

Supplementary Material

Patterns of real-world opioid prescribing in Australian general practice (2013–18)

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Table S1. Opioids of interest, their ATC codes, and public subsidy access restrictions.

Opioid medicine and formulation	ATC codes	PBS public subsidy access restrictions ^a
Buprenorphine	N02AE01	
Patch		Restricted benefit. Chronic severe disabling pain unresponsive to non-opioid analgesics
Patch		Authority required. Chronic severe disabling pain (palliative care) unresponsive to non-opioid analgesics
Codeine	R05DA04, N02AA59	
Tablets		Unrestricted benefit
Tablet (paracetamol 500 mg + codeine phosphate 30 mg) – 60 tablets		Authority required. Severe disabling pain unresponsive to non-opioid analgesics
Fentanyl	N02AB03	
Patch		Restricted benefit. Chronic severe disabling pain unresponsive to non-opioid analgesics
Lozenges, sublingual tablet, orally disintegrating tablet		Authority required. Breakthrough pain (palliative care and cancer)
Hydromorphone	N02AA03	
Tablet, oral liquid		Restricted benefit. Severe disabling pain unresponsive to non-opioid analgesics
Modified release tablet		Restricted benefit. Chronic severe disabling pain unresponsive to non-opioid analgesics
Methadone	N07BC02	
Tablet		Restricted benefit. Severe disabling pain unresponsive to non-opioid analgesics
Oral liquid		Authority Required. Initial or continuing treatment for chronic severe disabling pain (palliative care) unresponsive to non-opioid analgesics

Morphine	N02AA01, N02AA51	
Modified release tablet or capsule or granules		Restricted benefit. Chronic severe disabling pain unresponsive to non-opioid analgesics
Tablet, oral liquid		Restricted benefit. Severe disabling pain unresponsive to non-opioid analgesics
Modified release tablet		Authority required. Chronic severe disabling pain (palliative care, cancer) unresponsive to non-opioid analgesics
Tablet		Authority required. Severe disabling pain (palliative care) unresponsive to non-opioid analgesics
Oxycodone	N02AA05, N02AA55	
Tablet, capsule, oral liquid, suppository		Restricted benefit. Severe disabling pain unresponsive to non-opioid analgesics
Modified release tablet, modified release tablet (oxycodone + naloxone)		Restricted benefit. Chronic severe disabling pain unresponsive to non-opioid analgesics
Tapentadol	N02AX06	
Modified release tablet		Restricted benefit. Chronic severe disabling pain unresponsive to non-opioid analgesics
Tramadol	N02AX02	
Modified release tablet, oral liquid		Restricted benefit. Pain in which aspirin and/or paracetamol alone are inappropriate or have failed
Capsule		Restricted benefit. Acute pain or dose titration for chronic pain in which aspirin and/or paracetamol alone are inappropriate or have failed

^aNote that the PBS restrictions were updated in June 2020, while the restrictions included in this table are relevant for the study period, they are no longer current.

Unrestricted benefit: have no restrictions on their therapeutic uses.

Restricted benefit: can only be prescribed for specific therapeutic uses (noted as Restricted benefit). If the medicine is prescribed outside the PBS-specified indication, prescribers are required to write private (unsubsidised) prescriptions.

Authority required benefit: fall into two separate categories – *Authority required benefits* are restricted benefits that require the prescriber to obtain written or telephone approval from the Department of Human Services (DHS) or the Department of Veterans' Affairs (DVA); and *Authority required (streamlined) benefits* are restricted benefits that do not require prior approval from the DHS or the DVA but require the recording of a streamlined authority code. To prescribe quantities and/or additional repeats above those specified in the PBS schedule, the prescription is treated as an authority required item.

Table S2. Annual number of all prescriptions and opioid prescriptions for the baseline study population, MedicineInsight 1 October 2013 – 30 September 2018 (N = 3.4 million patients)

Year	Total number of all prescriptions (N)	Opioids prescriptions	
		Number of opioid prescriptions (n)	Percentage of all prescriptions
Year 1 (1 Oct 2013 to 30 Sep 2014)	10,179,704	760,412	7.47
Year 2 (1 Oct 2014 to 30 Sep 2015)	10,613,891	794,916	7.49
Year 3 (1 Oct 2015 to 30 Sep 2016)	10,578,726	811,195	7.67
Year 4 (1 Oct 2016 to 30 Sep 2017)	10,493,915	813,317	7.75
Year 5 (1 Oct 2017 to 30 Sep 2018)	10,295,657	826,575	8.03
Total	52,161,893	4,006,415	7.68

Note, 'all prescriptions and opioid prescriptions' refers to issued prescriptions (individual script-items, excluding repeats)

Table S3. Total number and proportion of individual opioid prescriptions (all, PBS and private), MedicineInsight 1 October 2013 – 30 September 2018 (N = 468,893 patients)

Opioid sub-group	All prescriptions for relevant opioids		PBS prescriptions for relevant opioids		Private prescriptions for relevant opioids	
	Number	% of total prescriptions for relevant opioids	Number	% of total PBS opioid prescriptions	Number	% of total private opioid prescriptions
Buprenorphine	568,121	14.18	561,547	14.92	6,574	2.71
Codeine S4 ^a	544,694	13.60	417,891	11.10	126,803	52.24
Codeine S8	76,173	1.90	70,014	1.86	6,159	2.54
Fentanyl (oral)	5,345	0.13	4,425	0.12	920	0.38
Fentanyl patches	203,939	5.09	202,657	5.38	1,282	0.53
Hydromorphone	61,791	1.54	61,317	1.63	474	0.20
Methadone	81,035	2.02	49,442	1.31	31,593	13.02
Morphine	191,754	4.79	186,370	4.95	5,384	2.22
Oxycodone (± naloxone)	1,508,282	37.65	1,484,160	39.43	24,122	9.94
Tapentadol ^b	186,908	4.67	173,192	4.60	13,716	5.65
Tramadol	578,373	14.44	552,686	14.68	25,687	2.71
Total	4,006,415	100	3,763,701	100	242,714	100

Oxycodone (± naloxone): all oxycodone prescriptions including the naloxone combination prescriptions.

^a Codeine was up-scheduled from being available over the counter to a prescription-only medicine on 1 February 2018.

^b Tapentadol was listed on the PBS on 1 June 2014, thus, for PBS prescriptions, the first year comprises 4 months only.

Table S4. Proportion (%; 95% CI) of all medicine prescriptions represented by opioid prescriptions. By opioid medicine and year of study period.

Opioid sub-group	Year 1 (N=10,179,704)	Year 2 (N=10,613,891)	Year 3 (N=10,578,726)	Year 4 (N=10,493,915)	Year 5 (N=10,295,657)
Buprenorphine	1.17 (1.09, 1.25)	1.11 (1.03, 1.18)	1.09 (1.02, 1.17)	1.05 (0.98, 1.12)	1.03 (0.95, 1.10)
Codeine S4 ^a	1.04 (0.86, 1.23)	1.02 (0.84, 1.20)	0.98 (0.81, 1.15)	0.93 (0.77, 1.08)	1.25 (1.06, 1.45)
Codeine S8	0.15 (0.13, 0.16)	0.15 (0.14, 0.17)	0.14 (0.13, 0.16)	0.15 (0.14, 0.17)	0.13 (0.12, 0.15)
Fentanyl patches	0.46 (0.42, 0.51)	0.43 (0.39, 0.47)	0.40 (0.36, 0.44)	0.36 (0.32, 0.39)	0.30 (0.27, 0.33)
Hydromorphone	0.12 (0.10, 0.14)	0.12 (0.10, 0.14)	0.13 (0.11, 0.15)	0.12 (0.10, 0.13)	0.11 (0.09, 0.13)
Methadone	0.16 (0.08, 0.24)	0.15 (0.08, 0.22)	0.16 (0.08, 0.23)	0.17 (0.08, 0.26)	0.14 (0.08, 0.20)
Morphine	0.42 (0.38, 0.45)	0.38 (0.35, 0.42)	0.37 (0.33, 0.40)	0.35 (0.31, 0.38)	0.32 (0.29, 0.35)
Oxycodone (± naloxone)	2.79 (2.64, 2.93)	2.82 (2.67, 2.98)	2.93 (2.77, 3.10)	2.98 (2.81, 3.15)	2.93 (2.76, 3.10)
<i>Oxycodone (without naloxone)</i>	2.32 (2.19, 2.44)	2.12 (2.00, 2.23)	2.09 (1.98, 2.21)	2.05 (1.94, 2.16)	1.96 (1.85, 2.06)
<i>Oxycodone + naloxone</i>	0.47 (0.41, 0.54)	0.71 (0.61, 0.80)	0.84 (0.73, 0.94)	0.93 (0.82, 1.05)	0.97 (0.86, 1.08)
Tapentadol ^b	0.02 (0.01, 0.02)	0.18 (0.15, 0.20)	0.33 (0.30, 0.36)	0.53 (0.48, 0.58)	0.73 (0.67, 0.80)
Tramadol	1.13 (1.07, 1.20)	1.11 (1.05, 1.18)	1.13 (1.06, 1.19)	1.10 (1.03, 1.17)	1.07 (1.00, 1.14)
All relevant opioids	7.47 (7.19, 7.75)	7.49 (7.21, 7.77)	7.67 (7.38, 7.95)	7.75 (7.46, 8.04)	8.03 (7.74, 8.32)

^a Codeine was up-scheduled from being available over the counter to a prescription-only medicine on 1 February 2018.

^b Tapentadol was listed on the PBS on 1 June 2014, thus, for PBS prescriptions, the first year comprises 4 months only.

Table S5. Opioid prescriptions stratified by PBS and private prescriptions, MedicineInsight 1 October 2013 – 30 September 2018 (N = 468,893 patients)

Opioid sub-group	All prescriptions for relevant opioids	PBS prescriptions for relevant opioids		Private prescriptions for relevant opioids	
		Number	% of all prescriptions for relevant opioids (N=4,006,415)	Number	% of all prescriptions for relevant opioids (N=4,006,415)
Buprenorphine	568,121	561,547	98.84	6,574	1.16
Codeine S4 ^a	544,694	417,891	76.72	126,803	23.28
Codeine S8	76,173	70,014	91.91	6,159	8.09
Fentanyl (oral)	5,345	4,425	82.79	920	17.21
Fentanyl patches	203,939	202,657	99.37	1,282	0.63
Hydromorphone	61,791	61,317	99.23	474	0.77
Methadone	81,035	49,442	61.01	31,593	38.99
Morphine	191,754	186,370	97.19	5,384	2.81
Oxycodone (± naloxone)	1,508,282	1,484,160	98.40	24,122	1.60
Tapentadol ^b	186,908	173,192	92.66	13,716	7.34
Tramadol	578,373	552,686	95.56	25,687	4.44
Total	4,006,415	3,763,701	93.94	242,714	6.06

Oxycodone (± naloxone): all oxycodone prescriptions including the naloxone combination prescriptions.

^a Codeine was up-scheduled from being available over the counter to a prescription-only medicine on 1 February 2018.

^b Tapentadol was listed on the PBS on 1 June 2014, thus, for PBS prescriptions, the first year comprises 4 months only.

Table S6. Proportion (%) of all public or private medicine prescriptions represented by opioid prescriptions. By opioid medicine and year of study period.

Opioid sub-group	PBS prescriptions (% , 95% CI)					Private market prescriptions (% , 95% CI)				
	Year 1 (N=8,944,163)	Year 2 (N=9,278,980)	Year 3 (N=9,128,313)	Year 4 (N=8,968,538)	Year 5 (N=8,669,657)	Year 1 (N=1,235,541)	Year 2 (N=1,334,911)	Year 3 (N=1,450,413)	Year 4 (N=1,525,377)	Year 5 (N=1,626,000)
Buprenorphine	1.32 (1.23, 1.41)	1.26 (1.17, 1.34)	1.25 (1.17, 1.34)	1.21 (1.13, 1.30)	1.20 (1.12, 1.28)	0.09 (0.06, 0.12)	0.08 (0.06, 0.10)	0.08 (0.07, 0.10)	0.10 (0.08, 0.11)	0.11 (0.09, 0.13)
Codeine S4 ^a	0.97 (0.80, 1.14)	0.96 (0.79, 1.12)	0.93 (0.77, 1.08)	0.87 (0.72, 1.02)	0.92 (0.76, 1.07)	1.55 (1.19, 1.90)	1.48 (1.13, 1.83)	1.32 (1.05, 1.60)	1.26 (1.01, 1.51)	3.04 (2.57, 3.51)
Codeine S8	0.15 (0.13, 0.17)	0.16 (0.14, 0.18)	0.14 (0.13, 0.16)	0.17 (0.15, 0.19)	0.15 (0.13, 0.17)	0.10 (0.08, 0.13)	0.10 (0.08, 0.12)	0.13 (0.10, 0.15)	0.06 (0.05, 0.07)	0.05 (0.04, 0.06)
Fentanyl patches	0.52 (0.48, 0.57)	0.49 (0.45, 0.54)	0.46 (0.42, 0.51)	0.42 (0.38, 0.45)	0.36 (0.32, 0.39)	0.03 (0.02, 0.04)	0.02 (0.01, 0.03)	0.02 (0.01, 0.03)	0.01 (0.01, 0.02)	0.01 (0.01, 0.02)
Hydromorphone	0.13 (0.11, 0.15)	0.14 (0.11, 0.16)	0.15 (0.12, 0.17)	0.14 (0.12, 0.16)	0.13 (0.11, 0.15)	0.01 (0.00, 0.01)	0.01 (0.00, 0.02)	0.01 (0.00, 0.01)	0.01 (0.00, 0.01)	0.00 (0.00, 0.01)
Methadone	0.12 (0.06, 0.19)	0.11 (0.05, 0.18)	0.10 (0.06, 0.14)	0.12 (0.03, 0.21)	0.08 (0.07, 0.10)	0.42 (0.14, 0.70)	0.40 (0.14, 0.66)	0.49 (0.17, 0.81)	0.43 (0.14, 0.73)	0.45 (0.08, 0.82)
Morphine	0.46 (0.42, 0.50)	0.43 (0.39, 0.47)	0.42 (0.38, 0.45)	0.39 (0.36, 0.43)	0.37 (0.34, 0.40)	0.08 (0.07, 0.10)	0.07 (0.06, 0.09)	0.08 (0.06, 0.09)	0.07 (0.06, 0.09)	0.07 (0.05, 0.08)
Oxycodone (± naloxone)	3.12 (2.96, 3.28)	3.18 (3.01, 3.35)	3.35 (3.16, 3.53)	3.44 (3.25, 3.63)	3.42 (3.23, 3.62)	0.41 (0.34, 0.48)	0.36 (0.30, 0.42)	0.34 (0.28, 0.40)	0.30 (0.25, 0.35)	0.29 (0.25, 0.34)
<i>Oxycodone (without naloxone)</i>	2.58 (2.45, 2.72)	2.38 (2.25, 2.50)	2.38 (2.25, 2.51)	2.35 (2.23, 2.48)	2.28 (2.16, 2.40)	0.37 (0.31, 0.44)	0.31 (0.26, 0.37)	0.29 (0.24, 0.33)	0.26 (0.22, 0.30)	0.25 (0.21, 0.29)
<i>Oxycodone + naloxone</i>	0.53 (0.46, 0.61)	0.80 (0.70, 0.90)	0.96 (0.84, 1.08)	1.09 (0.96, 1.22)	1.14 (1.01, 1.28)	0.04 (0.03, 0.05)	0.04 (0.03, 0.06)	0.05 (0.03, 0.08)	0.04 (0.03, 0.05)	0.04 (0.03, 0.06)
Tapentadol ^b	0.02 (0.01, 0.02)	0.20 (0.17, 0.22)	0.37 (0.34, 0.41)	0.58 (0.53, 0.64)	0.77 (0.70, 0.84)	0.03 (0.02, 0.04)	0.02 (0.02, 0.03)	0.06 (0.05, 0.07)	0.23 (0.20, 0.27)	0.53 (0.47, 0.60)
Tramadol	1.23 (1.16, 1.31)	1.22 (1.14, 1.29)	1.25 (1.17, 1.32)	1.24 (1.16, 1.32)	1.21 (1.13, 1.29)	0.41 (0.34, 0.48)	0.40 (0.33, 0.46)	0.36 (0.30, 0.42)	0.32 (0.26, 0.39)	0.32 (0.26, 0.38)
All relevant opioids	8.07 (7.78, 8.36)	8.14 (7.85, 8.43)	8.42 (8.13, 8.72)	8.59 (8.29, 8.89)	8.62 (8.32, 8.92)	3.14 (2.67, 3.60)	2.96 (2.52, 3.39)	2.91 (2.49, 3.32)	2.81 (2.43, 3.20)	4.89 (4.31, 5.47)

^a Codeine was up-scheduled from being available over the counter to a prescription-only medicine on 1 February 2018.

^b Tapentadol was listed on the PBS on 1 June 2014, thus, for PBS prescriptions, the first year comprises 4 months only.

Table S7. Proportion (%) of all, PBS and private opioid prescriptions with at least one repeat, MedicineInsight 1 October 2013 – 30 September 2018 (N = 468,893 patients)

Opioid sub-group	All opioid prescriptions with at least one repeat (N = 4,006,415)		PBS opioid prescriptions with at least one repeat (N = 3,763,701)		Private opioid prescriptions with at least one repeat (N = 242,714)	
	Number	% of all prescriptions for relevant opioids	Number	% of PBS prescriptions for relevant opioids	Number	% of private prescriptions for relevant opioids
Buprenorphine	37,810	6.66	35,906	6.39	1,904	28.96
Codeine S4 ^a	81,144	14.90	55,034	13.17	26,110	20.59
Codeine S8	2,519	3.31	1,407	2.01	1,112	18.05
Fentanyl patches	9,478	4.65	9,226	4.55	252	19.66
Hydromorphone	2,701	4.37	2,619	4.27	82	17.30
Methadone	9,418	11.62	3,599	7.28	5,819	18.42
Morphine	11,219	5.85	9,526	5.11	1,693	31.45
Oxycodone (± naloxone)	38,989	2.58	35,656	2.40	3,333	13.82
Tapentadol ^b	7,434	3.98	5,563	3.21	1,871	13.64
Tramadol	256,322	44.32	244,035	44.15	12,287	47.83
Total^c	457,689	11.42	402,887	10.70	54,802	22.58

Oxycodone (± naloxone): all oxycodone prescriptions including the naloxone combination prescriptions.

^a Codeine was up-scheduled from being available over the counter to a prescription-only medicine on 1 February 2018.

^b Tapentadol was listed on the PBS on 1 June 2014, thus, for PBS prescriptions, the first year comprises 4 months only.

^c Total includes repeat prescriptions for oral fentanyl, 655 prescriptions for all opioids, 316 for PBS and 339 for private prescriptions of opioids.

Table S8. PBS and private opioid prescriptions with at least one repeat recorded, by study year, MedicineInsight 1 October 2013 – 30 September 2018 (N = 468,893 patients)

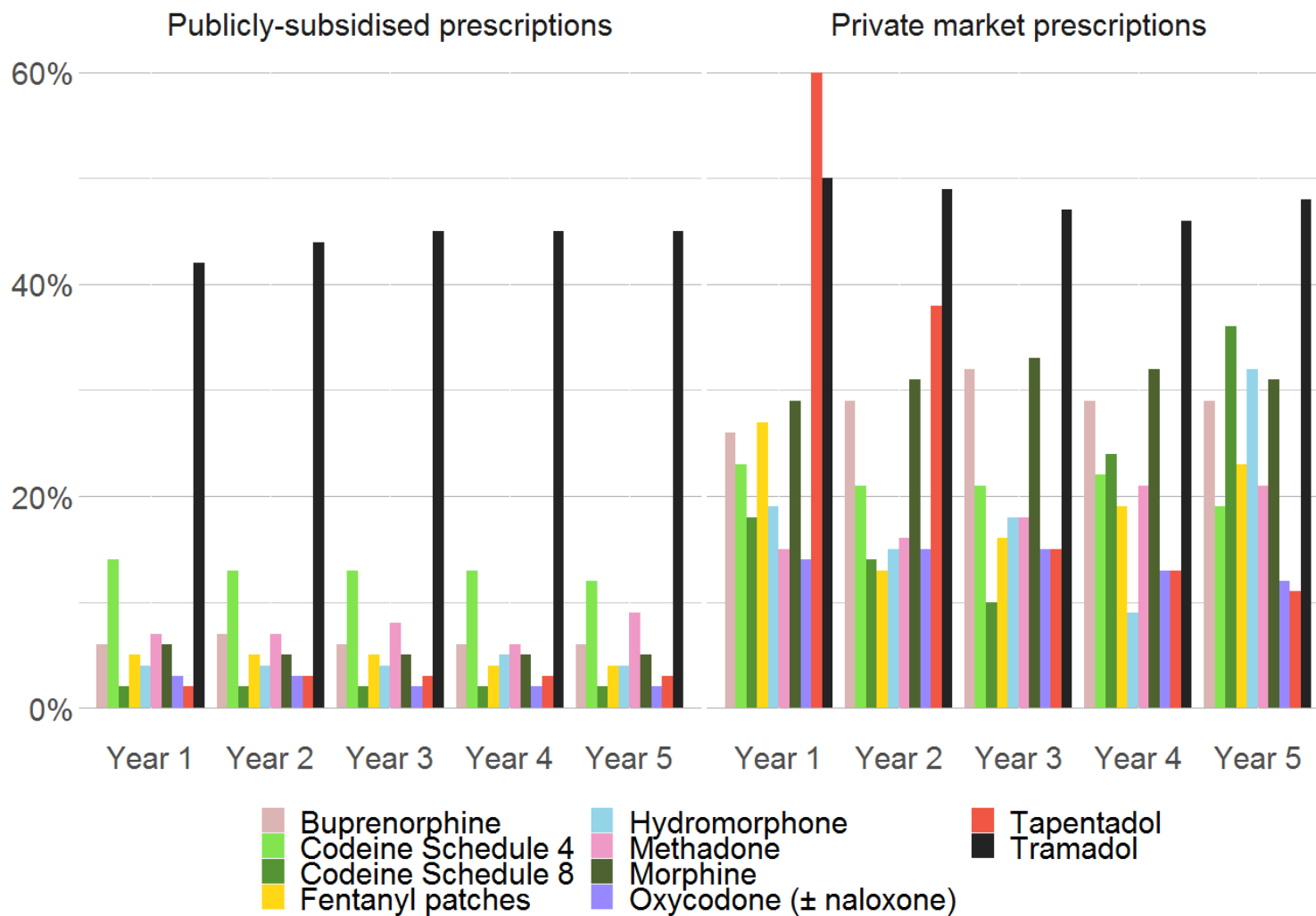
Opioid sub-group	Of PBS prescriptions for opioids, the proportion with at least one repeat, % (95% CI)					Of private prescriptions for opioids, the proportion with at least one repeat, % (95% CI)				
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Buprenorphine	6.38 (5.25, 7.51)	6.58 (5.48, 7.69)	6.45 (5.35, 7.56)	6.28 (5.24, 7.32)	6.25 (5.25, 7.25)	25.85 (17.18, 34.53)	28.77 (20.07, 37.47)	31.88 (25.23, 38.52)	29.33 (23.76, 34.89)	28.79 (23.58, 33.99)
Codeine S4 ^a	13.63 (11.82, 15.44)	13.42 (11.62, 15.22)	13.15 (11.26, 15.03)	13.10 (11.18, 15.01)	12.47 (10.80, 14.15)	22.82 (18.77, 26.87)	20.74 (16.78, 24.70)	21.27 (17.87, 24.67)	21.72 (18.52, 24.92)	18.97 (16.87, 21.07)
Codeine S8	2.10 (1.50, 2.69)	2.29 (1.68, 2.90)	2.32 (1.55, 3.08)	1.66 (1.12, 2.20)	1.70 (1.17, 2.23)	18.34 (12.25, 24.44)	14.24 (9.49, 19.00)	10.06 (7.27, 12.85)	24.38 (18.05, 30.71)	36.36 (29.93, 42.79)
Fentanyl patches	4.63 (3.63, 5.63)	4.73 (3.77, 5.68)	4.52 (3.58, 5.46)	4.33 (3.36, 5.29)	4.49 (3.48, 5.51)	27.08 (12.52, 41.63)	12.58 (3.26, 21.91)	15.85 (4.61, 27.10)	19.42 (7.87, 30.97)	23.15 (8.19, 38.11)
Hydromorphone	4.36 (2.98, 5.74)	4.45 (3.10, 5.80)	3.96 (2.84, 5.08)	4.63 (3.55, 5.70)	3.96 (2.93, 4.98)	18.56 (2.75, 34.36)	14.97 (0.08, 29.85)	17.71 (0.00, 39.58)	9.09 (0.00, 21.26)	31.58 (6.87, 56.28)
Methadone	7.26 (2.99, 11.52)	7.49 (3.14, 11.85)	7.75 (4.33, 11.16)	5.89 (1.33, 10.45)	8.52 (6.14, 10.90)	14.90 (6.10, 23.70)	16.00 (8.49, 23.52)	18.40 (7.89, 28.91)	20.60 (14.27, 26.92)	20.73 (14.25, 27.20)
Morphine	5.61 (4.50, 6.73)	5.44 (4.42, 6.46)	4.81 (3.82, 5.80)	4.76 (3.72, 5.79)	4.80 (3.80, 5.81)	29.18 (22.41, 35.95)	30.76 (23.92, 37.61)	33.42 (25.83, 41.01)	32.39 (25.48, 39.30)	31.11 (23.45, 38.76)
Oxycodone (± naloxone)	2.66 (2.17, 3.14)	2.61 (2.10, 3.11)	2.48 (1.99, 2.97)	2.25 (1.80, 2.69)	2.04 (1.66, 2.43)	14.30 (11.31, 17.28)	14.63 (11.51, 17.75)	15.01 (11.26, 18.75)	13.25 (9.81, 16.69)	11.80 (8.73, 14.87)
Tapentadol ^b	2.01 (1.15, 2.86)	2.97 (2.24, 3.69)	3.47 (2.65, 4.30)	3.23 (2.59, 3.88)	3.16 (2.61, 3.70)	59.83 (49.54, 70.12)	37.95 (26.48, 49.42)	15.25 (10.09, 20.41)	12.76 (10.11, 15.41)	11.15 (9.32, 12.98)
Tramadol	42.36 (40.31, 44.40)	44.11 (41.99, 46.23)	44.75 (42.74, 46.76)	44.88 (42.86, 46.90)	44.68 (42.61, 46.75)	50.00 (42.43, 57.57)	48.59 (41.75, 55.42)	46.91 (40.08, 53.74)	45.96 (36.85, 55.08)	47.64 (39.06, 56.22)

Oxycodone (± naloxone): all oxycodone prescriptions including the naloxone combination prescriptions.

^a Codeine was up-scheduled from being available over the counter to a prescription-only medicine on 1 February 2018.

^b Tapentadol was listed on the PBS on 1 June 2014, thus, for PBS prescriptions, the first year comprises 4 months only.

Fig. S1. Proportion of prescriptions for each opioid of interest that included at least one repeat in each study year, by market



All medicine prescriptions and opioid prescriptions refers to issued prescriptions (individual script-items, excluding repeats).

Year 1, 1 Oct 2013 to 30 Sep 2014; Year 2, 1 Oct 2014 to 30 Sep 2015; Year 3, 1 Oct 2015 to 30 Sep 2016; Year 4, 1 Oct 2016 to 30 Sep 2017; Year 5, 1 Oct 2017 to 30 Sep 2018.