493	1.028
	[0.950,4.014]	[1.521,4.085]	[0.810,1.305]
Lap nephrectomy partial or total	1.56	1.423	0.723
	[0.829,2.938]	[0.868,2.332]	[0.586,0.890]
Lap prostate w/ or w/out robot	0.338	0.413	0.476
	[0.189,0.605]	[0.275,0.620]	[0.423,0.536]
Lap/Robotic hysterectomy	0.895	1.026	0.813
	[0.451,1.778]	[0.644,1.634]	[0.694,0.954]
Lumbar laminotomy/laminectomy (posterior)	2.143	2.398	1.032
	[1.644,2.793]	[1.980,2.904]	[0.957,1.112]
Lumpectomy w/ and w/out SLNB	0.75	0.802	0.887
	[0.523,1.074]	[0.619,1.038]	[0.822,0.956]
Open Lung Lobectomy	3.348	3.7	1.109
	[1.979,5.665]	[2.506,5.462]	[0.878,1.401]
Open inguinal hernia repair	0.535	0.522	0.557
	[0.399,0.718]	[0.417,0.653]	[0.521,0.595]
Parathyroidectomy	0.649	0.629	0.649
	[0.340,1.241]	[0.388,1.019]	[0.563,0.748]
Partial colectomy w/ or w/out stoma	2.199	2.701	1.094
	[1.267,3.819]	[1.843,3.958]	[0.905,1.324]
Rotator Cuff Surgery	1.084	1.992	0.926
	[0.821,1.431]	[1.656,2.395]	[0.864,0.993]
Simple Mastectomy w/out reconstruction	1.448	1.759	1.21
	[0.913,2.296]	[1.285,2.408]	[1.076,1.360]
TKA	1.448	1.759	1.21
	[0.913,2.296]	[1.285,2.408]	[1.076,1.360]

	CONSORT chronic opioid dependence	Persistent opioid use after surgery	Additional opioid use after surgery
Total hip	0.819 [0.607,1.104]	1.129 [0.922,1.382]	0.663 [0.615,0.715]
VATS Wedge	0.819 [0.607,1.104]	1.129 [0.922,1.382]	0.663 [0.615,0.715]
Whipple, open		0.886 [0.126,6.226]	0.888 [0.446,1.766]
Female	1.067 [0.960,1.186]	1.186 [1.106,1.272]	1.22 [1.185,1.255]
Insurance group			
Commercial	Ref	Ref	Ref
Aged Medicare	1.092 [0.845,1.413]	1.132 [0.957,1.339]	0.96 [0.895,1.030]
Disabled Medicare	3.426 [2.799,4.194]	2.733 [2.357,3.170]	1.879 [1.743,2.025]
Race/Ethnicity			
White	Ref	Ref	Ref
Black	1.155 [0.986,1.353]	1.456 [1.316,1.611]	1.247 [1.195,1.302]
Hispanic	0.77 [0.623,0.951]	1.072 [0.943,1.218]	0.982 [0.936,1.030]
Asian	0.873 [0.605,1.259]	0.946 [0.738,1.212]	0.797 [0.723,0.880]
Unk/other	0.873 [0.605,1.259]	0.946 [0.738,1.212]	0.797 [0.723,0.880]
Census Division			
New England	Ref	Ref	Ref
Mid Atlantic	1.116 [0.752,1.657]	1.03 [0.797,1.332]	0.943 [0.859,1.035]
East North Central	1.566 [1.125,2.180]	1.495 [1.208,1.849]	1.292 [1.196,1.397]
West North Central	1.538 [1.100,2.150]	1.279 [1.028,1.591]	1.239 [1.144,1.342]
South Atlantic	1.828 [1.320,2.530]	1.576 [1.278,1.943]	1.376 [1.275,1.485]
East South Central	1.909 [1.307,2.787]	1.829 [1.429,2.342]	1.619 [1.476,1.776]
West South Central	1.869	1.873	1.672

	CONSORT chronic opioid dependence	Persistent opioid use after surgery	Additional opioid use after surgery
Mountain	[1.325,2.637] 1.576	[1.503,2.335] 1.399	[1.544,1.812] 1.352
Pacific	[1.113,2.230] 1.765	[1.117,1.752] 1.381	[1.244,1.469] 1.195
Unk/Other	[1.214,2.566] 5.109	[1.076,1.771] 2.955	[1.089,1.310] 1.685
Age group	[2.184,11.95]	[1.484,5.886]	[1.233,2.303]
18-24	Ref	Ref	Ref
25-34	5.684 [2.285,14.14]	5.982 [3.033,11.80]	1.101 [1.005,1.206]
35-44	6.648 [2.727,16.21]	6.987 [3.598,13.57]	1.155 [1.062,1.256]
45-54	9.187 [3.798,22.23]	9.458 [4.897,18.27]	1.277 [1.178,1.384]
55-64	7.425 [3.065,17.99]	8.468 [4.382,16.37]	1.271 [1.172,1.378]
65-74	5.976 [2.399,14.88]	6.707 [3.414,13.17]	1.292 [1.168,1.430]
75-84	4.416 [1.733,11.25]	5.26 [2.647,10.45]	1.169 [1.043,1.310]
85+	5.242 [1.535,17.90]	5.584 [2.376,13.12]	1.024 [0.820,1.280]
Discharge opioid prescription volume			
1-199 MME	1 [1,1]	1 [1,1]	1 [1,1]
200-299 MME	1.064 [0.903,1.255]	1.147 [1.018,1.292]	1.027 [0.991,1.064]
300-399 MME	1.304 [1.101,1.544]	1.386 [1.229,1.562]	1.056 [1.016,1.099]
400-499 MME	1.32 [1.088,1.603]	1.562 [1.369,1.783]	1.099 [1.047,1.153]
500+ MME	1.588 [1.309,1.926]	1.876 [1.648,2.136]	1.196 [1.138,1.257]
Elixhauser comorbidities			
CHF	0.731 [0.477,1.122]	0.912 [0.698,1.191]	1.214 [1.087,1.355]
ARRHYTHMIA	1.005	0.987	1.07

	CONSORT chronic opioid dependence	Persistent opioid use after surgery	Additional opioid use after surgery
VALVULAR	[0.810,1.248] 0.969	[0.855,1.140] 0.96	[1.003,1.141] 0.948
PULM_CIRC	[0.662,1.420] 1.596	[0.744,1.239] 1.277	[0.845,1.065] 1.236
PERIPH_VASC	[0.959,2.653] 1.645	[0.876,1.861] 1.333	[1.025,1.489] 1.266
HTN_UNCOMP	[1.151,2.349] 1.132	[1.029,1.726] 1.181	[1.124,1.426] 1.135
HTN_COMP	[1.008,1.270] 1.305	[1.093,1.275] 1.103	[1.098,1.172] 1.004
OTH_NEURO	[0.917,1.857] 1.45	[0.868,1.402] 1.302	[0.894,1.127] 1.093
CHRON_PULM	[0.999,2.106] 1.527	[0.991,1.711] 1.534	[0.960,1.244] 1.308
PEP_ULCER	[1.297,1.799] 2.741	[1.372,1.714] 2.573	[1.238,1.382] 1.292
DM_WO_CC	[1.313,5.719] 1.237	[1.502,4.408] 1.283	[0.965,1.728] 1.229
DM_W_CC	[1.070,1.430] 1.152	[1.166,1.412] 1.05	[1.176,1.285] 1.156
PARALYSIS	[0.854,1.552] 0.963	[0.862,1.279] 1.13	[1.058,1.262] 1.05
RENAL	[0.316,2.933] 0.816	[0.528,2.418] 1.008	[0.733,1.504] 1.077
LIVER	[0.550,1.213] 1.525	[0.786,1.292] 1.606	[0.963,1.205] 1.118
RHEUM_ARTH_COLL	[1.084,2.144] 1.168	[1.258,2.050] 1.228	[1.010,1.239] 1.368
HYPOTHYROID	[0.858,1.589] 1.004	[1.003,1.503] 1.01	[1.246,1.503] 1.028
COAGULOPATHY	[0.838,1.203] 1.648	[0.897,1.137] 1.245	[0.972,1.087] 1.2
OBESITY	[1.133,2.399] 1.047	[0.935,1.657] 1.076	[1.037,1.388] 1.116
FLUID_ELECTROLYTE	[0.881,1.244] 1.326	[0.961,1.205] 1.301	[1.056,1.181] 1.077
BLOOD_LOSS_ANEMIA	[1.055,1.667] 1.255	[1.114,1.520] 1.111	[0.995,1.166] 1.207
DEFICIENCY_ANEMIA	[0.703,2.240] 1.43	[0.738,1.672] 1.459	[0.972,1.498] 1.156

	CONSORT chronic opioid dependence	Persistent opioid use after surgery	Additional opioid use after surgery
ALCOHOL	[0.957,2.135] 1.705	[1.110,1.917] 1.831	[1.007,1.327] 1.477
DRUG_ABUSE	[1.034,2.814] 3.442	[1.275,2.631] 2.118	[1.227,1.779] 1.47
PSYCHOSIS	[1.918,6.178] 0.792	[1.264,3.550] 0.67	[1.110,1.947] 0.848
DEPRESSION	[0.316,1.985] 1.868	[0.321,1.400] 1.526	[0.626,1.149] 1.41
	[1.560,2.236] N	[1.337,1.742] 357,794	[1.322,1.503] 357,884

Exponentiated coefficients; 95% confidence intervals in brackets