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SHORT COMMUNICATION

COVID-19 restrictions and the incidence and prevalence of prescription opioid use in Australia – a nationwide study

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The COVID-19 pandemic has disrupted seeking and delivery of healthcare. Different Australian jurisdictions implemented different COVID-19 restrictions. We used Australian national pharmacy dispensing data to conduct interrupted time series analyses to examine the incidence and prevalence of opioid dispensing in different jurisdictions. Following nationwide COVID-19 restrictions, the incidence dropped by −0.40 (95% confidence interval [CI]: −0.50, −0.31), −0.33 (95% CI: −0.46, −0.21) and −0.21 (95% CI: −0.37, −0.04) per 1000 people per week and the prevalence dropped by −0.85 (95% CI: −1.39, −0.31), −0.54 (95% CI: −1.01, −0.07) and −0.62 (95% CI: −0.99, −0.25) per 1000 people per week in Victoria, New South Wales and other jurisdictions, respectively. Incidence and prevalence increased by 0.29 (95% CI: 0.13, 0.44) and 0.72 (95% CI: 0.11, 1.33) per 1000 people per week, respectively in Victoria post-lockdown; no significant changes were observed in other jurisdictions. No significant changes were observed in the initiation of long-term opioid use in any jurisdictions. More stringent restrictions coincided with more pronounced reductions in overall opioid initiation, but initiation of long-term opioid use did not change.

KEYWORDS
chronic pain, drug utilisation, medication safety, opioids, quality use of medicines

1 | INTRODUCTION

An increase in the prevalence of pain and mental health problems has been identified during the COVID-19 pandemic.[1] Psychological distress, physical pain and social stressors have been linked to extramedical opioid use.[2] Australia has the eighth highest national per capita opioid consumption with 1.9 million Australians initiating and 3 million using prescription opioids every year.[3,4]

COVID-19 has impacted the medication management of pain.[5] Lower rates of help-seeking have been reported including less frequent visits to general practitioners and pharmacies, with increased telehealth and medication home delivery services.[6,7] Cessation of

non-urgent elective surgery and allied health services may have precipitated increased reliance on prescription analgesics.[8] Conversely, a reduced number of surgeries and trauma and injury presentations may have led to reduced opioid prescribing.[9]

In Australia, there was a steep initial rise in COVID-19 cases in March 2020, followed by a sharp decline in May 2020. The state of Victoria then experienced a resurgence of COVID-19 cases peaking at 723 new cases daily, leading to restrictions and travel limits during July and August 2020.[10] This provides a natural experiment to compare the possible impact of different jurisdictional restrictions on opioid use.

The objective of this study was to investigate changes in the incidence and prevalence of opioid dispensing coinciding with different jurisdiction-based COVID-19 restrictions.

What is already known about this subject

- The COVID-19 pandemic has disrupted seeking and delivery of healthcare.
- An increase in the prevalence of pain and mental health problems has been identified during the COVID-19 pandemic.
- COVID-19 restrictions may impact pain management and, subsequently, the use of prescription opioids.

What this study adds

- More stringent COVID-19 restrictions coincided with more pronounced reductions in overall prescription opioid initiation.
- No significant changes were observed in the initiation of long-term opioid use in any jurisdictions.
- Monitoring and evaluation of prescription opioids during public health emergencies may be of importance to ensure safe and timely access to treatment of pain.

2 | METHODS

2.1 | Data source

We analysed data for a 10% random sample of people dispensed medications via the Pharmaceutical Benefits Scheme (PBS). The 10% random sample is a standard dataset maintained by Services Australia. The data include records of PBS medications dispensed to Australian residents and visitors from countries with a reciprocal health agreement, and dispensed at community pharmacies, private hospitals and discharge from public hospitals in all jurisdictions except New South Wales (NSW) and the Australian Capital Territory.[11] This national database has been shown to represent approximately 75% of all dispensed medicines and more than 80% of prescription opioid use in Australia.[3,11]

2.2 | Study design and setting

We conducted interrupted time series analyses using weekly count of people dispensed opioids from January 2018 to April 2021. We examined changes in dispensing trends at two intervention points: (1) the week beginning 23 March 2020, coinciding with nationwide introduction of COVID-19 restrictions[12] and (2) the week beginning 26 October 2020, coinciding with easing of lockdowns in Victoria.[10] COVID-19 deaths registered in 2020 were predominantly in Victoria (89%) and NSW (7%).[13] Victoria was the only jurisdiction to impose a second lockdown. We compared opioid dispensing in Victoria, NSW and other Australian jurisdictions (Australian Capital Territory, Northern Territory, Queensland, South Australia, Tasmania and Western Australia). This study was conducted and reported in accordance with methodological and reporting recommendations for interrupted time series studies (Table S1).[14] The study was approved by the Monash University Human Research Ethics Committee (Approval number: 22877). The analysis plan was approved and the manuscript noted by Services Australia (Reference number: RMS2097).

2.3 | Study sample

We identified people aged between 18 and 99 years dispensed opioids between January 2018 and April 2021. We excluded people with cancer using the RxRisk-V tool and other medications with PBS item codes specific to cancer dispensed on or 12 months prior to the date of first opioid supply (index date).[15] Opioid initiation was defined as no opioid dispensing in the 12 months prior to the index date. Long-term opioid therapy (LTOT) was defined as having continuous opioid dispensing for at least 90 days, with gaps of no more than 60 days between subsequent dispensings.[16,17] To ensure sufficient follow-up for identifying LTOT, the index date was censored at 31 December 2020.

2.4 | Opioid incidence and prevalence

Weekly counts of people initiating and using opioids were determined. People using opioids included people initiating and continuing any of the opioids available in the dataset. To determine weekly incidence and prevalence based on the 10% sample of PBS data, the number of people initiating and using opioids in each week was divided by 10% of the total representative population for each corresponding year.[18] The weekly proportion of people initiating on LTOT was determined by dividing the number of people initiating LTOT in a given week by the number of people initiating opioid use for the corresponding week.

2.5 | Opioids of interest

All PBS-listed opioids were included in our analyses. These include buprenorphine, codeine, fentanyl, hydromorphone, methadone, morphine, oxycodone, oxycodone-naloxone, tapentadol and tramadol (Table S2). We excluded opioid formulations for opiate dependence (buprenorphine sublingual tablets, buprenorphine modified-release injections, buprenorphine-naloxone sublingual films and methadone liquid) and palliative care (fentanyl lozenges, sublingual tablets and orally disintegrating tablets).

2.6 | Statistical analysis

Interrupted time series analyses were modelled using the autoregressive integrated moving average (ARIMA) model. The ARIMA model accounts for seasonality present in PBS data due to the safety net provisions.[11] Data are represented as change in weekly number of people with 95% confidence intervals (CI). All data preparation was conducted using Python® and Structured Query Language (SQL) on the Postgres® database. Interrupted time series analyses were performed using R® with codes adapted from Schaffer et al.[19]

3 | RESULTS

Totals of 205 071, 195 018 and 175 798 people initiated opioids in 2018, 2019 and 2020, respectively. This included 7102 (3.5%), 6159 (3.2%) and 5557 (3.2%) people who initiated LTOT in 2018, 2019 and 2020, respectively. There were 904 929 people who used opioids between January 2018 and April 2021. Of these, 499 270 (55.2%) were females and mean (SD) age was 52.6 (19.8) years. The number of people using opioids was 315 231, 306 944 and 282 754 in 2018, 2019 and 2020, respectively. Of the total, 287 404 (31.8%) persons appeared in more than one of the study years. Demographic information and characteristics of opioids dispensed at initiation are described in Tables S3 and S4.

Following the introduction of nationwide COVID-19 restrictions in March 2020, the number of people initiating on prescription opioid use dropped by −0.40 (95% CI: −0.50, −0.31), −0.33 (95% CI: −0.46, −0.21) and −0.21 (95% CI: −0.37, −0.04) per 1000 people per week in Victoria, NSW and other jurisdictions, respectively (Table 1, Figure 1A). Following the initial drop, there was a gradual increase of 0.004 (95% CI: 0.00, 0.01), 0.01 (95% CI: 0.00, 0.02) and 0.01 (95% CI: 0.00, 0.02) people initiating opioids per 1000 people per week in Victoria, NSW and other jurisdictions, respectively between March 2020 and October 2020. Following the easing of lockdown in Victoria in October 2020, we observed a significant increase in the number of people initiating opioids (0.29 [95% CI: 0.13, 0.44] per 1000 people per week) in Victoria, while no significant changes were observed in NSW and other jurisdictions.

We observed an immediate reduction in the number of people using opioids following the March nationwide COVID-19 restrictions by −0.85 (95% CI: −1.39, −0.31), −0.54 (95% CI: −1.01, −0.07) and −0.62 (95% CI: −0.99, −0.25) per 1000 people per week in Victoria, NSW and in other jurisdictions, respectively (Table 1, Figure 1B). There were no significant changes in the weekly count of people using opioids between March 2020 and October 2020. We observed a significant increase in the number of people using opioids of 0.72 (95% CI: 0.11, 1.33) per 1000 people per week in Victoria following the easing of the lockdown there. However, no significant changes were observed in NSW and in other jurisdictions. The reduction in the incidence of LTOT following the March nationwide restrictions in Victoria and NSW and an increase in other jurisdictions was not significant (Table 1, Figure 2). Similarly, following the October easing of lockdown in Victoria, the observed immediate drop in the incidence of LTOT in all jurisdictions was not statistically significant.

4 | DISCUSSION

This is the first Australian study to examine opioid initiation and use in Australia during COVID-19 pandemic. Our main finding is that the incidence and prevalence of prescription opioid use dropped in all jurisdictions immediately following the introduction of nationwide COVID-19 restrictions in March 2020. Incidence of opioid use but not prevalence increased between March 2020 and October 2020. Incidence and prevalence increased in Victoria, following the easing of the Victorian lockdown, with no significant change in the incidence and prevalence in NSW and in other jurisdictions over the same time period.

The nationwide reduction in the incidence and the prevalence of opioid use following the nationwide COVID-19 restrictions in March 2020 mirrors the reduced opioid dispensing trends observed in the United States[20] and decreased overall medication prescribing in Australian general practices during COVID-19 restrictions.[21] This may reflect reduced rates of help seeking during COVID-19 restrictions.

There was a weekly increase in the number of people initiating on opioids in all jurisdictions between March 2020 and October 2020, coinciding with progressive easing of restrictions in different jurisdictions. We observed a more delayed increase in Victoria with imposing of the second lockdown in July 2020. In contrast, the prevalence of opioid use remained relatively stable during the same time period, indicating that COVID-19 restrictions did not correspond with major disruptions in prevalent use. This may be due to reduced occurrence of injury and trauma with stay-at-home orders, and temporary suspension of non-urgent surgeries, which reduces the likelihood of people starting on opioids for acute or post-surgical pain.[9] Existing patients may have had continued access to opioids through Australian government initiatives such as expanded telehealth services and digital image prescriptions.[7] Further studies may examine whether delay in surgeries led to later increases in opioid use, or if opioid dose increased, despite the prevalence remaining constant.

TABLE 1 Intervention effects on weekly count of people initiating and using opioids

Jurisdictions			β	95% Confidence interval
Opioid initiation				
VIC	Intervention point 1	Step change	−0.40	−0.50, −0.31
		Ramp	0.00[a]	0.00[a], 0.01
	Intervention point 2	Step change	0.29	0.13, 0.44
		Ramp	−0.02	−0.05, 0.01
NSW	Intervention point 1	Step change	−0.33	−0.46, −0.21
		Ramp	0.01	0.00[a], 0.02
	Intervention point 2	Step change	0.10	−0.04, 0.24
		Ramp	−0.03	−0.06, 0.00[a]
OTH	Intervention point 1	Step change	−0.21	−0.37, −0.04
		Ramp	0.01	0.00[a], 0.02
	Intervention point 2	Step change	0.16	−0.02, 0.34
		Ramp	−0.04	−0.08, 0.00[a]
Opioid prevalence				
VIC	Intervention point 1	Step change	−0.85	−1.39, − 0.31
		Ramp	0.01	−0.02, 0.04
	Intervention point 2	Step change	0.72	0.11, 1.33
		Ramp	−0.13	−0.25, − 0.01
NSW	Intervention point 1	Step change	−0.54	−1.01, −0.07
		Ramp	0.02	−0.01, 0.04
	Intervention point 2	Step change	0.52	−0.04, 1.07
		Ramp	−0.15	−0.26, −0.05
OTH	Intervention point 1	Step change	−0.62	−0.99, −0.25
		Ramp	0.01	−0.01, 0.03
	Intervention point 2	Step change	0.22	−0.35, 0.80
		Ramp	−0.12	−0.22, −0.03
Long-term opioid initiation				
VIC	Intervention point 1	Step change	−0.16	−0.78, 0.47
		Ramp	0.01	−0.03, 0.04
	Intervention point 2	Step change	−0.12	−0.89, 0.64
		Ramp	−0.04	−0.18, 0.10
NSW	Intervention point 1	Step change	−0.25	−1.04, 0.54
		Ramp	<0.00[a]	−0.04, 0.04
	Intervention point 2	Step change	−0.03	−1.03, 0.97
		Ramp	−0.07	−0.25, 0.10
OTH	Intervention point 1	Step change	0.03	− 0.44, 0.50
		Ramp	−0.01	−0.03, 0.01
	Intervention point 2	Step change	−0.56	−1.20, 0.09
		Ramp	0.05	−0.07, 0.17

Step change: a sudden, sustained change where the time series is shifted up or down as a result of the intervention; Ramp: a change in slope occurring immediately following the intervention; Intervention point 1: week starting 23 March 2020, at the introduction of the nationwide COVID-19 restrictions; Intervention point 2: week starting 28 October 2020, at the easing of Victorian lockdown; VIC: Victoria; NSW: New South Wales; OTH: Other Australian jurisdictions.

[a]Figures greater than 0 and less than 0.005 are shown as 0.00 when rounded to two decimal points.

Contrary to one possible hypothesis, mental health and other stressors did not coincide with a change in the proportion of people initiating LTOT. This may reflect other system-level changes to curb inappropriate prescribing including modifications to approved pack sizes and clinical criteria for PBS subsidy in June 2020,[22] and implementation of mandatory prescription monitoring in Victoria in April

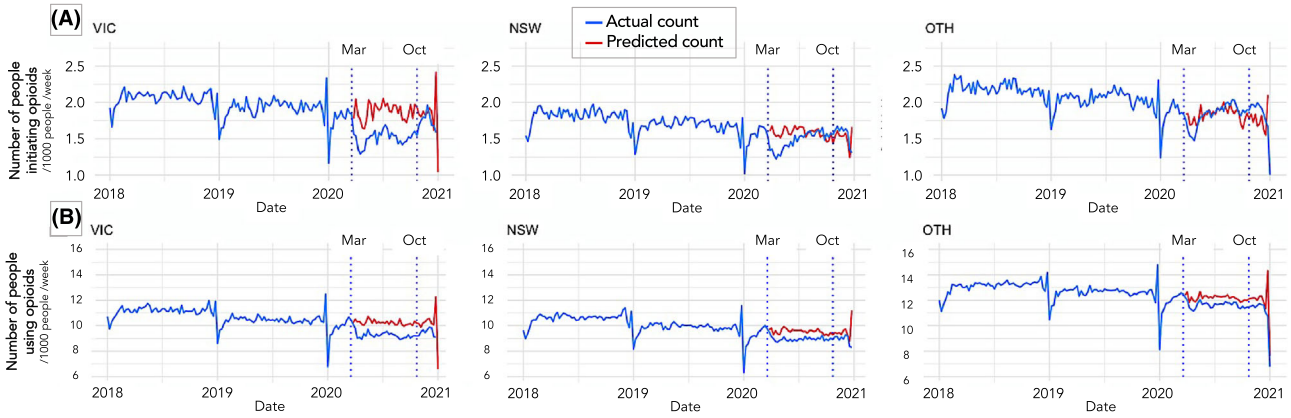

FIGURE 1 Weekly count of people initiating and using opioids per 1000 people. Weekly count of people initiating and using opioids in Victoria (VIC), New South Wales (NSW) and other jurisdictions (OTH) from January 2018 to December 2020. Blue line represents the actual count of people dispensed opioids while the red line represents the values predicted by the ARIMA model in the absence of COVID-19 restrictions (counterfactual). Dotted vertical lines correspond to the weeks starting 23 March 2020 and 28 October 2020. These dates coincide with the introduction of the nationwide COVID-19 restrictions and the easing of Victorian lockdown, respectively. (A) Total number of people initiating opioids per 1000 people per week in VIC, NSW and OTH. (B) The total number of people using opioids per 1000 people per week in VIC, NSW and OTH.

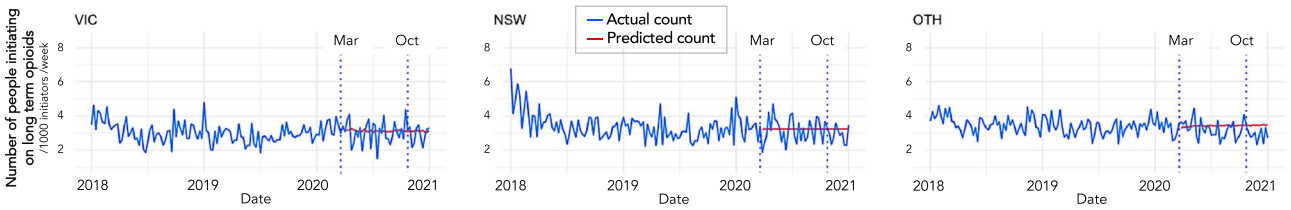

FIGURE 2 Weekly proportion of people initiating on long-term opioid use. Proportion of people initiating on long-term opioid use per 1000 people initiating on opioids per week in Victoria (VIC), New South Wales (NSW) and other jurisdictions (OTH) from January 2018 to December 2020. Blue line represents the actual count of people dispensed opioids while the red line is a forecast of the trends based on 2018 and 2019 data. Dotted vertical lines correspond to introduction of nationwide COVID-19 restrictions in the week starting 23 March 2020 and easing of Victorian lockdown in the week starting 28 October 2020.

2020.[23] Opioid prescribing declined from 2018 to 2020. The avoidance of escalating opioid prevalence in the community is an important outcome. Further evaluation of what may have contributed to these outcomes may be of importance in developing future strategic responses.

Expansion of telehealth services may have enabled better access to pain specialists and pain-related services.[24] Future research is needed to determine possible corresponding impacts on analgesic and opioid use. Moreover, it will be important to study whether or not reduction in the incidence and prevalence of opioid use observed so far are compensated with greater levels of use post-pandemic.

Our results did not show evidence of increased dispensing in March 2020, suggestive of stockpiling, as observed for other classes of medicine.[21] In Australia, opioid prescriptions require special approvals for repeat supplies, in contrast to other medication classes such as statins and antihypertensives, which are allowed multiple repeat supplies on a single prescription. This means that people must consult their prescribers for new opioid prescriptions each time, averting stockpiling. Furthermore, real-time prescription monitoring systems, although currently not mandatory in every jurisdiction,[23] may be deterring prescribers and dispensers from enabling excess supply of opioids.

Our study utilised a large-scale dataset representative of the national population. The ARIMA modelling controlled for trends in the data that are non-linear and subject to complex seasonality, as is known to exist with PBS data.[11] Comparison with data from the previous 2 years allowed for a more accurate projection of opioid dispensing trends in the absence of COVID-19 restrictions. Jurisdictional-level data enabled comparison of trends between jurisdictions with differing degrees of COVID-19 restrictions.

There are some inherent limitations in our study. Firstly, it was not possible to determine the extent to which changes in opioid dispensing may have reflected background system-level changes in opioid prescribing and monitoring. Secondly, we did not examine dose changes over time nor quantities prescribed per prescription. People already using opioids may have used higher or lower doses during COVID-19 restrictions. Thirdly, our data did not include private

prescriptions, which account for approximately 10% of opioid prescriptions in Australia.[25] Changes in the patterns of unsubsidised or extramedical opioid use may not be captured in our study.

In conclusion, more stringent restrictions coincided with more pronounced reductions in overall opioid initiation. Incidence rebounded to pre-pandemic levels, with a more gradual recovery in Victoria compared to other jurisdictions, while prevalence remained stable in all jurisdictions. Initiation of LTOT did not change during COVID-19 restrictions.

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COMPETING INTERESTS

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CONTRIBUTORS

All authors contributed to the study conception and design. J.I. acquired the data. G.W. acquired funding. J.I. and D.L. conducted the data management and analysis. All authors were involved in interpretation of the data. M.J. produced the first draft of the manuscript. All authors reviewed, edited and approved the final version submitted to the journal.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available with permission from Services Australia.

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REFERENCES

1. Cohen SP, Baber ZB, Buvanendran A, et al. Pain management best practices from multispecialty organizations during the COVID-19 pandemic and public health crises. *Pain Med*. 2020;21(7):1331-1346. doi:10.1093/pm/pnaa127
2. Wilson J, Lam T, Scott D, et al. 'Extreme personal stress' and 'a lot of pain': exploring the physical, mental and social contexts of extramedical pharmaceutical opioid use in Australian paramedic case descriptions. *Drug Alcohol Rev*. 2020;39(7):870-878. doi:10.1111/dar.13118
3. Lalic S, Ilomaki J, Bell JS, Korhonen MJ, Gisev N. Prevalence and incidence of prescription opioid analgesic use in Australia. *Br J Clin Pharmacol*. 2019;85(1):202-215. doi:10.1111/bcp.13792
4. Therapeutic Goods Administration. *Addressing prescription opioid use and misuse in Australia [Internet]*. Canberra, ACT: Commonwealth of Australia; 2019. https://www.tga.gov.au/sites/default/files/addressing-prescription-opioid-use-and-misuse-australia.pdf. Accessed June 30, 2022.
5. Mun CJ, Campbell CM, McGill LS, Aaron RV. The early impact of COVID-19 on chronic pain: a cross-sectional investigation of a large online sample of individuals with chronic pain in the United States, April to May, 2020. *Pain Med*. 2021;22(2):470-480. doi:10.1093/pm/pnaa446
6. Siette J, Seaman K, Dodds L, et al. A national survey on COVID-19 second-wave lockdowns on older adults' mental wellbeing, health-seeking behaviours and social outcomes across Australia. *BMC Geriatr*. 2021;21(1):400. doi:10.1186/s12877-021-02352-1
7. Bell J, Reynolds L, Freeman C, Jackson JK. Strategies to promote access to medications during the COVID-19 pandemic. *Aust J Gen Pract*. 2020;49(8):530-532. doi:10.31128/AJGP-04-20-5390
8. Lee B, Yang KC, Kaminski P, et al. Substitution of nonpharmacologic therapy with opioid prescribing for pain during the COVID-19 pandemic. *JAMA Netw Open*. 2021;4(12):e2138453. doi:10.1001/jamanetworkopen.2021.38453
9. Mitchell RD, O'Reilly GM, Mitra B, Smit V, Miller JP, Cameron PA. Impact of COVID-19 state of emergency restrictions on presentations to two Victorian emergency departments. *Emerg Med Australas*. 2020;32(6):1027-1033. doi:10.1111/1742-6723.13606
10. Department of Health and Human Services, State Government of Victoria. Coronavirus (COVID-19) updates archive [Internet]. Melbourne, VIC; 2020. https://www.dhhs.vic.gov.au/coronavirus/updates/202007. Accessed June 30, 2022.
11. Mellish L, Karanges EA, Litchfield MJ, et al. The Australian Pharmaceutical Benefits Scheme data collection: a practical guide for researchers. *BMC Res Notes*. 2015;8(1):634. doi:10.1186/s13104-015-1616-8
12. Storen R, Corrigan N. COVID-19: a chronology of state and territory government announcements (up until 30 June 2020) [Internet]. Canberra, ACT: Parliament of Australia, Department of Parliamentary Services; 2020. https://parlinfo.aph.gov.au/parlInfo/download/library/prspub/7614514/upload_binary/7614514.pdf. Accessed June 30, 2022.
13. Australian Institute of Health and Welfare. *The first year of COVID-19 in Australia: direct and indirect health effects [Internet]*. Canberra, ACT: AIHW; 2021. https://www.aihw.gov.au/reports/burden-of-disease/the-first-year-of-covid-19-in-australia/summary. Accessed June 30, 2022.

14. Jandoc R, Burden AM, Mamdani M, Levesque LE, Cadarette SM. Interrupted time series analysis in drug utilization research is increasing: systematic review and recommendations. *J Clin Epidemiol*. 2015;68(8):950-956. doi:10.1016/j.jclinepi.2014.12.018
15. Pratt NL, Kerr M, Barratt JD, et al. The validity of the Rx-Risk comorbidity index using medicines mapped to the Anatomical Therapeutic Chemical (ATC) classification system. *BMJ Open*. 2018;8(4):e021122. doi:10.1136/bmjopen-2017-021122
16. Gisev N, Pearson S-A, Dobbins T, et al. Combating escalating harms associated with pharmaceutical opioid use in Australia: the POPPY II study protocol. *BMJ Open*. 2018;8(12):e025840. doi:10.1136/bmjopen-2018-025840
17. de Oliveira Costa J, Bruno C, Baranwal N, et al. Variations in long-term opioid therapy definitions: a systematic review of observational studies using routinely collected data (2000–2019). *Br J Clin Pharmacol*. 2021;87(10):3706-3720. doi:10.1111/bcp.14798
18. Australian Bureau of Statistics. National, state and territory population [Internet]. Abs; 2020. https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/latest-release. Accessed June 10, 2022.
19. Schaffer AL, Dobbins TA, Pearson SA. Interrupted time series analysis using autoregressive integrated moving average (ARIMA) models: a guide for evaluating large-scale health interventions. *BMC Med Res Methodol*. 2021;21(1):58. doi:10.1186/s12874-021-01235-8
20. Currie JM, Schnell MK, Schwandt H, Zhang J. Prescribing of opioid analgesics and buprenorphine for opioid use disorder during the COVID-19 pandemic. *JAMA Netw Open*. 2021;4(4):e216147. doi:10.1001/jamanetworkopen.2021.6147
21. Wabe NTJ, Hardie R-A, Dai Z, Imai C, Sezgin G, Li J, Georgiou A. Changes in medication prescribing in general practice during the COVID-19 pandemic. General practice snapshot. Issue 6, 12 May 2021. Sydney: Macquarie University. doi:10.25949/zpw2-wj80
22. Wilson HHK, Armstrong F, Thong IG. Opioid prescribing: what do the 2020 PBS changes mean for GPs? *Med Today*. 2020;21(9):21-28.
23. Department of Health. *Safescript: for prescribers and pharmacists [Internet]*. Melbourne, VIC: The State Government of Victoria; 2021. https://www.health.vic.gov.au/drugs-and-poisons/for-prescribers-and-pharmacists. Accessed June 30, 2022.
24. Peacock A, Nielsen S, Bruno R, Campbell G, Larance B, Degenhardt L. Geographic variation in health service use and perceived access barriers for Australian adults with chronic non-cancer pain receiving opioid therapy. *Pain Med*. 2016;17(11):2003-2016. doi:10.1093/pm/pnw109
25. Gisev N, Pearson SA, Karanges EA, et al. To what extent do data from pharmaceutical claims under-estimate opioid analgesic utilisation in Australia? *Pharmacoepidemiol Drug Saf*. 2018;27(5):550-555. doi:10.1002/pds.4329

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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