

Supplementary Online Content

Bao Y, Zhang H, Bruera E, et al. Medical marijuana legalization and opioid- and pain-related outcomes among patients newly diagnosed with cancer receiving anticancer treatment. *JAMA Oncol*. Published online December 1, 2022. doi:10.1001/jamaoncol.2022.5623

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. ICD-9 and ICD-10 diagnostic codes used to identify new breast, colorectal, or lung cancer diagnosis

	ICD-9	ICD-10
Breast cancer	1740 1741 1742 1743 1744 1745 1746 1748 1749	C50 C500 C5001 C50011 C50012 C50019 C5002 C50021 C50022 C50029 C501 C5011 C50111 C50112 C50119 C5012 C50121 C50122 C50129 C502 C5021 C50211 C50212 C50219 C5022 C50221 C50222 C50229 C503 C5031 C50311 C50312 C50319 C5032 C50321 C50322 C50329 C504 C5041 C50411 C50412 C50419 C5042 C50421 C50422 C50429 C505 C5051 C50511 C50512 C50519 C5052 C50521 C50522 C50529 C506 C5061 C50611 C50612 C50619 C5062 C50621 C50622 C50629 C508 C5081 C50811 C50812 C50819 C5082 C50821 C50822 C50829 C509 C5091 C50911 C50912 C50919 C5092 C50921 C50922 C50929
Colorectal cancer	1530 1531 1532 1533 1534 1535 1536 1537 1538 1539 1540 1541 1542 1543 1548	C18 C180 C181 C182 C183 C184 C185 C186 C187 C188 C189 C19 C20
Lung cancer	1620 1622 1623 1624 1625 1628 1629	C34 C340 C3400 C3401 C3402 C341 C3410 C3411 C3412 C342 C343 C3430 C3431 C3432 C348 C3480 C3481 C3482 C349 C3490 C3491 C3492

eTable 2. Diagnostic, procedure, revenue center codes, and National Drug Codes used to identify anti-cancer treatment including cancer resection surgery, chemotherapy, and radiation

		ICD-9 Procedure Codes	ICD-10 Procedure Codes	ICD-9 Diagnosis Codes	ICD-10 Diagnosis Codes	Revenue Center Codes	HCPCS Codes	National Drug Codes
Breast cancer resection surgery	breast-conserving surgery	85.20, 85.21, 85.22, 85.23, or 85.25	OHS.T0ZZ, OHS.T3ZZ, OHS.T7ZZ, OHS.T8ZZ, OHS.U0ZZ, OHS.U3ZZ, OHS.U7ZZ, OHS.U8ZZ, OHS.V0ZZ, OHS.V3ZZ, OHS.V7ZZ, OHS.V8ZZ, OHS.W0ZZ, OHS.W3ZZ, OHS.W7ZZ, OHS.W8ZZ, OHS.WXZZ, OHS.X0ZZ, OHS.X3ZZ, OHS.X7ZZ, OHS.X8ZZ, OHS.XXZZ, OHB.TOZZ, OHB.T3ZZ, OHB.T7ZZ, OHB.T8ZZ, OHB.U0ZZ, OHB.U3ZZ, OHB.U7ZZ, OHB.U8ZZ, OHB.V0ZZ, OHB.V3ZZ, OHB.V7ZZ, OHB.V8ZZ, OHB.W0ZZ, OHB.W3ZZ, OHB.W7ZZ, OHB.W8ZZ, OHB.WXZZ, OHB.X0ZZ, OHB.X3ZZ, OHB.X7ZZ, OHB.X8ZZ, OHB.XXZZ, OHT.WXZZ, OHT.XXZZ					
	mastectomy	85.41, 85.42, 85.43, 85.44, 85.45, 85.46, 85.47, or 85.48	OHT.TOZZ, OHT.U0ZZ, OHT.V0ZZ, (O7T.5OZZ & OHT.TOZZ), (O7T.6OZZ & OHT.U0ZZ), (O7T.5OZZ & O7T.6OZZ & OHT.V0ZZ), (O7T.5OZZ & OHT.TOZZ & OHT.HOZZ), (O7T.6OZZ & OHT.U0ZZ & OHT.JOZZ), (O7T.5OZZ & O7T.6OZZ & OHT.V0ZZ & OHT.HOZZ & OHT.JOZZ), (O7T.5OZZ & O7T.6OZZ & O7T.7OZZ & O7T.8OZZ & O7T.9OZZ & OHT.V0ZZ & OHT.HOZZ & OHT.JOZZ)					
Colorectal cancer resection surgery	colon resection	45.71-45.79, 45.81-45.83	ODB.E0ZZ, ODB.E3ZZ, ODB.E7ZZ, ODB.E8ZZ, ODB.GFZZ, ODB.LFZZ, ODB.MFZZ, ODB.NFZZ, ODT.E0ZZ, ODT.E4ZZ, ODT.E7ZZ, ODT.E8ZZ, ODT.FOZZ, ODT.F7ZZ, ODT.GOZZ, ODT.G7ZZ, ODT.G8ZZ, ODT.GFZZ, ODT.F8ZZ, ODT.HOZZ, ODT.H7ZZ, ODT.H8ZZ, ODT.KOZZ, ODT.LOZZ, ODT.L7ZZ, ODT.L8ZZ, ODT.LFZZ, ODT.MFZZ, ODT.NOZZ, ODT.N7ZZ, ODT.N8ZZ, ODT.NFZZ					
	rectal resection	48.40-48.49, 48.50-48.59, 48.61-48.69	ODT.P0ZZ, ODT.P4ZZ, ODT.P7ZZ, ODT.P8ZZ, OD1.N0Z4 & (ODT.P0ZZ OR ODT.P4ZZ OR ODT.P7ZZ OR ODT.P8ZZ), (ODT.NOZZ OR ODT.N4ZZ) & (ODT.P0ZZ OR ODT.P4ZZ)					
	laparoscopic colon resection	17.31-17.39	ODB.E4ZZ, ODT.F4ZZ, ODT.G4ZZ, ODT.H4ZZ, ODT.L4ZZ, ODT.N4ZZ					
Lung cancer resection surgery	lung cancer resection surgery	32.3, 32.30, 32.39, 32.4, 32.41, 32.49, 32.5, 32.50, and 32.59	OBB.C4ZZ, OBB.D4ZZ, OBB.F4ZZ, OBB.G4ZZ, OBB.H4ZZ, OBB.J4ZZ, OBB.KOZZ, OBB.K3ZZ, OBB.K4ZZ, OBB.K7ZZ, OBB.LOZZ, OBB.L3ZZ, OBB.L4ZZ, OBB.L7ZZ, OBT.COZZ, OBT.C4ZZ, OBT.DOZZ, OBT.D4ZZ, OBT.FOZZ, OBT.F4ZZ, OBT.GOZZ, OBT.G4ZZ, OBT.H4ZZ, OBT.JOZZ, OBT.J4ZZ, OBT.KOZZ, OBT.K4ZZ, OBT.LOZZ, OBT.L4ZZ, OBT.MOZZ, OBT.M4ZZ					
Radiation Therapy	Radiation Therapy	92.21-92.29		V58.0, V66.1, V67.1	Z51.0, Z51.89, Z08, Z09	0330, 0333	77401-77499, 77520, 77523, 77750-77799, G0256, G0261	
				3E0.0X05, 3E0.1305, 3E0.2305, 3E0.A305, 3E0.F305, 3E0.F705, 3E0.F805, 3E0.G305, 3E0.G705, 3E0.G805, 3E0.H305, 3E0.H705, 3E0.H805, 3E0.I305, 3E0.I705, 3E0.I805, 3E0.K305, 3E0.K705, 3E0.K805, 3E0.L305, 3E0.L705, 3E0.M305, 3E0.M705, 3E0.N305, 3E0.N705, 3E0.N805, 3E0.P305, 3E0.P705, 3E0.P805, 3E0.Q005, 3E0.Q305, 3E0.Q705, 3E0.R305, 3E0.S305, 3E0.V305, 3E0.W305, 3E0.Y305, 3E0.Y705, 3E0.300P, 3E0.330P, 3E0.400P, 3E0.430P, 3E0.500P, 3E0.530P, 3E0.600P, 3E0.630P, 3E0.3305, 3E0.4305, XW0.3351, XW0.33B3, XW0.33C3, XW0.4351, XW0.43B3, XW0.43C3, 3E0.0X0M, 3E0.130M, 3E0.230M, 3E0.3303, 3E0.330M, 3E0.4303, 3E0.430M, 3E0.5303, 3E0.530M, 3E0.6303, 3E0.630M	V58.1x, V67.2	Z51.11, Z51.12, Z08, Z09		0519F, 36823, 51720, 61517, 95990, 95991, 96400-96499, 96500-96549, C8953-C8955, G0355, G0357, G0362, G0370, G9021-G9032, J7150, Q0083-Q0085, S5019, S5020, S9329-S9331, S9425, C1086, C1166, C1167, C1178, C9012, C9110, C9437, C9440, J0594, J0894, J8510, J8520, J8521, J8530, J8560, J8565
Chemotherapy	Chemotherapy	00.10, 17.70, 99.25, 99.28						

eTable 3. Effective dates of medical marijuana legalization (MML) and comprehensive PDMP mandates among 34 states without MML prior to 01/01/2012

State	Effective date of MML	Effective date of MML dispensary allowance	Effective date of comprehensive PDMP mandate	MML by 12/31/2017	MML dispensary by 12/31/17	Operating PDMP by 01/01/2012	Comprehensive PDMP mandate by 12/31/2017
Arkansas	November 9, 2016	November 9, 2016	July 30, 2017	Y	Y	N	Y
Connecticut	October 1, 2012	August 20, 2014	October 1, 2015	Y	Y	Y	Y
Florida	January 3, 2017	December 19, 2018	July 1, 2018	Y	N	Y	N
Illinois	January 1, 2014	November 9, 2015		Y	Y	Y	N
Louisiana	May 19, 2016*	August 6, 2019		Y	N	Y	N
Maryland	June 1, 2014*	July 6, 2017	July 1, 2018	Y	Y	N	N
Massachusetts	January 1, 2013	June 24, 2015	October 15, 2016	Y	Y	Y	Y
Minnesota	May 30, 2014	July 1, 2015		Y	Y	Y	N
New Hampshire	July 23, 2013	April 30, 2016	September 1, 2016	Y	Y	N	Y
New York	July 5, 2014	January 7, 2016	August 27, 2013	Y	Y	N	Y
North Dakota	April 18, 2017	March 1, 2019		Y	N	Y	N
Ohio	September 8, 2016	January 16, 2019	April 1, 2015	Y	N	Y	Y
Pennsylvania	May 17, 2016		August 1, 2016	Y	N	N	Y
West Virginia	April 19, 2017*		June 8, 2012	Y	N	Y	Y
Alabama				N	N	Y	N
Georgia			July 1, 2018	N	N	N	N
Idaho				N	N	Y	N
Indiana			January 1, 2021	N	N	Y	N
Iowa				N	N	Y	N
Kansas				N	N	Y	N
Kentucky			July 1, 2012	N	N	Y	Y
Mississippi				N	N	Y	N
Missouri	December 6, 2018			N	N	N	N
Nebraska				N	N	Y	N
North Carolina				N	N	Y	N
Oklahoma	August 25, 2018	October 26, 2018	November 1, 2015	N	N	Y	Y
South Carolina				N	N	Y	N
South Dakota				N	N	N	N
Tennessee			January 1, 2013	N	N	Y	Y
Texas			September 1, 2019	N	N	N	N
Utah	December 3, 2018			N	N	Y	N
Virginia			July 1, 2016	N	N	Y	Y
Wisconsin				N	N	N	N
Wyoming			July 1, 2019	N	N	N	N

Source of MML status and effective dates: RAND-USC Schaeffer Opioid Policy Tools and Information Center (OPTIC). *MML effective dates were missing from the RAND OPTIC-vetted data for Louisiana and West Virginia and drastically different from what was reported in previous studies for Maryland. The dates reported here for the three states reflect authors' research using the legal literature, law databases, and internet resources.

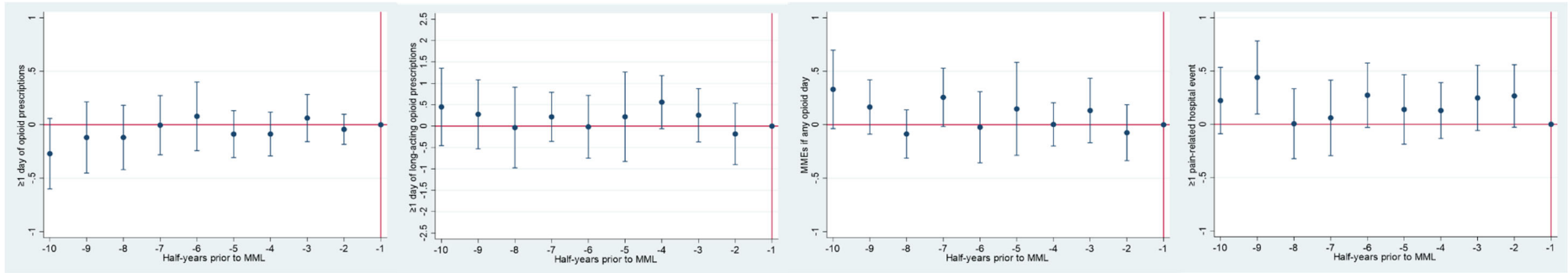
eTable 4. ICD-9 and ICD-10 diagnostic codes used to identify pain-related emergency department visits and hospitalizations

ICD-9	ICD-9 Descriptor	ICD-10	ICD-10 Descriptor	ICD-9	ICD-9 Descriptor	ICD-10	ICD-10 Descriptor
338.29	Other chronic pain	G89.29	Other chronic pain	729.5	Pain in limb	M79.603	Pain in arm, unspecified
338.3	Neoplasm related pain (acute)	G89.3	Neoplasm related pain (acute) (chronic)	729.5	Pain in limb	M79.604	Pain in right leg
379.91	Pain in or around eye	H57.10	Ocular pain, unspecified eye	729.5	Pain in limb	M79.605	Pain in left leg
379.91	Pain in or around eye	H57.11	Ocular pain, right eye	729.5	Pain in limb	M79.606	Pain in leg, unspecified
379.91	Pain in or around eye	H57.12	Ocular pain, left eye	729.5	Pain in limb	M79.609	Pain in unspecified limb
379.91	Pain in or around eye	H57.13	Ocular pain, bilateral	729.5	Pain in limb	M79.621	Pain in right upper arm
388.70	Otalgia, unspecified	H92.01	Otalgia, right ear	729.5	Pain in limb	M79.622	Pain in left upper arm
388.70	Otalgia, unspecified	H92.02	Otalgia, left ear	729.5	Pain in limb	M79.629	Pain in unspecified upper arm
388.70	Otalgia, unspecified	H92.03	Otalgia, bilateral	729.5	Pain in limb	M79.631	Pain in right forearm
388.70	Otalgia, unspecified	H92.09	Otalgia, unspecified ear	729.5	Pain in limb	M79.632	Pain in left forearm
388.71	Otogenic pain	H92.09	Otalgia, unspecified ear	729.5	Pain in limb	M79.639	Pain in unspecified forearm
388.72	Referred otogenic pain	H92.09	Otalgia, unspecified ear	729.5	Pain in limb	M79.641	Pain in right hand
528.01	Oral Mucositis	K12.30	Oral Mucositis (ulcerative), unspecified	729.5	Pain in limb	M79.642	Pain in left hand
528.01	Oral Mucositis	K12.31	Oral Mucositis (ulcerative) due to antineoplastic therapy	719.44	Pain in joint, hand	M79.643	Pain in unspecified hand
528.02	Oral Mucositis	K12.32	Oral Mucositis (ulcerative) due to other drugs	729.5	Pain in limb	M79.643	Pain in unspecified hand
528.09	Oral Mucositis	K12.39	Other Oral Mucositis (ulcerative)	729.5	Pain in limb	M79.644	Pain in right finger(s)
528.9	Other and Unspecified Diseases of the Oral Soft Tissue	K13.79	Other lesions of oral mucosa	729.5	Pain in limb	M79.645	Pain in left finger(s)
569.42	Anal or rectal pain	K62.89	Other specified diseases of anus and rectum	719.44	Pain in joint, hand	M79.646	Pain in unspecified finger(s)
719.40	Pain in joint, site unspecified	M25.50	Pain in unspecified joint	729.5	Pain in limb	M79.646	Pain in unspecified finger(s)
719.48	Pain in joint, other specified sites	M25.50	Pain in unspecified joint	729.5	Pain in limb	M79.651	Pain in right thigh
719.49	Pain in joint, multiple sites	M25.50	Pain in unspecified joint	729.5	Pain in limb	M79.652	Pain in left thigh
719.41	Pain in joint, shoulder region	M25.511	Pain in right shoulder	729.5	Pain in limb	M79.659	Pain in unspecified thigh
719.41	Pain in joint, shoulder region	M25.512	Pain in left shoulder	729.5	Pain in limb	M79.661	Pain in right lower leg
719.41	Pain in joint, shoulder region	M25.519	Pain in unspecified shoulder	729.5	Pain in limb	M79.662	Pain in left lower leg
719.42	Pain in joint, upper arm	M25.521	Pain in right elbow	729.5	Pain in limb	M79.669	Pain in unspecified lower leg
719.42	Pain in joint, upper arm	M25.522	Pain in left elbow	729.5	Pain in limb	M79.671	Pain in right foot
719.42	Pain in joint, upper arm	M25.529	Pain in unspecified elbow	729.5	Pain in limb	M79.672	Pain in left foot
719.43	Pain in joint, forearm	M25.531	Pain in right wrist	729.5	Pain in limb	M79.673	Pain in unspecified foot
719.43	Pain in joint, forearm	M25.532	Pain in left wrist	729.5	Pain in limb	M79.674	Pain in right toe(s)
719.43	Pain in joint, forearm	M25.539	Pain in unspecified wrist	729.5	Pain in limb	M79.675	Pain in left toe(s)
719.44	Pain in joint, hand	M25.541	Pain in joints of right hand	729.5	Pain in limb	M79.676	Pain in unspecified toe(s)
719.44	Pain in joint, hand	M25.542	Pain in joints of left hand	784.1	Throat pain	R07.0	Pain in throat
719.45	Pain in joint, pelvic region and	M25.551	Pain in right hip	786.52	Painful respiration	R07.1	Chest pain on breathing
719.45	Pain in joint, pelvic region and	M25.552	Pain in left hip	786.51	Precordial pain	R07.2	Precordial pain
719.45	Pain in joint, pelvic region and	M25.559	Pain in unspecified hip	786.52	Painful respiration	R07.81	Pleurodynia
719.46	Pain in joint, lower leg	M25.561	Pain in right knee	786.59	Other chest pain	R07.82	Intercostal pain
719.46	Pain in joint, lower leg	M25.562	Pain in left knee	786.59	Other chest pain	R07.89	Other chest pain
719.46	Pain in joint, lower leg	M25.569	Pain in unspecified knee	786.50	Unspecified chest pain	R07.9	Chest pain, unspecified
719.47	Pain in joint, ankle and foot	M25.571	Pain in right ankle and joints of right foot	789.00	Abdominal pain, unspecified site	R10.0	Acute abdomen
719.47	Pain in joint, ankle and foot	M25.572	Pain in left ankle and joints of left foot	789.09	Abdominal pain, other specified site	R10.10	Upper abdominal pain, unspecified
719.47	Pain in joint, ankle and foot	M25.579	Pain in unspecified ankle and joints of unspecified foot	789.01	Abdominal pain, right upper quadrant	R10.11	Right upper quadrant pain
723.8	cervical region	M53.81	atlanto-axial region	789.02	Abdominal pain, upper quadrant	R10.12	Left upper quadrant pain
723.8	Other syndromes affecting cervical region	M53.82	Other specified dorsopathies, cervical region	789.06	Abdominal pain, epigastric	R10.13	Epigastric pain
723.8	Other syndromes affecting cervical region	M53.83	Other specified dorsopathies, cervicothoracic region	608.9	Unspecified disorder of male genital	R10.2	Pelvic and perineal pain
724.2	Lumbago	M54.5	Low back pain	625.9	Unspecified symptom associated with female genital organs	R10.2	Pelvic and perineal pain
724.1	Pain in thoracic spine	M54.6	Pain in thoracic spine	789.09	Abdominal pain, other specified site	R10.2	Pelvic and perineal pain
723.8	Other syndromes affecting cervical region	M54.81	Occipital neuralgia	789.09	Abdominal pain, other specified site	R10.30	Lower abdominal pain, unspecified
724.5	Backache, unspecified	M54.89	Other dorsalgia	789.03	Abdominal pain, right lower quadrant	R10.31	Right lower quadrant pain
724.5	Backache, unspecified	M54.9	Dorsalgia, unspecified	789.04	Abdominal pain, left lower quadrant	R10.32	Left lower quadrant pain
729.1	Myalgia and myositis, unspecified	M79.10	Myalgia, unspecified site	789.05	Abdominal pain, periumbilic	R10.33	Periumbilical pain
729.1	Myalgia and myositis, unspecified	M79.11	Myalgia of mastication muscle	789.07	Abdominal pain, generalized	R10.34	Generalized abdominal pain
729.1	Myalgia and myositis, unspecified	M79.12	Myalgia of auxiliary muscles, head and neck	789.00	Abdominal pain, unspecified site	R10.9	Unspecified abdominal pain
729.1	Myalgia and myositis, unspecified	M79.18	Myalgia, other site	784.0	Headache	R51	Headache
729.5	Pain in limb	M79.601	Pain in right arm	338.19	Other acute pain	R52	Pain, unspecified
729.5	Pain in limb	M79.602	Pain in left arm	780.96	Generalized pain	R52	Pain, unspecified
				784.92	Jaw pain	R68.84	Jaw pain

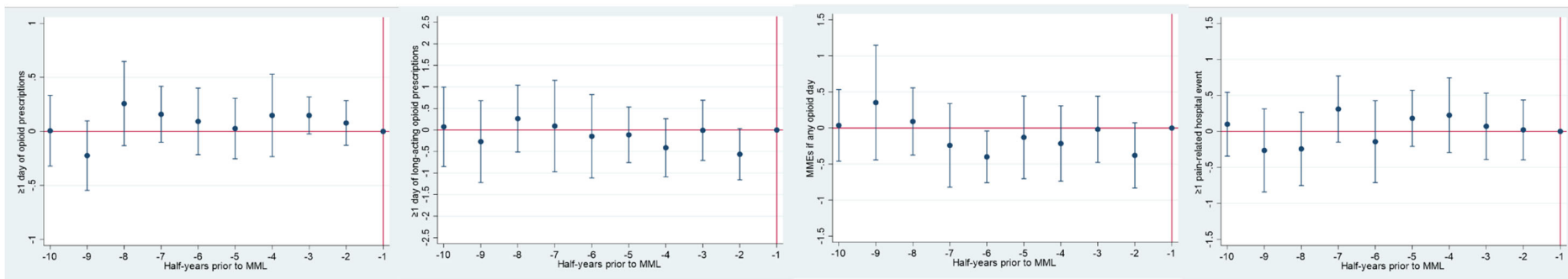
Source: CMS Chemotherapy Measure (OP-35), available at <https://qualitynet.cms.gov/outpatient/measures/chemotherapy/methodology>

eFigure 1. Results of event study analysis assessing the parallel trends assumption between states that implemented MML and those that did not yet implement MML, main analysis including 34 states

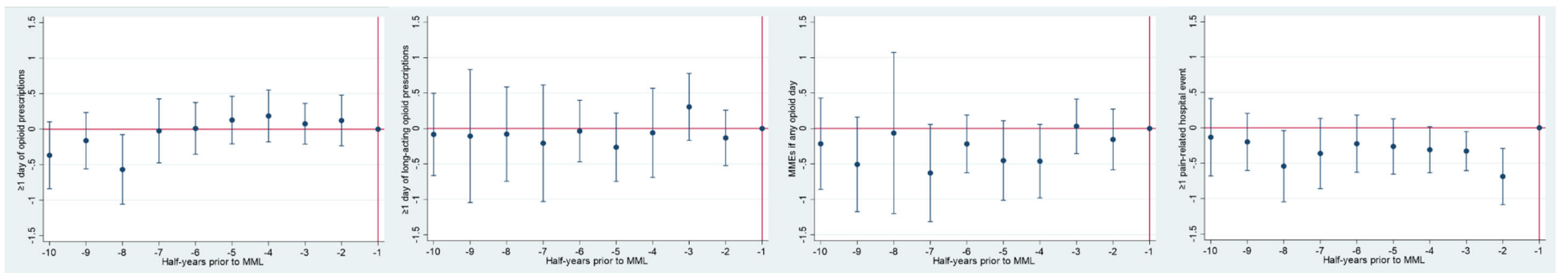
Breast Cancer



Colorectal Cancer



Lung Cancer



Value plotted is estimated difference (and 95% confidence interval) between states that implemented MML and states that did not (yet) implement MML in the half-years before implementation, holding the difference in the half-year/6 months immediately before implement (denoted as “-1” in the charts) at 0.

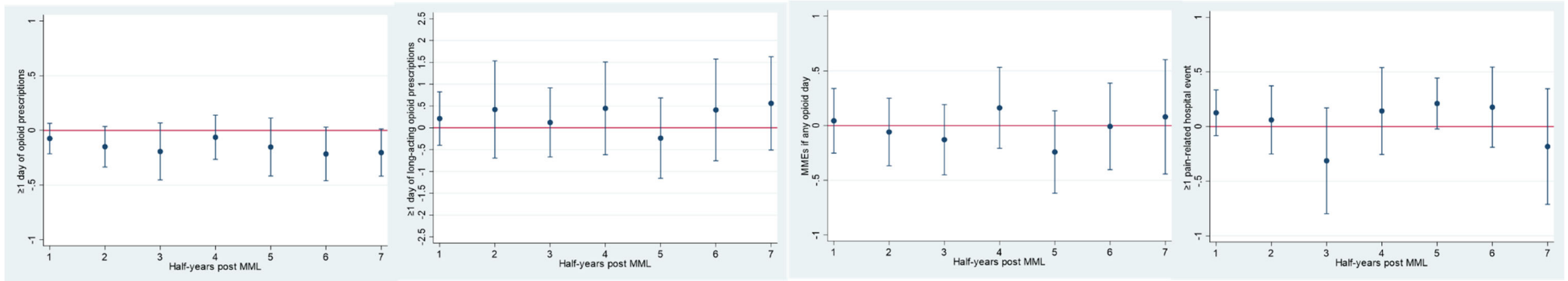
eTable 5. Conditional estimates and estimated policy effects, main analysis including 34 states

		sample mean	Predicted, no MML	Predicted, MML	Est. policy effect, mean (95% CI)	p-value	Predicted, no comprehensive PDMP mandate	Predicted, comprehensive PDMP mandate	Est. policy effect, mean (95% CI)	p-value
Breast Cancer (N=38,189)										
≥1 opioid day	no recent opioids	0.377	0.381	0.355	-0.025 (-0.055, 0.004)	0.087	0.374	0.391	0.017 (-0.010, 0.043)	0.222
	recent opioids	0.891	0.901	0.844	-0.056 (-0.090, -0.022)	0.001	0.893	0.885	-0.008 (-0.032, 0.016)	0.522
≥1 long-acting opioid day	no recent opioids	0.005	0.005	0.007	0.002 (-0.002, 0.006)	0.363	0.006	0.004	-0.002 (-0.005, 0.000)	0.108
	recent opioids	0.056	0.046	0.057	0.011 (-0.015, 0.037)	0.411	0.050	0.028	-0.022 (-0.040, -0.004)	0.018
Total MMEs if any	no recent opioids	558.9	592.8	580.1	-12.6 (-86.7, 61.4)	0.738	591.0	594.1	3.1 (-126.7, 132.9)	0.963
	recent opioids	2211.3	1910.9	2044.6	133.8 (-762.0, 1029.6)	0.770	1966.0	1591.3	-374.7 (-1089.5, 340.1)	0.304
≥1 pain-related hospital events	no recent opioids	0.050	0.052	0.049	-0.003 (-0.011, 0.004)	0.420	0.051	0.054	0.003 (-0.003, 0.010)	0.301
	recent opioids	0.080	0.069	0.051	-0.018 (-0.038, 0.001)	0.061	0.067	0.061	-0.006 (-0.037, 0.025)	0.706
Colorectal cancer (N=12,816)										
≥1 opioid day	no recent opioids	0.379	0.378	0.373	-0.005 (-0.055, 0.045)	0.851	0.378	0.372	-0.006 (-0.052, 0.040)	0.789
	recent opioids	0.883	0.894	0.844	-0.049 (-0.094, -0.005)	0.030	0.888	0.874	-0.014 (-0.046, 0.018)	0.396
≥1 long-acting opioid day	no recent opioids	0.027	0.027	0.030	0.003 (-0.013, 0.189)	0.721	0.026	0.038	0.011 (-0.005, 0.028)	0.166
	recent opioids	0.129	0.116	0.104	-0.012 (-0.066, 0.042)	0.667	0.113	0.130	0.017 (-0.031, 0.066)	0.488
Total MMEs if any	no recent opioids	1414.1	1476.4	1558.0	81.5 (-326.0, 489.1)	0.695	1455.9	1758.5	302.6 (-233.7, 839.0)	0.269
	recent opioids	3166.8	3201.2	3909.1	707.9 (-949.7, 2365.5)	0.403	3159.7	4352.1	1192.4 (-1019.9, 3404.6)	0.291
≥1 pain-related hospital events	no recent opioids	0.108	0.111	0.104	-0.007 (-0.026, 0.012)	0.455	0.108	0.121	0.013 (-0.015, 0.041)	0.353
	recent opioids	0.125	0.113	0.097	-0.016 (-0.042, 0.009)	0.210	0.107	0.137	0.030 (-0.028, 0.088)	0.312
Lung cancer (N=7,190)										
≥1 opioid day	no recent opioids	0.329	0.338	0.272	-0.065 (-0.119, -0.012)	0.016	0.319	0.381	0.062 (0.003, 0.120)	0.039
	recent opioids	0.896	0.907	0.829	-0.078 (-0.161, 0.006)	0.067	0.893	0.917	0.024 (-0.022, 0.070)	0.309
≥1 long-acting opioid day	no recent opioids	0.070	0.072	0.064	-0.007 (-0.031, 0.016)	0.538	0.069	0.080	0.010 (-0.015, 0.035)	0.415
	recent opioids	0.302	0.315	0.221	-0.094 (-0.179, -0.008)	0.031	0.299	0.315	0.016 (-0.109, 0.141)	0.801
Total MMEs if any	no recent opioids	3475.8	3555.2	3617.0	61.9 (-1274.8, 1398.5)	0.928	3541.7	3698.0	156.4 (-819.9, 1132.6)	0.754
	recent opioids	7080.9	7667.9	8238.8	570.9 (-2862.2, 4003.9)	0.744	7647.0	8331.8	684.9 (-3286.2, 4656.0)	0.735
≥1 pain-related hospital events	no recent opioids	0.135	0.135	0.145	0.010 (-0.013, 0.034)	0.385	0.141	0.112	-0.029 (-0.059, 0.001)	0.059
	recent opioids	0.194	0.193	0.130	-0.063 (-0.120, -0.007)	0.028	0.188	0.164	-0.024 (-0.070, 0.021)	0.292

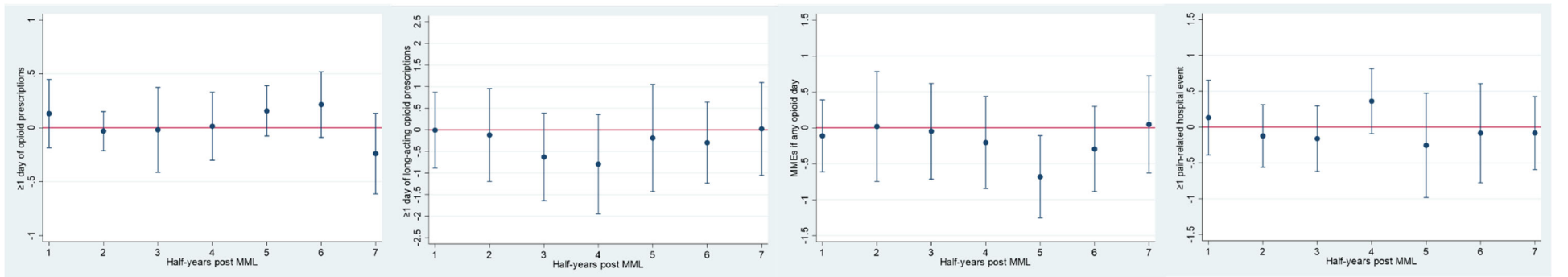
Main analysis includes 34 states that did not have MML prior to 1/1/2012 and does not differentiate between MML with and without dispensary allowance.

eFigure 2. Results of event study analysis estimating policy effects over seven time intervals post MML implementation, main analysis including 34 states

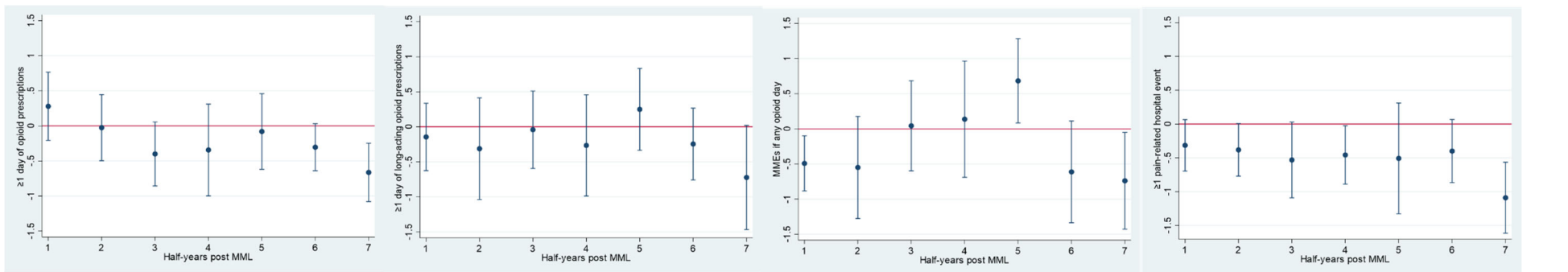
Breast Cancer



Colorectal Cancer



Lung Cancer



Value plotted is estimated difference (and 95% confidence interval) in a given outcome between states that implemented MML and states that did not (yet) implement MML in the half-years post implementation. The 7th time interval groups all time periods after (and including) the 7th half-year post implementation.

eTable 6. Conditional estimates and estimated effects of MML with and without dispensary allowances, secondary analysis including 34 states

		sample mean	Predicted Mean Outcomes			Estimated Policy Effects			
			no MML	MML, without dispensary	MML, with dispensary	MML without dispensary, mean (95% CI)	p-value	MML with dispensary, mean (95% CI)	p-value
Breast Cancer (N=38,189)									
≥1 opioid day	no recent opioids	0.377	0.381	0.361	0.333	-0.020 (-0.047, 0.007)	0.146	-0.048 (-0.094, -0.002)	0.041
	recent opioids	0.891	0.901	0.851	0.821	-0.049 (-0.084, -0.015)	0.005	-0.079 (-0.132, -0.027)	0.003
≥1 long-acting opioid day	no recent opioids	0.005	0.005	0.009	0.004	0.003 (-0.001, 0.008)	0.160	-0.001 (-0.005, 0.002)	0.453
	recent opioids	0.056	0.046	0.045	0.099	-0.001 (-0.026, 0.024)	0.948	0.053 (0.001, 0.105)	0.047
Total MMEs if any	no recent opioids	558.9	592.0	580.2	599.6	-11.8 (-91.9, 68.2)	0.772	7.6 (-78.4, 93.6)	0.863
	recent opioids	2211.3	1908.4	1898.8	2568.5	-9.6 (-784.5, 765.3)	0.981	660.2 (-1892.6, 3212.9)	0.612
≥1 pain-related hospital events	no recent opioids	0.050	0.052	0.049	0.049	-0.003 (-0.011, 0.004)	0.405	-0.003 (-0.016, 0.011)	0.703
	recent opioids	0.080	0.069	0.052	0.048	-0.017 (-0.037, 0.002)	0.085	-0.021 (-0.061, 0.019)	0.301
Colorectal cancer (N=12,816)									
≥1 opioid day	no recent opioids	0.379	0.378	0.369	0.384	-0.009 (-0.059, 0.041)	0.728	0.006 (-0.059, 0.071)	0.856
	recent opioids	0.883	0.894	0.865	0.808	-0.028 (-0.080, 0.024)	0.292	-0.086 (-0.150, -0.022)	0.009
≥1 long-acting opioid day	no recent opioids	0.027	0.027	0.027	0.038	0.000 (-0.016, 0.016)	0.994	0.012 (-0.011, 0.034)	0.316
	recent opioids	0.129	0.115	0.109	0.102	-0.006 (-0.053, 0.040)	0.787	-0.014 (-0.103, 0.076)	0.765
Total MMEs if any	no recent opioids	1414.1	1477.6	1570.0	1479.3	92.4 (-357.2, 542.0)	0.687	1.8 (-595.8, 599.3)	0.995
	recent opioids	3611.8	3210.4	4498.9	2715.1	1288.5 (-951.4, 3528.4)	0.260	-495.3 (-1610.0, 619.4)	0.384
≥1 pain-related hospital event	no recent opioids	0.108	0.111	0.105	0.100	-0.006 (-0.027, 0.014)	0.536	-0.011 (-0.035, 0.012)	0.342
	recent opioids	0.125	0.113	0.111	0.072	-0.003 (-0.030, 0.025)	0.855	-0.041 (-0.097, 0.015)	0.152
Lung cancer (N=7,190)									
≥1 opioid day	no recent opioids	0.329	0.339	0.291	0.214	-0.048 (-0.108, 0.012)	0.0115	-0.125 (-0.175, -0.075)	0.000
	recent opioids	0.896	0.908	0.821	0.833	-0.087 (-0.188, 0.014)	0.093	-0.074 (-0.182, 0.034)	0.177
≥1 long-acting opioid day	no recent opioids	0.070	0.072	0.071	0.047	-0.001 (-0.026, 0.024)	0.914	-0.026 (-0.066, 0.014)	0.210
	recent opioids	0.302	0.316	0.220	0.211	-0.096 (-0.191, -0.001)	0.047	-0.105 (-0.242, 0.033)	0.136
Total MMEs if any	no recent opioids	3475.8	3562.5	4010.2	2719.400	447.7 (-1179.8, 2075.2)	0.590	-843.0 (-125.1, 439.1)	0.197
	recent opioids	7080.9	7674.7	6322.4	12813.600	-1352.3 (-3982.8, 1278.3)	0.314	5138.9 (-1924.8, 12202.6)	0.154
≥1 pain-related hospital event	no recent opioids	0.135	0.135	0.149	0.133	0.0134 (-0.010, 0.036)	0.254	-0.002 (-0.044, 0.040)	0.919
	recent opioids	0.194	0.194	0.137	0.113	-0.057 (-0.114, -0.000)	0.049	-0.081 (-0.206, 0.045)	0.208

Secondary analysis includes 34 states that did not have MML prior to 1/1/2012 and differentiates between MML with and without dispensary allowance.

eTable 7. Conditional estimates and estimated effects of MML, sensitivity analysis including 23 states

		sample mean	Predicted, no MML	Predicted, MML	Est. policy effect, MML vs. no MML, mean (95% CI)	p-value
Breast Cancer (N=20,043)						
≥1 opioid day	no recent opioids	0.396	0.406	0.351	-0.055 (-0.101, -0.008)	0.021
	recent opioids	0.898	0.909	0.853	-0.056 (-0.001, -0.002)	0.043
≥1 long-acting opioid day	no recent opioids	0.005	0.005	0.009	0.004 (-0.002, 0.009)	0.175
	recent opioids	0.059	0.047	0.075	0.028 (-0.003, 0.060)	0.074
Total MMEs if any	no recent opioids	570.8	586.1	677.0	90.8 (-36.4, 218.1)	0.162
	recent opioids	2442.4	2498.3	3977.3	1479.1 (-2364.2, 5322.3)	0.451
≥1 pain-related hospital events	no recent opioids	0.051	0.053	0.051	-0.002 (-0.012, 0.008)	0.661
	recent opioids	0.086	0.079	0.043	-0.036 (-0.056, -0.017)	<0.001
Colorectal cancer (N=6,877)						
≥1 opioid day	no recent opioids	0.385	0.386	0.371	-0.015 (-0.060, 0.029)	0.504
	recent opioids	0.886	0.896	0.853	-0.043 (-0.089, 0.003)	0.065
≥1 long-acting opioid day	no recent opioids	0.025	0.024	0.031	0.007 (-0.007, 0.021)	0.330
	recent opioids	0.128	0.120	0.115	-0.005 (-0.070, 0.060)	0.876
Total MMEs if any	no recent opioids	1458.7	1587.7	1579.9	-7.8 (-344.9, 329.3)	0.964
	recent opioids	3821.7	3934.7	3606.1	-328.6 (-2654.3, 1997.2)	0.782
≥1 pain-related hospital events	no recent opioids	0.109	0.110	0.118	0.008 (-0.020, 0.035)	0.589
	recent opioids	0.126	0.113	0.101	-0.011 (-0.051, 0.028)	0.576
Lung cancer (N=4,177)						
≥1 opioid day	no recent opioids	0.337	0.350	0.270	-0.080 (-0.157, -0.004)	0.040
	recent opioids	0.911	0.920	0.865	-0.055 (-0.133, 0.022)	0.159
≥1 long-acting opioid day	no recent opioids	0.071	0.075	0.058	-0.017 (-0.047, 0.014)	0.286
	recent opioids	0.299	0.316	0.208	-0.109 (-0.207, -0.010)	0.032
Total MMEs if any	no recent opioids	3723.0	3864.9	3693.2	-171.7 (-1933.6, 1590.3)	0.849
	recent opioids	7773.0	7471.0	8342.100	871.1 (-2774.9, 4517.1)	0.640
≥1 pain-related hospital events	no recent opioids	0.141	0.139	0.157	0.018 (-0.020, 0.056)	0.357
	recent opioids	0.207	0.210	0.125	-0.084 (-0.145, -0.024)	0.006

Sensitivity analysis restricting to the 23 states with no MML but with an operating PDMP by 1/1/2012.