

COVID-19 pandemic and crime trends in NSW

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AIM

To examine changes in crime in New South Wales, Australia, in the six-week period (15 March – 26 April, 2020) following the implementation of social distancing strategies to mitigate the COVID-19 pandemic.

METHOD

We examine trends in violent, property, drug and justice-related criminal incidents recorded by the NSW Police Force from the week ending 15 March 2020 to the week ending 26 April 2020. Observed crime volumes are compared with a seasonally adjusted forecast model estimated from the previous five years of data.

RESULTS

When assessed against the best performing forecast model for each category of crime, we find that, in April 2020:

- Non-domestic violence related assaults were 39 per cent lower than expected. Domestic violence related assaults were consistent with expectations.
- Sexual offences were 32 per cent lower and robberies 42 per cent lower than expected.
- Various property offences were lower than expected including: residential break-ins (down 29 per cent), non-residential break-ins (down 25 per cent), vehicle theft (down 24 per cent), stealing from a vehicle (down 34 per cent) and retail theft (down 55 per cent).
- Drug possession and dealing incidents remained stable in aggregate. But cocaine possession incidents were 40 per cent lower than expected while amphetamine possession incidents were 30 per cent higher than expected.
- Breaches of Apprehended Violence Orders (AVOs) and bail conditions remained stable, despite an 85 per cent increase in AVO compliance checks and a 13 per cent increase in bail compliance checks.

CONCLUSION

The six-week period following the introduction of social distancing measures in response to the COVID-19 pandemic was associated with large falls in various violent and property crimes in NSW. However, offences sensitive to police enforcement activity, such as drug offences and breaches of AVOs and bail conditions, were mostly stable.

KEYWORDS

social isolation

social distancing

COVID-19

Coronavirus

crime trends

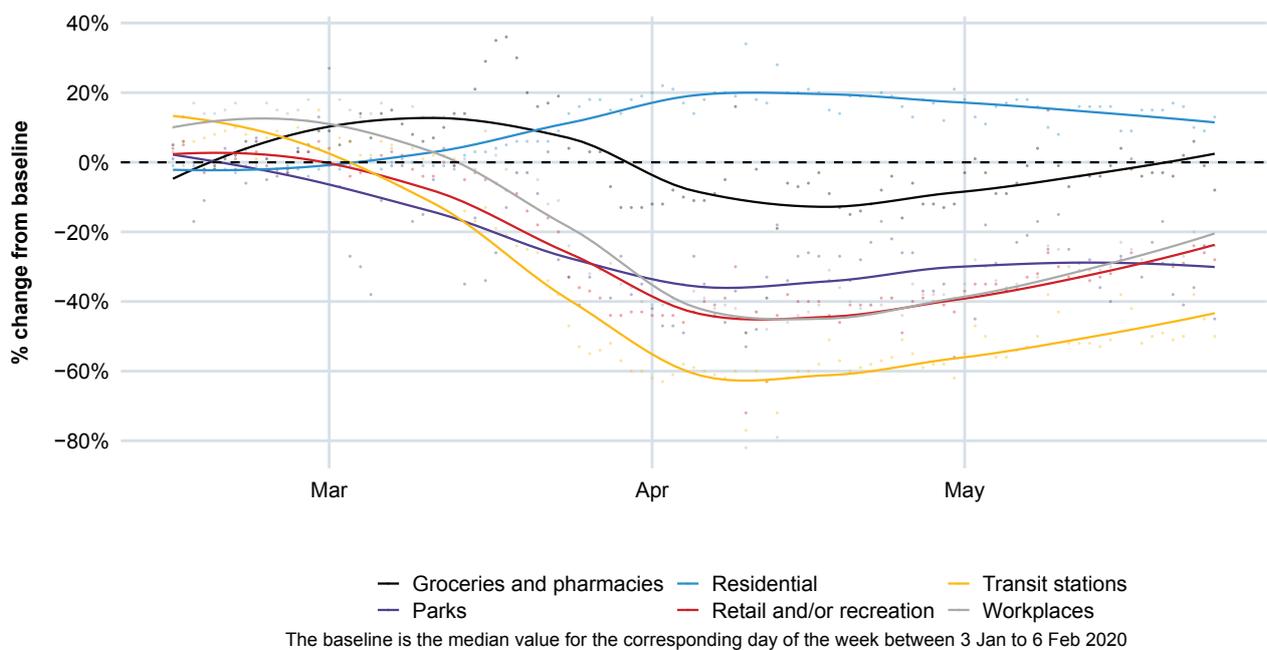
INTRODUCTION

A global pandemic was declared on 11 March 2020 by the World Health Organization in response to the global spread of COVID-19. The spread of COVID-19 forced governments to initiate significant social restrictions aimed at containing its outbreak. In NSW, the first four COVID-19 cases were detected in late January 2020.¹ No new cases were detected in February 2020, but from 1 March 2020, new diagnoses began to rise sharply.

The Australian and NSW Governments' response to COVID-19 included minimising community transmission through the use of social distancing measures and enforced isolation. Social distancing advice, rules and restrictions were introduced and strengthened from mid-March 2020 through April 2020 with the intention of reducing person-to-person transmission by minimising contact between people. These include:

- On 15 March, NSW residents were advised to work from home if possible, avoid crowds and gatherings, reduce public transport use and keep 1.5 metres away from other people.²
- On 18 March, non-essential indoor gatherings were formally limited to 100 people and outdoor gatherings limited to 500 people.³ Indoor gatherings needed to allow four square metres per person.
- On 23 March, non-essential NSW businesses and activities were closed including pubs, gyms, cinemas, restaurants, cafes and places of worship. Work from home messaging was reinforced.⁴
- Starting 24 March, public schools moved to an online curriculum with parents encouraged to keep children home from school.
- On 31 March, criminal offences were enacted under the NSW Public Health Act 2010 requiring that people not leave their place of residence without a reasonable excuse and limiting outdoor gatherings to two people.

Figure 1. Trends in community mobility (Google location data)



1 The first case was detected in NSW on 24 January 2020, two more were detected on 25 January and a fourth on 30 January 2020. Source: <https://www.nsw.gov.au/covid-19/find-facts-about-covid-19>

2 Advice issued 15 March 2020: <https://www.health.nsw.gov.au/Infectious/factsheets/Factsheets/social-distancing.pdf>

3 Advice issued 18 March 2020: <https://www.pm.gov.au/media/update-coronavirus-measures>

4 Advice issued 23 March 2020: <https://www.nsw.gov.au/media-releases/new-covid-19-restrictions-begin-as-schools-move-towards-online-learning>

The most stringent restrictions were in place throughout April, with some restrictions relating to isolation being relaxed from 15 May 2020.

Community mobility changed dramatically in response to these government directions. To illustrate, Figure 1 shows Google location data⁵ charting changes in time spent in various locations, such as, residences, workplaces, parks, transit stations and shops from mid-February to the end of May 2020 compared with a baseline period in early 2020.⁶

Time spent at home started to rise in the second half of March before stabilising for the month of April, at 19 per cent higher than baseline. By contrast, time spent in other locations began to fall in the second half of March and remained low throughout April. In April 2020, compared to baseline, time spent in workplaces fell by 40 per cent, transit stations fell by 60 per cent, parks fell by 35 per cent, grocery and pharmacy locations fell by 10 per cent and retail and recreation locations fell by 40 per cent.

Given the significant disruption to regular activities due to the COVID-19 response, it is relevant to consider the effect that these changes have had on crime. Emerging research from other jurisdictions suggest that some crime categories have fallen considerably during COVID-19 lockdowns (see, for instance, Payne & Morgan, 2020, for Queensland; Ashby, 2020, for various US locations; Campedelli, Aziani, & Favarin, 2020, for Los Angeles; Gerell, Kardell, & Kindgren, 2020, for Sweden).

This brief examines trends in crime in NSW since the COVID-19 containment measures were implemented and community mobility fell. We compare the level of crime observed in the six weeks to 26 April with the levels expected in that period based on historical trends.

METHOD

This brief relies on weekly counts of incidents reported to, or detected by, the NSW Police Force from January 2015 to the week ending 26 April 2020. These data were extracted from the NSW Police Force's (NSWPF) Computerised Operational Policing System (COPS) on 9 May 2020. Crime data are generally subject to revision over time and BOCSAR's usual practice is to process crime data six weeks after the close of the period to ensure that the figures are relatively stable. For this brief, the processing has been brought forward by one month. As a result, April 2020 data are likely to be revised upward, by around two or three per cent, at a later date. Data are presented based on the report date rather than the incident date, a factor which considerably reduces revision.

This brief focuses on the following crime categories:

- Violent crime:
 - assault – domestic and non-domestic violence related;
 - sexual offences; and
 - robbery.
- Property offences:
 - break and enter dwelling;
 - break and enter non-dwelling;
 - steal from motor vehicle;
 - steal from retail store; and
 - motor vehicle theft.

⁵ Data are based on Google users who have opted-in to Location History for their Google Account. Data accessed from google.com/covid19/mobility/

⁶ The baseline is the median value for the corresponding day of the week during the five-week period from 3 January to 6 February 2020.

- Drug offences:
 - possession and/or use of drugs – total, and amphetamines, cannabis, cocaine, ecstasy;
 - dealing/trafficking in drugs.
- Justice order offences:
 - breach Apprehended Violence Order; and
 - breach bail condition.

Forecast model

To determine whether crime has changed since social distancing measures were introduced, it is necessary to estimate how much crime would be expected to occur in the absence of the pandemic. Forecasting techniques were used to predict crime from 15 March to 26 April 2020, based on historical observations. These forecasts included adjustment for seasonal fluctuations (as necessary) and accounted for pre-existing upward or downward trends. We then considered whether actual crime reported differed from what was expected.

The following section describes the process used to evaluate and select the optimal forecasting method for each offence time series examined in this brief.⁷ For each offence time series, the following five forecasting methods were estimated:

1. **Exponential smoothing state space model (ETS).** In an ETS model, exponential smoothing is applied to the error, trend and seasonal components. This state space approach to forecasting is fully automated. The exact model specification and model parameters are selected based on the Akaike's Information Criterion (AIC), corrected for small sample bias (Hyndman, Koehler, Snyder, & Grose, 2002).
2. **ETS with Box-Cox transformation, ARMA errors, Trend and Seasonal components (TBATS).** The TBATS model is another automated forecasting method that can better accommodate complex seasonality (De Livera, Hyndman, & Snyder, 2011).
3. **Autoregressive models on seasonally adjusted time series (STL-AR).** The time series is first decomposed into the seasonal and trend components using the STL method (Cleveland, Cleveland, McRae, & Terpenning, 1990).⁸ An autoregressive model, of which the order is chosen using the AIC, is then fitted to the de-seasonalised time series.
4. **Theta.** The theta method, proposed by Assimakopoulos and Nikolopoulos (2000), is one of the top performing methods in the M3 forecasting competition,⁹ and therefore serves as a useful benchmark.
5. **Single-layer neural network (NN).** This is a feed-forward neural network model with a single hidden layer, with lagged values of the time series used as inputs (Hyndman et al., 2019).

The forecast accuracy of each method was evaluated based on cross-validated forecast errors, namely the Mean Absolute Percentage Error (MAPE). For each model, the 1-week, 2-week, 3 week etc up to 12-week ahead MAPEs were averaged over 36 test sets. The model with the smallest MAPE over the forecast horizon was then selected.

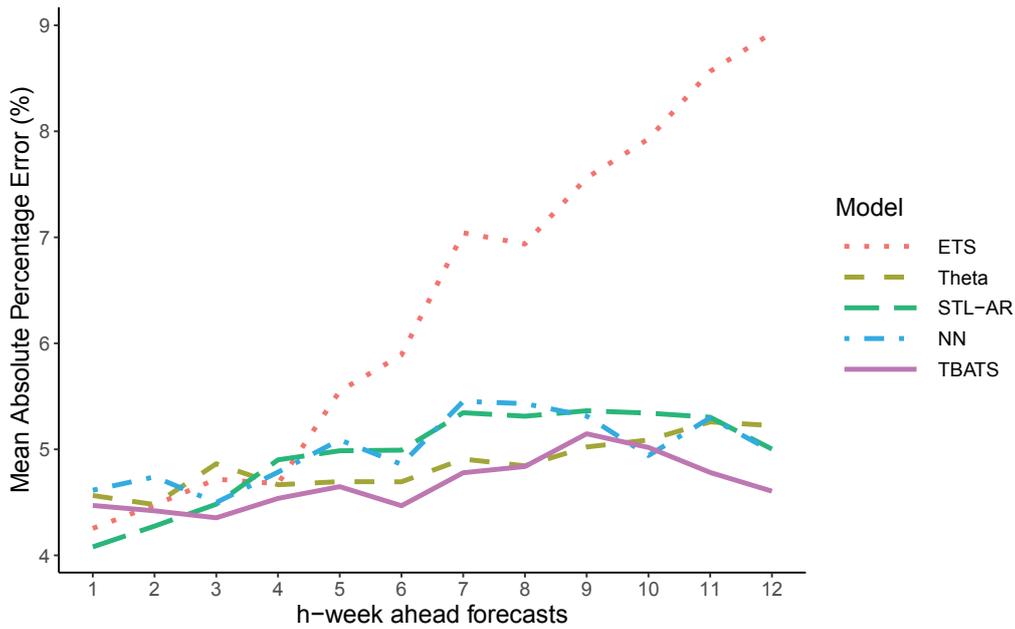
Figure 2 provides an example of the cross-validation results for assault offences. It can be seen that, in general, the forecast errors become larger the further ahead the forecasts were made. For assault, the best model with the smallest MAPEs overall was the TBATS model, which, on average, has a MAPE of between four and five per cent over the forecast horizon. Thus, for this offence, the TBATS forecast was used to forecast the expected crime rate for comparison.

⁷ All models are estimated using the forecast package (Hyndman et al., 2019) in R, the software environment for statistical computing (R Core Team, 2020).

⁸ STL stands for "Seasonal and Trend decomposition using Loess".

⁹ The M3 forecasting competition is the third open forecasting competition organised by researcher Spyros Makridakis in 1998.

Figure 2. MAPE over a 12-week horizon



For all offence time series where data were available,¹⁰ weekly data from 4 January 2015 to 15 March 2020 were used for model evaluation and selection. The best model for each series was then used to generate weekly forecasts to the end of May 2020.

RESULTS

The following sections present the number of incidents observed per week, before and during the COVID-19 period (15 March to 26 April, 2020), together with the number of incidents that we would have expected to observe, based on trends prior to the COVID-19 period. Weekly recorded incident counts in 2019 are also shown for reference.

In addition, the change in the number of incidents observed were examined in the week ending 26 April versus the week ending 15 March (column 4 in each table), and comparisons are provided between the observed and expected number of incidents across the four weeks of April (column 7 in each table).

The prediction intervals from the forecast model were used for each incident type to judge whether the changes observed are consistent (or inconsistent) with what could have been expected, based on existing trends.

Violent offences

Domestic violence related assault – consistent with forecast

Non-domestic violence related assault – down 39 per cent

As Table 1 shows, in the six weeks between 15 March and 26 April, 2020, both domestic violence (DV) related assaults and non-DV related assaults declined, by 23 per cent (from 620 to 479 incidents) and 38 per cent (from 612 to 377 incidents), respectively.

¹⁰ Where five years of data were not available, the TBATS method was used to generate the forecasts, as the cross-validation is less likely to be effective with less data. This is true for the number of compliance checks for bail and AVOs.

Some seasonal decline over these six weeks would be expected as winter approaches. However, as shown in Figure 3, the reductions for non-DV related assault were larger than would be expected, based on the forecast model. The actual number of non-DV related assaults were well below the lower bound of the 95 per cent prediction interval. The observed number of DV related assaults, on the other hand, were largely consistent with the predictions from the forecast model.

Figure 3. Domestic and non-domestic violence related assaults per week in NSW

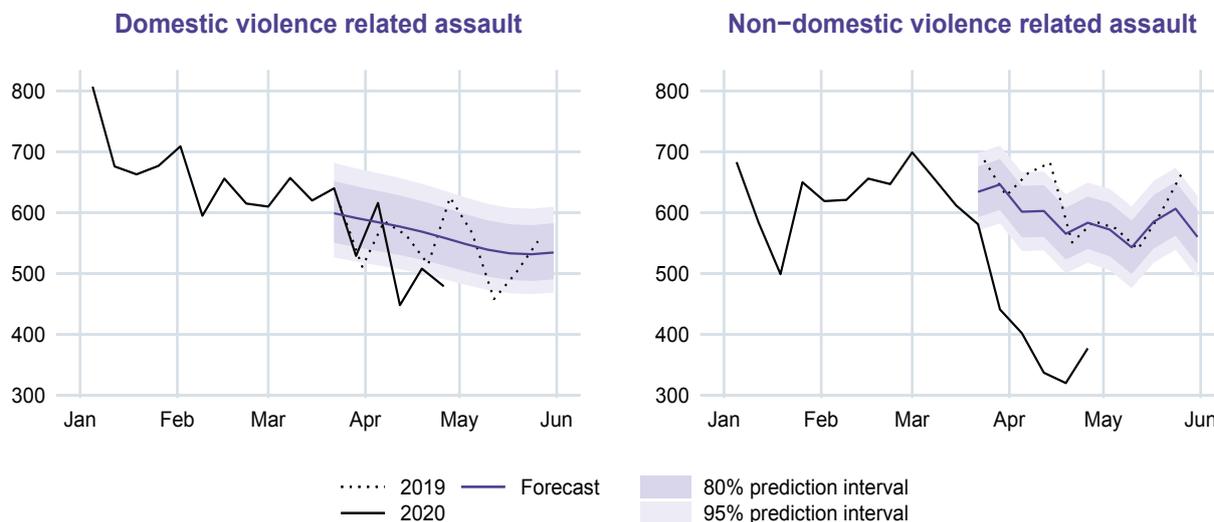


Table 1. Changes in the number of assault incidents, NSW, 15 March – 26 April 2020

Offence	Week ending 15 March	Week ending 26 April	% change v 15 March	April		% difference v forecast
	Incidents	Incidents		Average per week Incidents	Forecast	
Domestic violence related assault	620	479	-23%	513	572	-10%
Non-domestic violence related assault	612	377	-38%	359	588	-39%

Sexual offences – down 32 per cent

Robbery – down 42 per cent

The number of recorded sexual offences¹¹ are shown in Figure 4. It can be seen that sexual offences declined during the COVID-19 period under examination, from 324 in the week ending 15 March to 181 incidents in the week ending 26 April.

As for DV and non-DV related assault, the COVID-19 period coincides with a time of year where, historically, there are falls in recorded sexual offences. For example, in 2019, over the same six-week period, recorded sexual offence incidents fell 39 per cent, from 354 to 220; this is comparable to the decrease observed in 2020.

Although, given historical data, a decline is expected during this period, the observed number of incidents during April 2020 were still lower than the decline predicted by the forecast model. As shown in Table 2, an average of 180 sexual offences incidents per week were observed in April 2020, which is 32 per cent lower than expected.¹²

¹¹ Sexual offences include incidents of sexual assault, indecent assault, acts of indecency and a small number of other sexual offences.

¹² Although the declines in these offences are outside the 95 per cent prediction interval for much of the COVID-19 period, one should be cautious in interpreting these results. These differences may reflect a failure of the model to account for the seasonality in the number of incidents rather than an unexpected decline in incidents.

Figure 4. Sexual offences and robberies per week in NSW

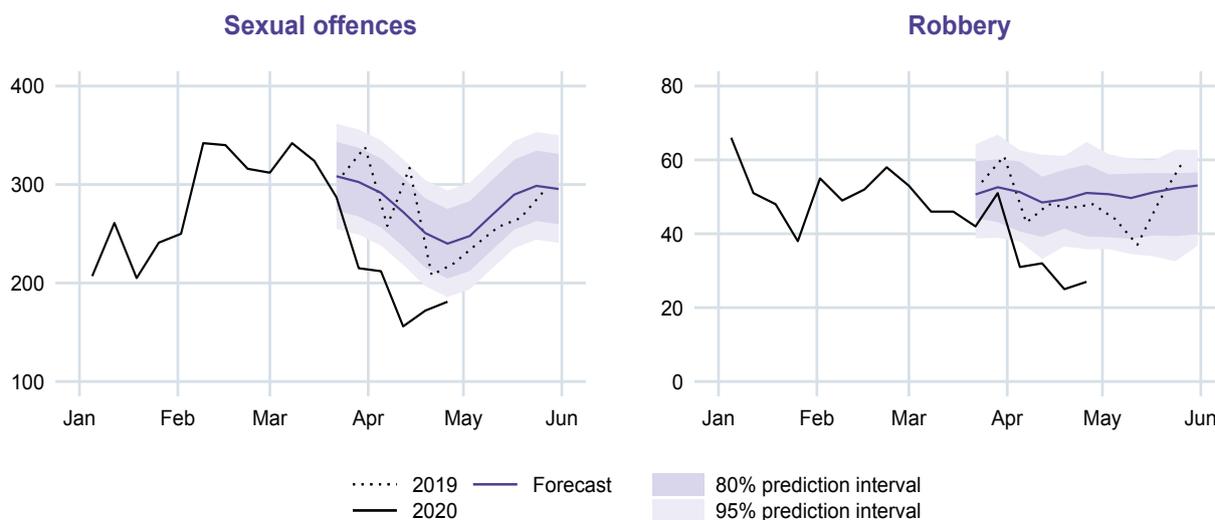


Table 2 shows that the number of robberies also dropped between the week ending 15 March and 26 April, 2020, falling from 46 to 27 incidents, or 41 per cent. This reduction in robberies is not consistent with the forecast model, as the observed number of incidents falls outside the 95 per cent prediction interval. Based on the forecast, during this period, the number of robberies was expected to remain relatively stable.

Table 2. Changes in the number of incidents of sexual offences and robbery, NSW, 15 March – 26 April 2020

Offence	Week ending 15 March	Week ending 26 April	% change v 15 March	April		% difference v forecast
	Incidents	Incidents		Average per week Incidents	Forecast	
Sexual offences	324	181	-44%	180	264	-32%
Robbery	46	27	-41%	29	50	-42%

Property offences

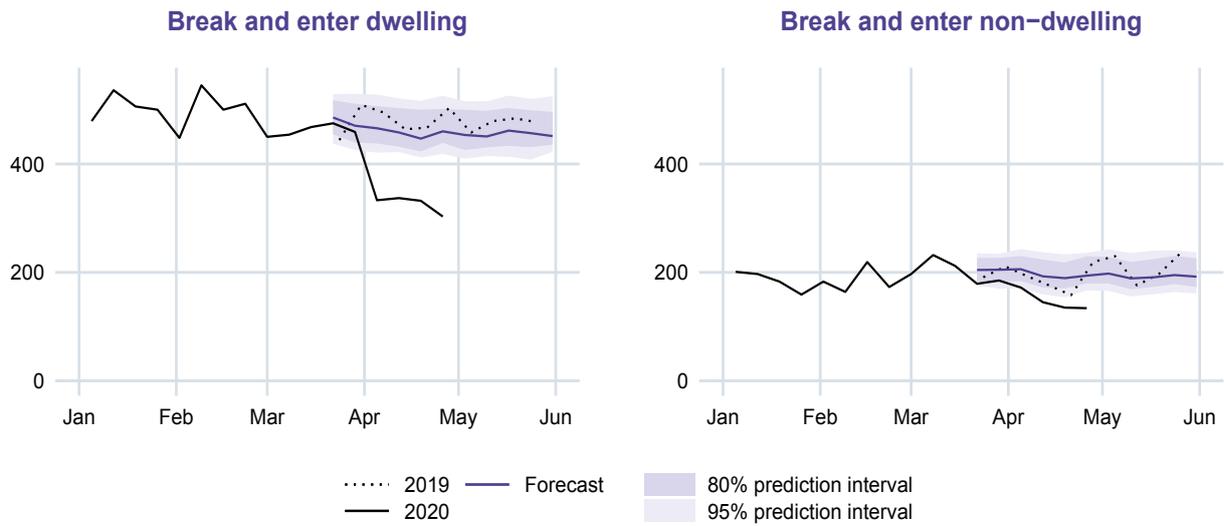
Figures 5, 6 and 7 show the number of property offences recorded by police in 2019 and 2020, together with the forecasted results for the COVID-19 period. Five offences were examined: break and enter, dwelling and non-dwelling; vehicle theft; steal from motor vehicle and steal from retail store. For each of the five offence types examined, the number of incidents during April 2020 was below the lower bound of the 95 per cent prediction interval.

Break and enter dwelling – down 29 per cent

Break and enter non-dwelling – down 25 per cent

Figure 5 shows a sharp decline in residential break-ins since the end of March 2020. As Table 3 shows, incidents of break and enter dwelling decreased 35 per cent, from 468 incidents recorded in the week ending 15 March to 303 incidents recorded in the week ending 26 April. Non-residential break and enter incidents also declined over this six-week period, decreasing from 212 to 134 incidents, or 37 per cent.

Figure 5. Break and enter offences per week in NSW, by subcategory



The difference, in percentage terms, between the expected and observed incident counts during April 2020 is very similar for both residential and non-residential break and enter incidents. As Table 3 shows, there were 29 per cent fewer break and enter incidents in dwellings than were expected in April (approximately 132 fewer incidents per week) and 25 per cent fewer break and enter incidents in non-dwellings (approximately 49 fewer incidents per week).

Table 3. Changes in the number of incidents of break and enter offences, NSW, 15 March – 26 April 2020

Offence	Week ending 15 March	Week ending 26 April	% change v 15 March	April		% difference v forecast
	Incidents	Incidents		Average per week Incidents	Forecast	
Break and enter dwelling	468	303	-35%	326	458	-29%
Break and enter non-dwelling	212	134	-37%	146	195	-25%

Steal from motor vehicle – down 34 per cent

Motor vehicle theft – down 24 per cent

The number of motor vehicle theft incidents fell during the COVID-19 period under examination. As Table 4 shows, between 15 March and 26 April 2020, there was a 26 per cent reduction in recorded steal from motor vehicle offences (from 662 to 489 incidents). Over the same period, there was also a reduction of 44 per cent in motor vehicle theft incidents (from 320 to 179 incidents).

Figure 6. Motor vehicle offences per week in NSW, by subcategory

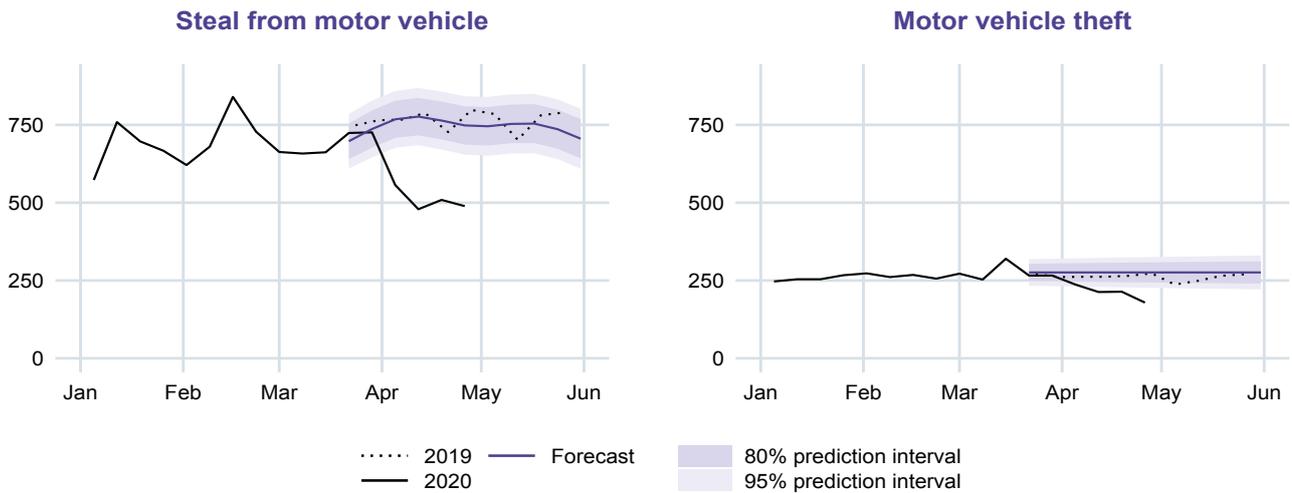


Table 4 also shows, that comparing the number of incidents observed to the forecasted numbers for April, steal from motor vehicle theft offences were down by 34 per cent and motor vehicle theft offences were down by 24 per cent. The number of incidents for both types of motor vehicle offences were below the forecasted expectations, falling below the lower bound of the 95 per cent prediction interval.

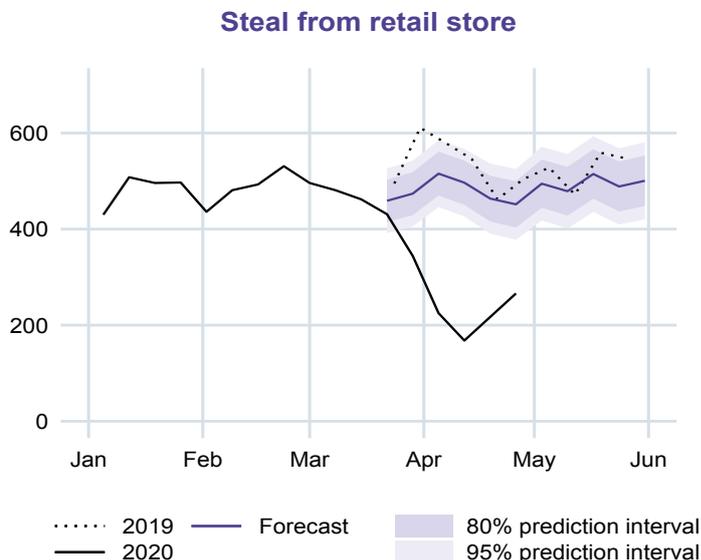
Table 4. Changes in the number of incidents of motor vehicle theft and steal from motor vehicle, NSW, 15 March – 26 April 2020

Offence	Week ending 15 March	Week ending 26 April	% change v 15 March	April		% difference v forecast
	Incidents	Incidents		Average per week Incidents	Forecast	
Steal from motor vehicle	662	489	-26%	508	764	-34%
Motor vehicle theft	320	179	-44%	211	276	-24%

Steal from retail store – down 55 per cent

As Table 5 shows, the number of steal from retail store incidents fell by 42 per cent (from 462 to 266 incidents) between 15 March and 26 April 2020.

Figure 7. Steal from retail store incidents per week



Comparing the number of incidents observed in April to the forecasted number, it is estimated that steal from retail store incidents decreased by 55 per cent. This drop is far greater than the forecast expectations.

Table 5. Changes in the number of incidents of steal from retail store, NSW, 15 March – 26 April 2020

Offence	Week ending 15 March	Week ending 26 April	% change v 15 March	April		% difference v forecast
	Incidents	Incidents		Average per week Incidents	Forecast	
Steal from retail store	462	266	-42%	219	482	-55%

Drug offences

Property and violent offences largely come to police attention through victims reporting these crimes. The next section considers the recorded incidence of a number of offences that are more sensitive to pro-active enforcement activity by police, namely, drug possession/use and drug dealing/trafficking.

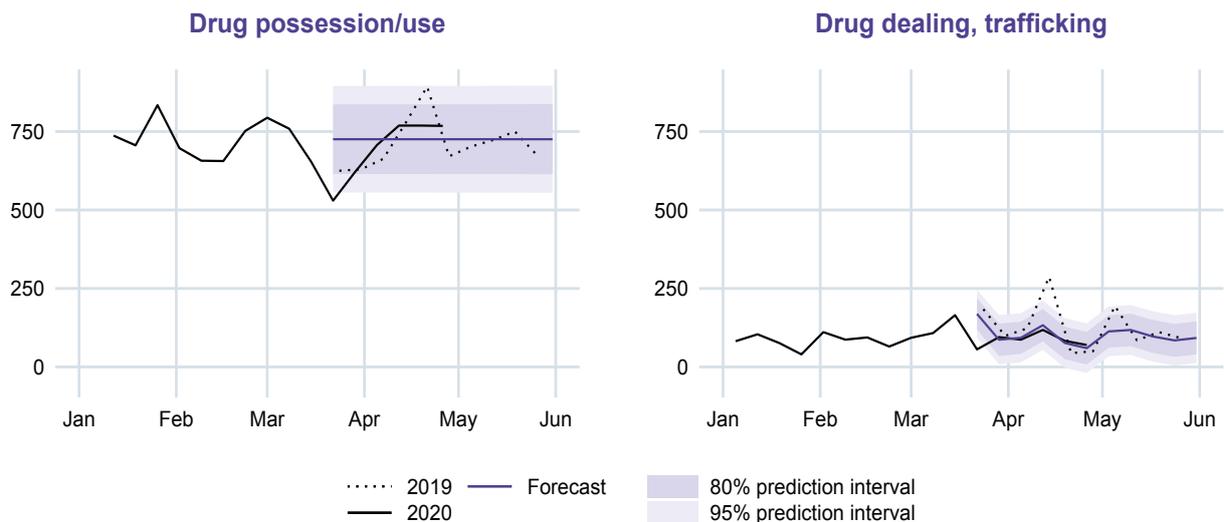
Drug possession and use – consistent with forecast

Drug dealing and trafficking – consistent with forecast

In contrast to the offences described in the previous sections, the total numbers of drug possession and dealing incidents recorded by police remained largely unchanged during the COVID-19 period under examination.

As reported in Table 6, there was a slight increase in incidents of drug possession and/or use (from 654 to 768 incidents) and a drop in the number of drug dealing and trafficking incidents between 15 March and 26 April 2020 (from 165 to 70 incidents).

Figure 8. Drug incidents per week in NSW, by subcategory



As shown in Figure 8, observed numbers of incidents of drug possession and/or use, and drug dealing and trafficking were very similar to the numbers forecast for this period. Compared to the forecast, drug dealing incidents in April 2020 were down by one per cent (90 versus 91 incidents per week), and drug possession incidents were up by four per cent (753 versus 726 incidents per week). However, these fluctuations are within the bounds of what would be expected based on the forecast models.

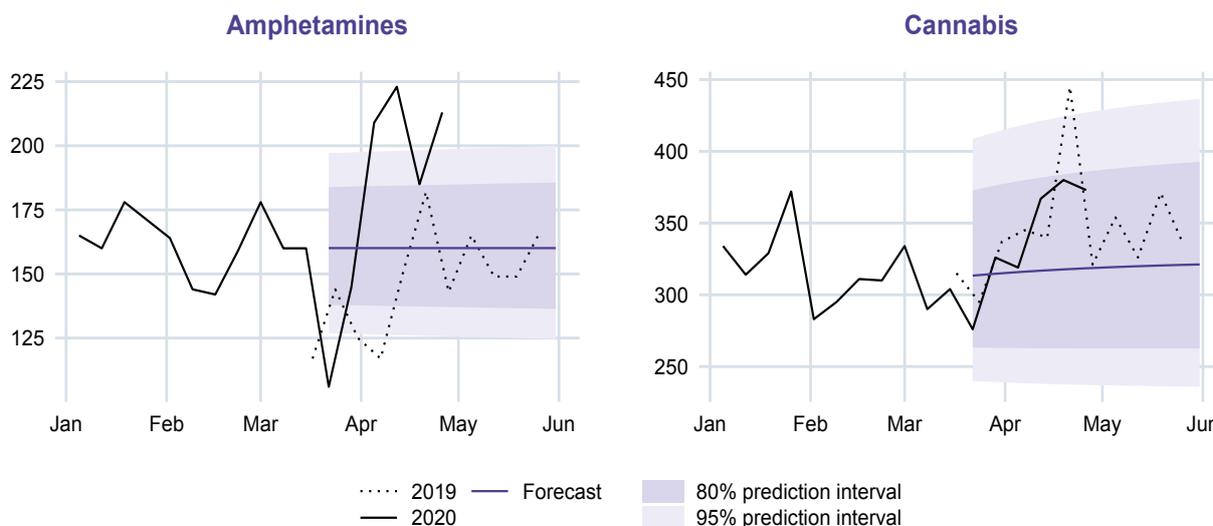
Table 6. Changes in the number of incidents of drug offences, NSW, 15 March – 26 April 2020

Offence	Week ending 15 March		Week ending 26 April		April	
	Incidents	Incidents	% change v 15 March	Average per week		% difference v forecast
				Incidents	Forecast	
Dealing, trafficking in drugs	165	70	-58%	90	91	-1%
Possession and/or use of drugs	654	768	17%	753	726	4%

While the total volume of drug possession and/or use incidents is stable, there were some changes in the drug types coming to police attention. Figures 9 and 10 show trends in drug possession incidents by drug type.

As Table 7 shows, incidents of amphetamine possession increased by 33 per cent, from 160 incidents in the week ending 15 March to 213 incidents in the week ending 26 April. The increase in amphetamine possession incidents exceeds the forecasted expectation for most of April. Over the same period, incidents of cannabis possession also increased from 304 incidents to 373 incidents, an increase of 23 per cent.¹³ However, in the case of cannabis the increase is within the 80% prediction interval suggesting that the increase is in line with historical variation.

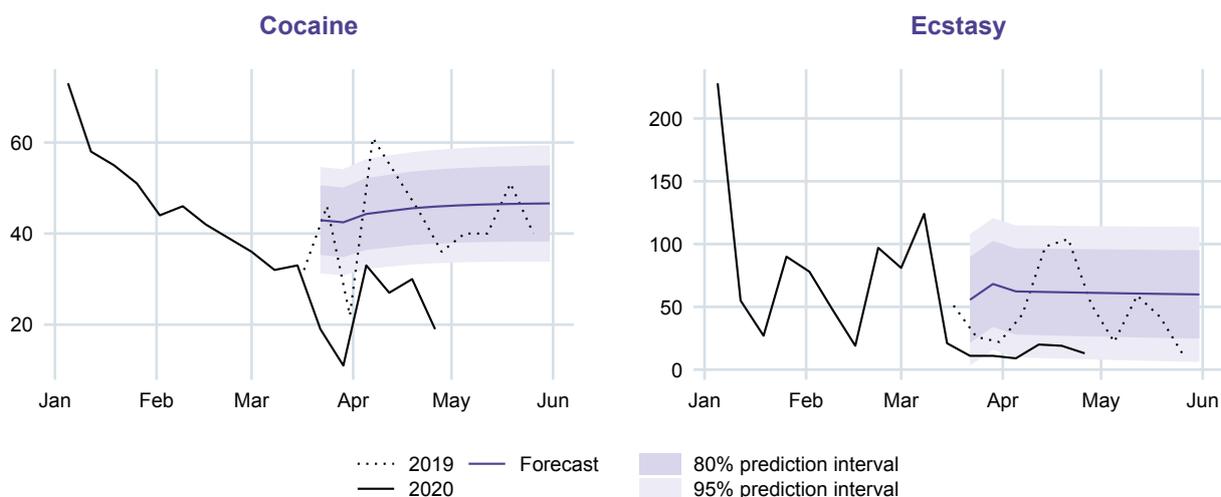
Figure 9. Drug possession incidents per week in NSW, amphetamines and cannabis



Conversely, the weekly number of incidents of cocaine possession and/or use decreased from 33 to 19 during the COVID-19 period (week ending 15 March through to week ending 26 April); similarly, the weekly number of incidents of ecstasy possession and/or use decreased from 21 to 13 over the same period.

¹³ The patterns are similar for incidents of drug dealing and trafficking – an increase in the number of offences for amphetamines and cannabis, compared with large reductions in cocaine and ecstasy offences – but the numbers of these offences were much smaller per week, making inference more challenging.

Figure 10. Drug possession incidents per week in NSW, cocaine and ecstasy



Compared with forecasts for the month of April, incidents of cocaine possession and/or use and ecstasy possession and/or use were down by 40 per cent and 76 per cent, respectively. The decrease observed for cocaine falls outside the 95 per cent prediction intervals estimated by the forecast model, but the decrease observed for ecstasy possession falls largely within the expected range.

Table 7. Changes in the number of incidents of drug possession and/or use, NSW, 15 March – 26 April 2020

Drug type	Week ending 15 March	Week ending 26 April	% change v 15 March	April		% difference v forecast
	Incidents	Incidents		Average per week Incidents	Forecast	
Amphetamines	160	213	33%	208	160	30%
Cannabis	304	373	23%	360	317	14%
Cocaine	33	19	-42%	27	45	-40%
Ecstasy	21	13	-38%	15	62	-76%
Narcotics	25	30	20%	26	26	0%
Other	111	120	8%	118	119	-1%

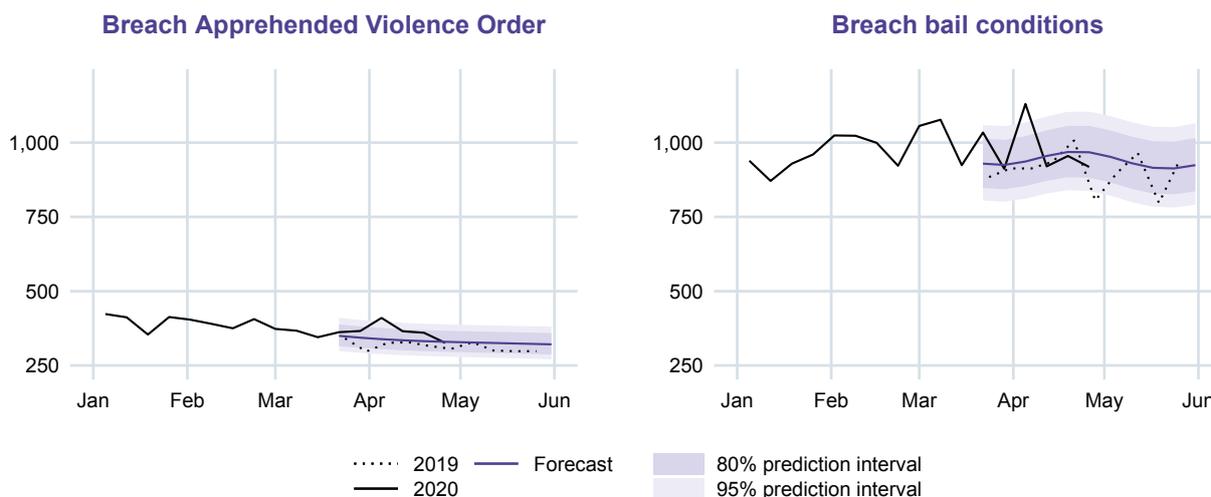
Justice Offences

Breach Apprehended Violence Order (AVO) – consistent with forecast

Breach bail conditions – consistent with forecast

As with drug offences, justice order breaches are more heavily influenced by proactive policing efforts than offences reported earlier in this brief. Figure 11 shows the observed and expected number of breaches of bail conditions and breaches of Apprehended Violence Orders.

Figure 11. Breaches of AVOs and bail conditions per week in NSW



As Table 8 shows, between 15 March and 26 April, 2020, there was a six per cent decline in breaches of Apprehended Violence Orders (from 345 to 326 incidents) and a one per cent decline in breaches of bail conditions (from 924 to 918 incidents). Compared to the forecasts for April, breaches of Apprehended Violence Orders increased by nine per cent and breaches of bail conditions increased by three per cent. However, these slight increases in breaches are consistent with the forecast model, with the observed number of breaches falling well within the 95 per cent prediction intervals.

Table 8. Changes in the number of incidents of breach AVO and breach bail conditions, NSW, 15 March – 26 April 2020

Offence	Week ending 15 March Incidents	Week ending 26 April Incidents	% change v 15 March	April		% difference v forecast
				Average per week Incidents	Forecast	
Breach Apprehended Violence Order	345	326	-6%	365	334	9%
Breach bail conditions	924	918	-1%	981	957	3%

Compliance checks for Apprehended Violence Order (AVO) – up 85 per cent

Compliance checks for bail conditions – up 13 per cent

This section presents weekly numbers of police recorded AVO compliance checks and bail compliance checks. These data can be considered reliable indicators of the level of police enforcement of both AVO and bail conditions. As can be seen from Figure 12, the volume of both AVO and bail compliance checks undertaken by police increased during the COVID-19 period under examination and the weekly counts fall largely outside the 95 per cent prediction intervals from the forecast models.

As shown in Table 9, the number of AVO compliance checks increased from 1,320 per week on 15 March to 1,933 per week on 26 April, 2020, an increase of 46 per cent. The increase was also pronounced for bail compliance checks; with 1,778 checks conducted in the week ending 15 March and 2,427 in the week ending 26 April (an increase of 37 per cent).

The forecast models predicted small declines in the number of compliance checks during April. Compared with expectations, AVO compliance checks increased by 85 per cent and bail compliance checks increased by 13 per cent.

Given such a large increase in compliance checks, it is surprising that there was no accompanying increase in the number of breaches for either AVOs or bail conditions over the same period.

Figure 12. Compliance checks per week in NSW

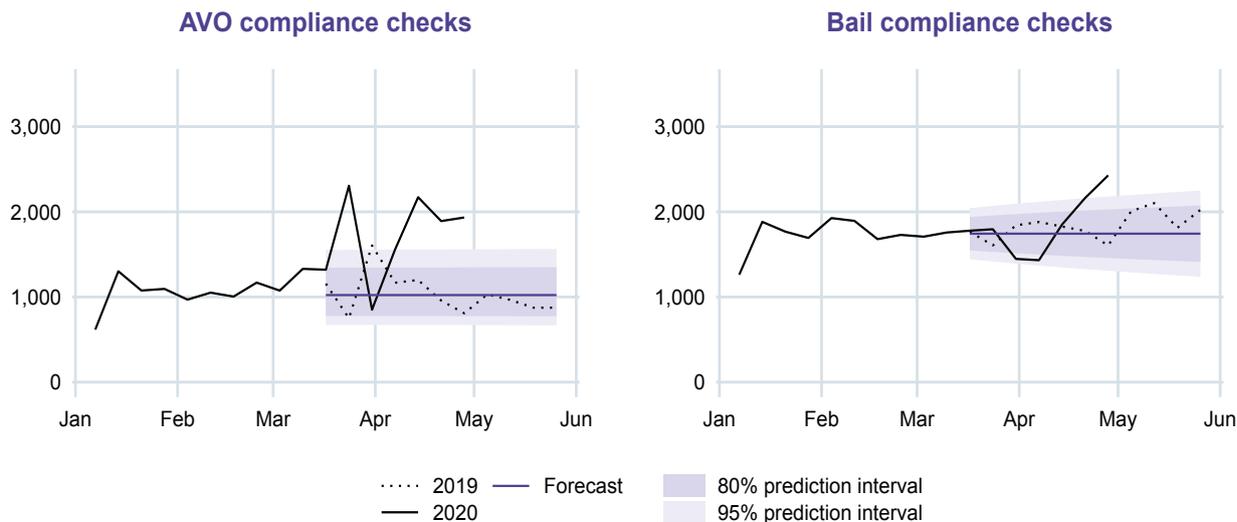


Table 9. Changes in the number of incidents of AVO and bail compliance checks, NSW, 15 March – 26 April 2020

Offence	Week ending 15 March Incidents	Week ending 26 April Incidents	% change v 15 March	April		% difference v forecast
				Average per week Incidents	Forecast	
AVO compliance checks	1,320	1,933	46%	1,888	1,023	85%
Bail compliance checks	1,778	2,427	37%	1,968	1,743	13%

SUMMARY

Since the start of the COVID-19 containment measures (i.e. between 15 March and 26 April 2020), there have been sharp falls in non-domestic related assault, sexual offences, robbery, break and enter (dwelling and non-dwelling), vehicle theft, stealing from vehicles and stealing from retail premises. Domestic violence related assaults also decreased, but remained largely within expected ranges. Drug trafficking and drug possession offences were stable in aggregate while subordinate changes were observed among particular drug types.

Over the same six-week period, there has been a sharp increase in police compliance checks for people on bail and people subject to an Apprehended Violence Order, while bail and AVO breaches have remained relatively stable.

It is important to note a limitation of this study, namely, this study measures criminal incidents detected by, or reported to, police and is therefore not sensitive to changes in unreported offences. A fall in reporting rates could account for some of the crime decline reported here. This is more likely to affect offences known to be under-reported, such as, domestic violence and sexual offences, rather than well-reported crimes, such as, stealing.

These reductions in recorded crime in NSW closely coincide with the social distancing and isolation measures implemented in response to the COVID-19 pandemic. It is possible that, as these restrictions are relaxed and NSW residents resume regular activities, crime rates will return to normal levels. Weekly crime trends should therefore continue to be closely monitored.

ACKNOWLEDGEMENTS

We would like to thank Jackie Fitzgerald, Suzanne Poynton and Clare Ringland for their help editing and writing this brief, Malindi Sayle, Elina Gilbourd, Rebekah Hitchenson and Nick Halloran for providing comments, Nick Halloran for helping with the forecasting, Derek Goh and Darren Kwok for data extraction, Florence Sin for desktop publishing, and Lily Trimboli and Nick Chan for their help with proofreading.

REFERENCES

- Ashby, M. (2020). Initial evidence on the relationship between corona virus pandemic and crime in the United States. *Crime Science*, 9, Article 6. Retrieved 2 June 2020 from: <https://crimesciencejournal.biomedcentral.com/articles/10.1186/s40163-020-00117-6>
- Assimakopoulos, V., & Nikolopoulos, K. (2000). The theta model: A decomposition approach to forecasting. *International Journal of Forecasting*, 16, 521-530.
- Campedelli, G. M., Aziani, A., & Favarin, S. (2020). Exploring the effect of 2019-nCoV containment policies on crime: The case of Los Angeles. Retrieved 2 June 2020 from: <https://doi.org/10.31219/osf.io/gcpq8>
- Cleveland, R. B., Cleveland, W. S., McRae, J. E., & Terpenning, I. J. (1990). STL: A seasonal-trend decomposition procedure based on loess. *Journal of Official Statistics*, 6(1), 3-33.
- De Livera, A. M., Hyndman, R. J., & Snyder, R. D. (2011). Forecasting time series with complex seasonal patterns using exponential smoothing. *Journal of the American Statistical Association*, 106(496), 1513-1527.
- Gerell, M., Kardell, J., & Kindgren, J. (2020). Minor covid-19 association with crime in Sweden, a ten-week follow up. Retrieved 2 June 2020 from: <https://doi.org/10.31235/osf.io/w7gka>
- Hyndman, R. J., Athanasopoulos, G., Bergmeir, C., Caceres, G., Chhay, L., O'Hara-Wild, M., Petropoulos, F., Razbash, S., Wang, E., & Yasmeeen, F. (2019). *forecast: Forecasting functions for time series and linear models*. R package version 8.9.
- Hyndman, R.J., Koehler, A.B., Snyder, R.D., & Grose, S. (2002). A state space framework for automatic forecasting using exponential smoothing methods. *International Journal of Forecasting*, 18(3), 439-454.
- Payne, J. L., & Morgan, A. (2020). *COVID-19 and violent crime: A comparison of recorded offence rates and dynamic forecasts (ARIMA) for March 2020 in Queensland, Australia*. Retrieved 2 June 2020 from: <https://doi.org/10.31235/osf.io/g4kh7>
- R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.