Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

APPENDIX

STROBE Statement

	Item No	Recommendation	Page
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	5-6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-9
Bias	9	Describe any efforts to address potential sources of bias	7-9
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8-9
		(*b*) Describe any methods used to examine subgroups and interactions	8-9
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	8, Appendix
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Appendix
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	Appendix
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11-13
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Appendix
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15-16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	10, 17

Appendix Table 1. Classification of violent and property offences

Offence type	ANZSOC code[1]
Violent offences[2]	
Murder	011, 012, 012
Assault	021, 029
Robbery	0611, 0612
Sexual assault and indecent assault/act of indecency/other sexual offences	0311, 0312
Property offences	
Break and enter	071
Motor vehicle theft	081
Theft	082
Fraud	091, 092

ANZSOC: Australian and New Zealand Standard Offence Classification

References:
1. Pink B. Australian and New Zealand Standard Offence Classification (ANZSOC) Third edition. Canberra: Australian Bureau of Statistics; 2011.
2. Bureau of Crime Statistics and Research. NSW Recorded Crime Statistics Quarterly Update September 2018. 2018. https://www.bocsar.nsw.gov.au/Documents/RCS-Quarterly/NSW_Recorded_Crime_September_2018.pdf (accessed December 18, 2018).

Appendix Table 2. Characteristics of the cohort (n, %) overall, and by form of opioid agonist therapy (methadone or buprenorphine) at the time of OAT initiation

	Entire cohort	Methadone[1]	Buprenorphine[1]
	(n=10,744)	(n=5,738)	(n=5,006)
Men	7607 (70.8%)	4179 (72.8%)	3428 (68.5%)
Indigenous	2467 (23.0%)	1762 (30.7%)	705 (14.1%)
Age at OAT initiation			
Younger than 25 years	3063 (28.5%)	1636 (28.5%)	1427 (28.5%)
25-29 years	2721 (25.3%)	1422 (24.8%)	1299 (26.0%)
30-34 years	1907 (17.8%)	1038 (18.1%)	869 (17.4%)
35+ years	3053 (28.4%)	1642 (28.6%)	1411 (28.2%)
Year of OAT initiation			
2004-2005	3445 (32.1%)	1735 (30.2%)	1710 (34.2%)
2006-2007	2597 (24.2%)	1505 (26.2%)	1092 (21.8%)
2008-2009	3001 (27.9%)	1626 (28.3%)	1375 (27.5%)
2010	1701 (15.8%)	872 (15.2%)	829 (16.6%)
Number of charges before OAT initiation[2]			
0	4285 (39.9%)	1817 (31.7%)	2468 (49.3%)
1-4	2857 (26.6%)	1427 (24.9%)	1430 (28.6%)
5-14	2558 (23.8%)	1674 (29.2%)	884 (17.7%)
15 or more	1044 (9.7%)	820 (14.3%)	224 (4.5%)
Previous charge for a violent offence[3]	2827 (26.3%)	2016 (35.1%)	811 (16.2%)
Previous charge for a property offence[4]	3240 (30.2%)	2141 (37.3%)	1099 (22.0%)
Previous charge for a drug offence	2223 (20.7%)	1408 (24.5%)	815 (16.3%)
Number of prison episodes before OAT initiation[2]			
0	6844 (63.7%)	2913 (50.8%)	3931 (78.5%)
1	1418 (13.2%)	907 (15.8%)	511 (10.2%)
2-3	1467 (13.7%)	1077 (18.8%)	390 (7.8%)
4 or more	1015 (9.5%)	841 (14.7%)	174 (3.5%)

[1]Treatment at initiation of OAT
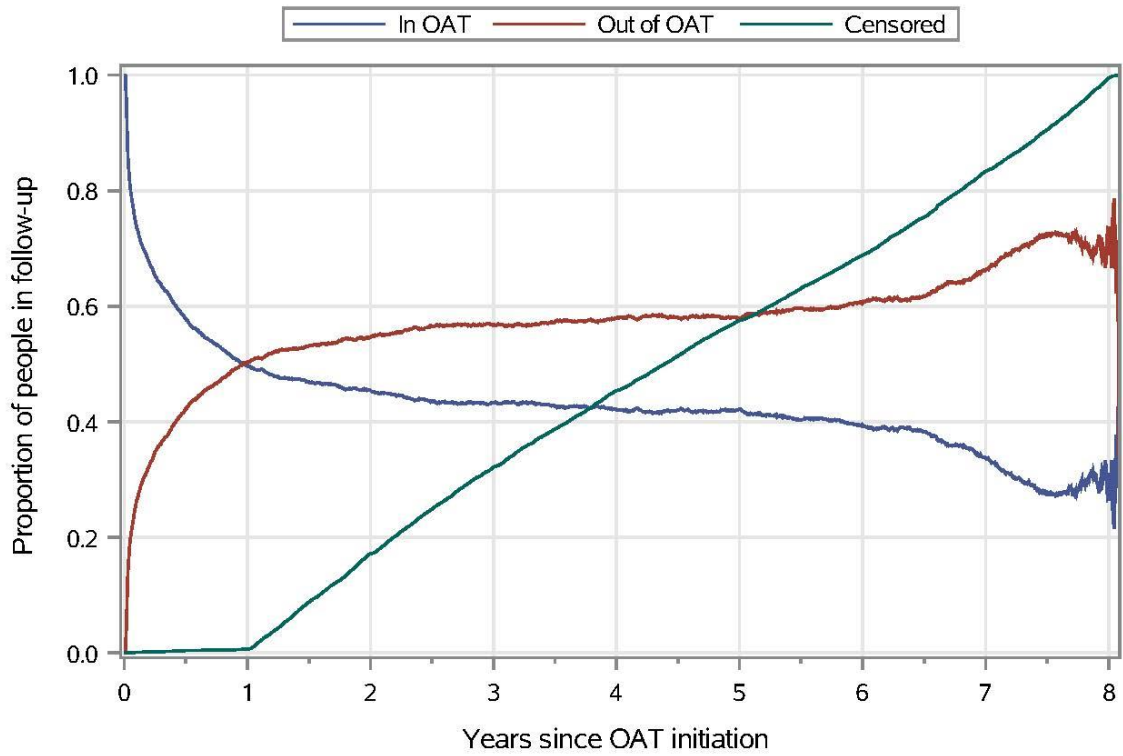[2]In the four years prior to OAT initiation
[3]The definition of violent offences included: murder, assault, robbery, sexual assault and indecent assault/act of indecency/other sexual offences (see Appendix, Table 1 for ANZSOC codes).
[4]The definition of property offences included: break and enter, motor vehicle theft, theft and fraud (see Appendix, Table 1 for ANZSOC codes).

Appendix Table 3. Frequencies of the number of charge-days per person, and number of charges per person, during follow-up

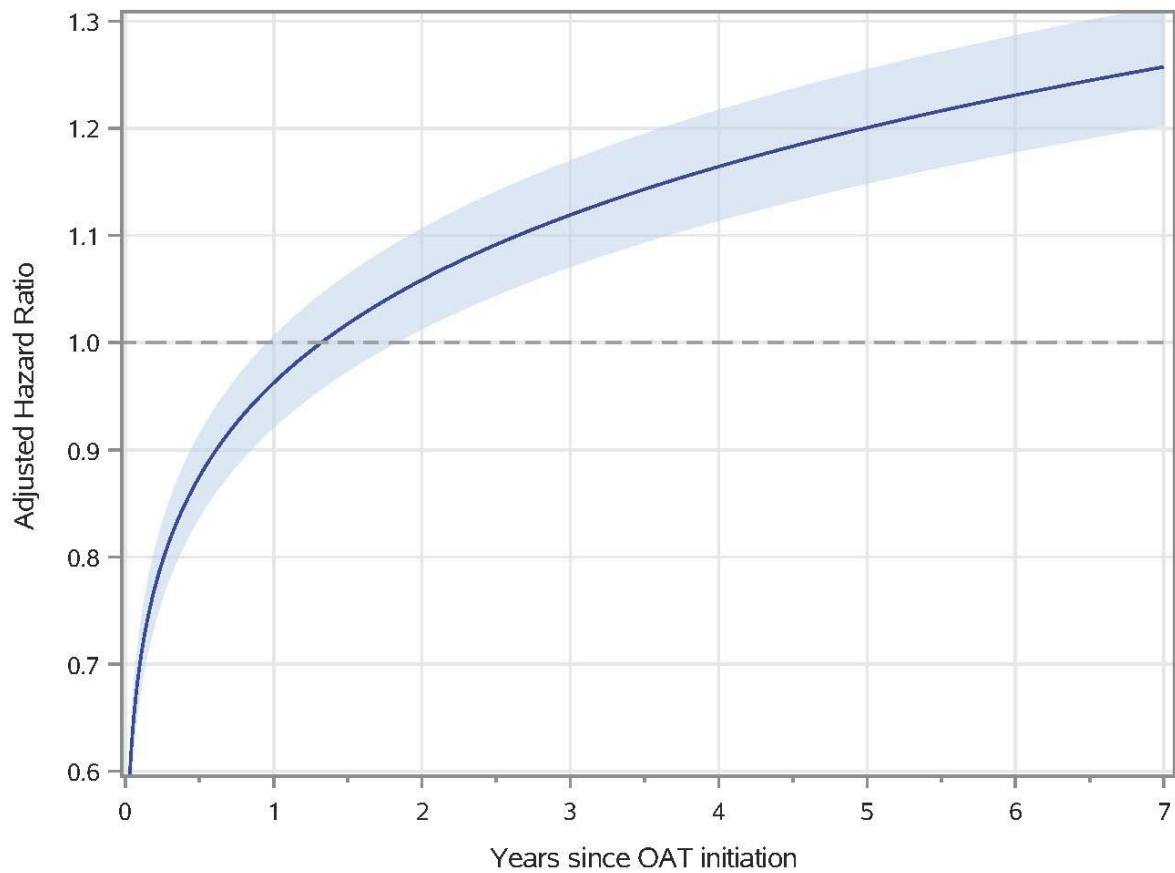| Number of charge-days during follow-up	N	Percent (%)	Cumulative Percent (%)	Number of charges during follow-up	N	Percent (%)	Cumulative Percent (%)
0	4993	46.47	46.47	0	4993	46.47	46.47
1	1809	16.84	63.31	1	1249	11.63	58.1
2	992	9.23	72.54	2	786	7.32	65.41
3	692	6.44	78.98	3	596	5.55	70.96
4	464	4.32	83.30	4	434	4.04	75.00
5	356	3.31	86.62	5	352	3.28	78.28
6	300	2.79	89.41	6	319	2.97	81.25
7	232	2.16	91.57	7	237	2.21	83.45
8	200	1.86	93.43	8	223	2.08	85.53
9	142	1.32	94.75	9	189	1.76	87.29
10+	564	5.25	100	10+	1366	12.71	100

Appendix Figure 1. Treatment status of the cohort (n=10,744) – proportion in and out of opioid agonist treatment (OAT) and proportion censored - according to time since OAT initiation

In OAT	10744	5307	4041	3152	2469	1923	1313	605	15
Out of OAT	0	5370	4863	4140	3399	2638	2034	1188	37
Total	10744	10677	8904	7292	5868	4561	3347	1793	52

Note: counts at the bottom of the graph indicate the total number of people still in follow-up at annual intervals. People were censored at time of death or at the end of follow-up.
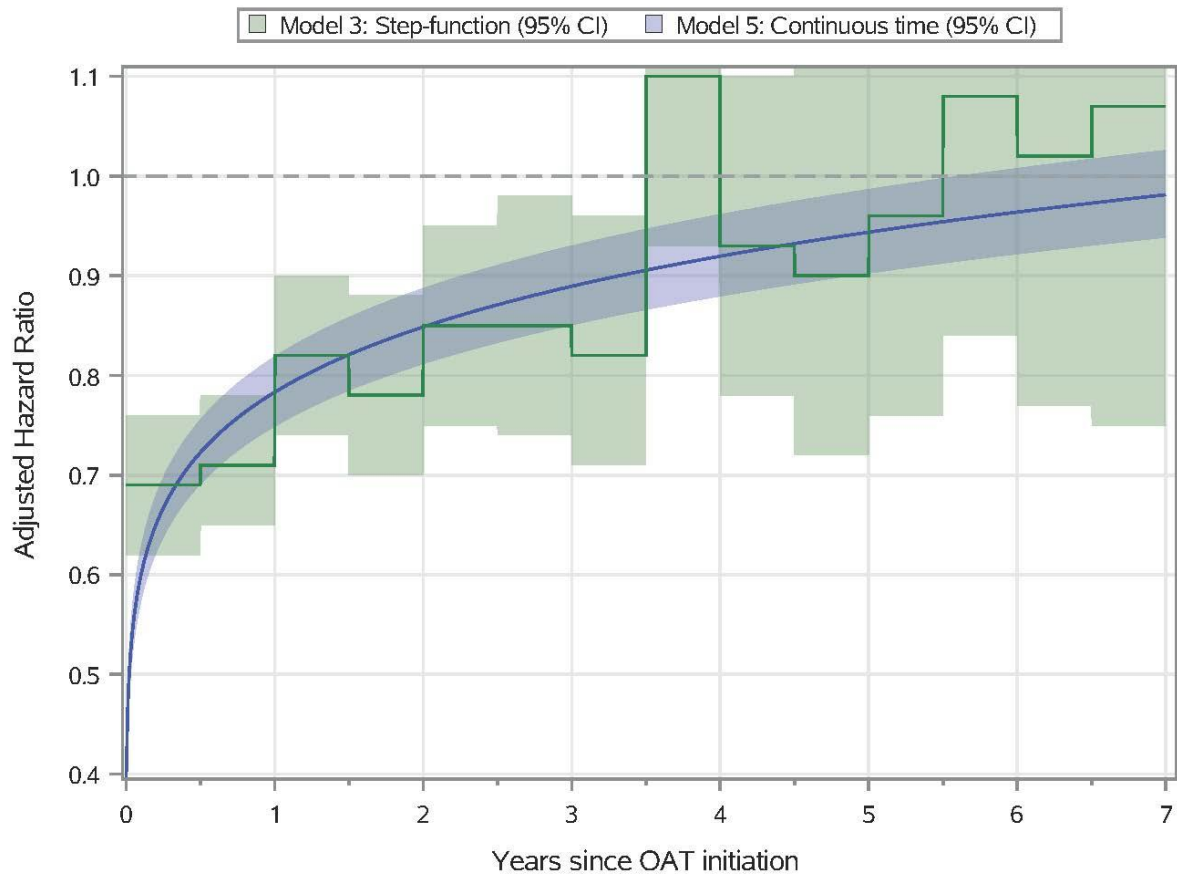
Appendix Figure 2. Adjusted hazard ratios of association between time spent in opioid agonist treatment (OAT) and risk of first charge according to time since OAT initiation[1]

Results are from a multivariate Cox proportional hazards regression adjusting for sociodemographic, treatment and criminographic variables (see Model 3 in Table 1).
[1.] Years since OAT initiation (x-axis) truncated at seven years.

Appendix Figure 3. Effect of opioid agonist treatment (OAT) on charge-days modelled as a half-yearly step-function (Model 3; see Table 2) and a continuous time-dependent coefficient (Model 5; see Table 2)

Note: Years since OAT initiation, x-axis truncated at seven years. The Anderson-Gill counting process model, an extension of the Cox proportional hazards model which relates the intensity function of event recurrences to covariates multiplicatively, was used to evaluate the impact of being in OAT on charge-days (complete set of results available in Table 2). Hazard ratio adjusted for sex, age of OAT initiation, Indigeneity, year of OAT initiation, time in prison, number of prison episodes since OAT initiation, number of prison episodes before OAT initiation and number of charges before OAT initiation.

Appendix Table 4. Crosstabulation of charge rate (per 100-person years) and 95% confidence interval while in and out of opioid agonist treatment (OAT), by total number of treatment episodes during follow-up and quartile groupings of proportion of follow-up spent in treatment

Proportion of follow-up time in OAT[a]	OAT status	Number of treatment episodes									
		1	2	3	4	5	6	7	8	9	10+
Lowest	In	57.3 (44.4,70.2)	99.9 (85.1,114.7)	141.1 (121.3,161.0)	106.3 (85.9,126.8)	120.6 (91.3,145.0)	178.9 (138.4,219.4)	85.3 (42.1,128.5)	15 (0.00,35.90)	120.4 (41.7,199.0)	332.7 (222.5,443.0)
	Out	46.5 (44.9,48.1)	82.1 (78.7,85.5)	99.1 (93.4,104.8)	123.4 (114.9,132.0)	140 (127.5,152.5)	140.7 (125.0,156.4)	99 (80.5,117.5)	82 (57.8,106.3)	234 (185.1,282.9)	106.3 (79.6,132.9)
Low-Mid	In	65.1 (60.4,69.8)	99.5 (92.5,106.4)	98.6 (89.4,107.7)	117.3 (104.6,130.1)	135.5 (116.1,154.9)	105.4 (85.0,125.7)	94.2 (66.7,121.7)	135.3 (93.4,177.3)	173.7 (115.3,232.1)	138.9 (95.9,181.9)
	Out	53.1 (51.0,55.2)	110.8 (106.0,115.5)	160.1 (151.3,168.9)	161.5 (149.8,173.1)	199.4 (181.0,217.9)	243.8 (219.8,267.9)	250.8 (217.7,283.9)	243.9 (196.1,291.7)	199.8 (153.3,246.3)	147 (113.8,180.3)
High-Mid	In	69.2 (66.6,71.7)	78.6 (74.5,82.8)	110.5 (103.0,117.9)	118.8 (108.7,129.0)	122.8 (108.4,137.3)	155.3 (135.1,175.6)	143.9 (118.8,169.0)	189.3 (151.9,226.8)	276.4 (215.8,337.0)	173.3 (133.3,213.3)
	Out	38.6 (35.3,41.9)	128.2 (121.1,135.2)	197 (184.5,209.5)	222.6 (206.1,239.2)	169.8 (149.3,190.3)	259.5 (230.4,288.7)	245.5 (208.1,282.8)	228.6 (175.0,282.1)	297.8 (235.2,360.4)	310.7 (256.9,364.5)
Highest	In	34.2 (32.7,35.8)	70.9 (67.8,74.2)	101.9 (96.3,107.6)	110.3 (102.1,118.4)	117.7 (106.1,129.2)	173.9 (156.4,191.3)	88.9 (71.3,106.5)	136.3 (108.7,163.8)	59.8 (35.9,83.7)	169.4 (136.9,202.0)
	Out	-b	208.6 (190.7,226.5)	255.8 (233.1,278.5)	183.7 (161.8,205.5)	243 (209.4,276.5)	322.3 (279.1,365.5)	319 (260.17,377.8)	183.4 (117.8,249.1)	222.1 (154.9,289.3)	200.3 (147.9,252.8)

[a] Cut-points for quartile groupings of proportion of follow-up time spent in OAT defined as quartiles among people with the same number of treatment episodes.
[b] All persons with one treatment episode and in the highest quartile grouping had a proportion of follow-up time spent in OAT equal to one (i.e. spent entirety of follow-up in OAT) hence no out-of-treatment crime rate was evaluated for this cell.

Appendix Table 5. Quartile thresholds used to define groupings (lowest, low-mid, high-mid and highest) of proportion of follow-up time spent in opioid agonist treatment (OAT) among people with the same number of treatment episodes

Quartile	Number of OAT episodes									
	1	2	3	4	5	6	7	8	9	10+
Lower	6	15	24	26	27	28	22	34	29	27
Median	41	45	49	49	47	45	47	55	43	44
Upper	100	80	74	68	68	66	68	71	64	60

Appendix Table 6. Sensitivity analysis of Anderson-Gill intensity models investigating associations between time spent in opioid agonist treatment (OAT) and overall charge rates, with end of follow-up set to 30th June 2011 (N=10,744 people; N=22,975 charge-days)

	Model 1	6-month step-function for OAT		Continuous time-dependent coefficient for OAT	
		Model 2	Model 3	Model 4	Model 5
	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
Opioid agonist treatment (OAT, Ref: Not in OAT)					
In OAT	0.79 (0.75,0.84)	-	-	0.27 (0.21,0.35)	0.4 (0.3,0.52)
In OAT: 0-0.5 years since initiation	-	0.63 (0.57,0.7)	0.69 (0.63,0.77)	-	-
In OAT: 0.5-1 years since initiation	-	0.67 (0.61,0.74)	0.73 (0.66,0.8)	-	-
In OAT: 1-1.5 years since initiation	-	0.79 (0.71,0.88)	0.83 (0.75,0.92)	-	-
In OAT: 1.5-2 years since initiation	-	0.77 (0.68,0.87)	0.79 (0.7,0.89)	-	-
In OAT: 2-2.5 years since initiation	-	0.82 (0.73,0.93)	0.85 (0.75,0.96)	-	-
In OAT: 2.5-3 years since initiation	-	0.88 (0.77,1)	0.85 (0.74,0.97)	-	-
In OAT: 3-3.5 years since initiation	-	0.85 (0.73,0.99)	0.83 (0.71,0.98)	-	-
In OAT: 3.5-4 years since initiation	-	1.15 (0.98,1.34)	1.11 (0.94,1.32)	-	-
In OAT: 4-4.5 years since initiation	-	1.01 (0.86,1.2)	0.94 (0.78,1.13)	-	-
In OAT: 4.5-5 years since initiation	-	1.05 (0.85,1.31)	0.89 (0.71,1.13)	-	-
In OAT: 5-5.5 years since initiation	-	1.17 (0.93,1.48)	0.96 (0.75,1.22)	-	-
In OAT: 5.5-6 years since initiation	-	1.38 (1.08,1.76)	1.13 (0.86,1.48)	-	-
In OAT: 6-6.5 years since initiation	-	1.25 (0.94,1.66)	1.02 (0.75,1.39)	-	-
In OAT: 6.5-7 years since initiation	-	1.26 (0.88,1.81)	1.13 (0.75,1.69)	-	-
In OAT: 7-7.5 years since initiation	-	1.73 (0.9,3.33)	1.98 (1,3.91)	-	-
In OAT: 7.5-8 years since initiation	-	N/A	N/A	-	-
In OAT x ln(time since OAT initiation)				1.19 (1.15,1.24)	1.12 (1.07,1.18)
Sex					
Male	1.37 (1.27,1.48)	1.42 (1.32,1.53)	1.15 (1.08,1.22)	1.42 (1.32,1.53)	1.15 (1.09,1.23)
Female *(Ref)*	1	1	1	1	1
Indigenous					
Yes	2.1 (1.98,2.23)	-	1.36 (1.29,1.43)	-	1.37 (1.3,1.44)
No *(Ref)*	1	-	1	-	1
Age of OAT initiation					
Less than 25 years	2.83 (2.59,3.1)	2.84 (2.6,3.1)	1.66 (1.55,1.79)	2.85 (2.61,3.11)	1.69 (1.57,1.82)
25-29 years	1.95 (1.78,2.15)	1.94 (1.76,2.13)	1.5 (1.39,1.61)	1.94 (1.76,2.13)	1.51 (1.4,1.63)
30-34 years	1.73 (1.56,1.93)	1.72 (1.55,1.92)	1.39 (1.28,1.51)	1.72 (1.55,1.92)	1.4 (1.29,1.52)
35+ years *(Ref)*	1	1	1	1	1
Year at OAT initiation					
2004-2005 *(Ref)*	1	-	1	-	1
2006-2007	0.85 (0.79,0.92)	-	0.9 (0.85,0.95)	-	0.89 (0.85,0.94)
2008-2009	0.67 (0.62,0.73)	-	0.77 (0.72,0.81)	-	0.76 (0.71,0.81)
2010-2011	0.44 (0.38,0.49)	-	0.52 (0.47,0.58)	-	0.52 (0.46,0.58)
Number of charges before OAT initiation					
0 *(Ref)*	1	-	1	-	1
1-4	2.29 (2.08,2.51)	-	1.8 (1.65,1.97)	-	1.82 (1.67,1.99)
5-14	3.68 (3.37,4.01)	-	2.27 (2.08,2.48)	-	2.32 (2.12,2.53)
15 or more	5.23 (4.76,5.75)	-	2.46 (2.18,2.79)	-	2.55 (2.26,2.87)
Number of charges since OAT initiation[1]	1.16 (1.14,1.18)	-	1.15 (1.13,1.17)	-	1.14 (1.12,1.16)
In prison[1]					
Yes	0.81 (0.76,0.86)	-	0.32 (0.29,0.34)	-	0.32 (0.29,0.34)

No (Ref)	1	-	1	-	1
Number of prison episodes before OAT initiation					
0 (Ref)	1	-	1	-	1
1-5	1.8 (1.65,1.96)	-	1.13 (1.01,1.26)	-	1.13 (1.02,1.25)
6-10	2.41 (2.23,2.6)	-	1.4 (1.29,1.51)	-	1.39 (1.28,1.5)
11 or more	3.41 (3.17,3.67)	-	1.65 (1.51,1.81)	-	1.64 (1.5,1.8)

CI – confidence interval; NA – not applicable; Ref – reference level

[1] Time-dependent variable

Model 1: bivariate models;

Model 2: includes age, sex, treatment, and a step-function for OAT;

Model 3: further adjusts for all sociodemographic characteristics;

Model 4: includes age, sex, treatment and a continuous time-dependent coefficient for OAT;

Model 5: further adjusts for all sociodemographic characteristics

Appendix Table 7. Sensitivity analysis investigating associations between number of opioid agonist treatment (OAT) episodes and time spent in OAT and number of charges during follow-up, with end of follow-up set to 30th June 2011 (N = 38,427 charges)

	No charges during follow-up	Number of charges during follow-up
	OR (95% CI)	IRR (95% CI)
Number of OAT episodes	0.43* (0.37,0.50)	1.12* (1.10,1.14)
Proportion of follow-up time spent in OAT		
Low	1.21 (0.96,1.53)	1.06 (0.98,1.16)
Low-Mid	0.89 (0.70,1.15)	1.18* (1.08,1.28)
High-Mid	0.92 (0.71,1.18)	1.22* (1.12,1.33)
High *(Ref)*	1	
Percent (/10) of days in OAT spent in prison	1.08* (1.03,1.13)	0.98* (0.96,0.99)
Percent (/10) of follow-up time spent in prison	1.06 (1.00,1.13)	1.13* (1.11,1.16)
Sex		
Male	0.60* (0.5,0.73)	0.99 (0.92,1.06)
Female *(Ref)*	1	1
Indigenous		
Yes	0.42* (0.32,0.54)	1.14* (1.07,1.22)
No *(Ref)*	1	1
Age at OAT initiation		
Less than 25 years	0.53* (0.42,0.68)	1.38* (1.27,1.51)
25-29 years	0.69* (0.55,0.87)	1.26* (1.15,1.38)
30-34 years	0.66* (0.51,0.85)	1.18* (1.07,1.31)
35+ years *(Ref)*	1	1
Any charge before OAT initiation		
No	8.29* (6.41,10.71)	NA
Yes *(Ref)*	1	NA
Number of charges before OAT initiation		
0 *(Ref)*	NA	1
1-4	NA	1.20* (1.10,1.30)
5-14	NA	1.65* (1.51,1.80)
15 or more	NA	1.97* (1.76,2.21)

Note: Results from zero-inflated negative binomial model.
* significant at the 0.05 level, two-sided test.
CI – confidence interval; IRR – incident rate ratio; NA – not applicable; OR – odds ratio; Ref – reference level