

## Trends in assaults after midnight

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**Aim:** To determine whether there has been a decline in assaults after midnight following changes to liquor licensing policy after March 2008.

**Method:** Time series analysis of reported assaults between January 2004 and December 2010.

**Results:** The upward trend in assault between midnight and 5:00 a.m. in NSW between 2004 and 2008 reversed following changes to liquor licensing policy after March 2008 and the NSW Liquor Act in October 2008. Assaults on licensed premises have fallen by about one per cent a month since March 2008. The fall is not restricted to licensed premises but was found to affect all location categories other than non-licensed business/commercial premises.

**Conclusion:** The imposition of new restrictions on licensed premises may have assisted in reducing the assault rate in NSW.

### Introduction

On 11 March 2008, following a number of requests from the public and the media, the NSW Bureau of Crime Statistics and Research (BOCSAR) published a ranked list of the top 100<sup>1</sup> licensed premises for assaults occurring between January and September 2007. On 30 October 2008, new licence restrictions were imposed on the top 48 licensed premises on BOCSAR's top 100 list<sup>2</sup>. The restrictions placed on the top 48 list came into force on 1 December 2008 and included:

- Mandatory 2:00 a.m. lock outs
- Cessation of alcohol service 30 minutes before closing time
- Plastic or polycarbonate glasses for beer service after midnight
- No 'shots' and drink purchase limits after midnight
- Ten minute alcohol sale time outs every hour after midnight.

In October 2009, Moffatt, Mason, Borzycki, and Weatherburn (2009) evaluated the effect of these initiatives and found a decline in the incidence of assault on the 48 licensed premises upon which restrictions were imposed. The decline, however, was not restricted to these premises. A general decline in the number of assaults on licensed premises occurred across the

top 100 licensed premises listed on the BOCSAR website. The precise cause of the decline is unclear but likely influences include adverse publicity and increased enforcement activity by the NSW Police Force and the Office of Liquor, Gaming and Racing (OLGR).

Though the restrictions only applied across a minority (48) of licensed premises, it would be fair to say that all licensees and the vast majority of patrons have become well aware of the increased level of supervision within the hotel and clubs sector since early 2008. Since much of the policy emphasis has been on alcohol related assault on the listed licensed premises after midnight (when most assaults occur), it is of interest to enquire into trends in assault on all licensed premises after midnight (when more than 40 per cent of assaults occur). It is also of interest to see whether the decline in assaults on licensed premises has been accompanied by decreases in assault in other premises types. This report examines these issues.

### Method

The data used to carry out this study were drawn from COPS, the NSW Police Computerised and Operational Policing System. The data extracted from COPS consisted of all assaults recorded by the NSW Police Force as having occurred between midnight and 5:00 a.m. on any day between 1 January 2004 and 31 December 2010. Location information on each assault was

also extracted, thereby permitting the creation of five separate time series:

1. Assaults on licensed premises
2. Assaults in outdoor/public places
3. Assaults on business/commercial premises
4. Assaults on residential premises
5. Assaults on public transport

In addition to these five series two aggregate series are also included. The sixth, 'total' comprises the total monthly number of assaults in NSW after midnight (i.e. all premises types) and the seventh, 'total non-licensed' is made up from total assaults excluding those occurring on licensed premises. Descriptive statistics for each of these series are presented in Table 1.

Time series analysis was used to investigate the trends in the number of assaults for the premises types listed in Table 1 before and after March 2008. After testing for stationarity (and finding that no stochastic trends were present in the seven time series over the period January 2004 to December 2010), a statistical model was constructed that expressed the monthly number of assaults as a function of a set of variables to control for the following factors;

- i. Any general trend;
- ii. Any change in trend around March 2008 (the policy effect); and
- iii. Seasonal factors using controls for weekend time<sup>3</sup> and month of year.

## Results

Table 1 shows that the vast majority of reported assaults occurring between midnight and 5:00 a.m. take place at residential, outdoor/public places or licensed premises. The monthly NSW counts for these three series are plotted below in Figures 1 and 2. Monthly counts for public transport, business/commercial premises, all non-licensed premises and all premises types are plotted in Figures A1 to A4 in the Appendix. The monthly series of assaults on licensed premises is included in all figures since it is the focal issue of the report. Note, too, that counts of assaults on licensed premises peak early in 2008, followed by a downtrend which seems to have flattened out over the last six months of 2010. Seasonality is

more pronounced for the assaults occurring in outdoor/public places and residential premises (see strong January peaks in Figures 1 and 2). However these strong seasonal components make it difficult to see trends and turning points in the two series. The inclusion of a 12-month moving average trend line sheds some light on rising, stationary and falling levels for the series over the period of interest.

Figure 1 shows a fall in the reported assaults for NSW on licensed premises after midnight and a fall in assaults recorded in outdoor/public places after midnight. Note that for Figure 1 (assaults on licensed premises and outdoor/public places), the two moving average lines seem to follow similar paths since about 2006, whereas for Figure 2 (assaults on licensed premises and residential premises) the moving averages seem to be more divergent since March 2008. Whilst the series for assaults in residential premises does not show a clear turning point, the principal question of interest here is whether there is evidence of a slope change around the March 2008 policy changes. The models used to deseasonalise and test for underlying trend and any trend change since March 2008 are given in Table 2, along with the estimated results.

Phillips-Perron unit root tests suggest that all the series used in these analyses are stationary<sup>4</sup> for the periods analysed. Autocorrelation<sup>5</sup> is present but can be successfully controlled by the inclusion of the months and an autoregressive process in the models.

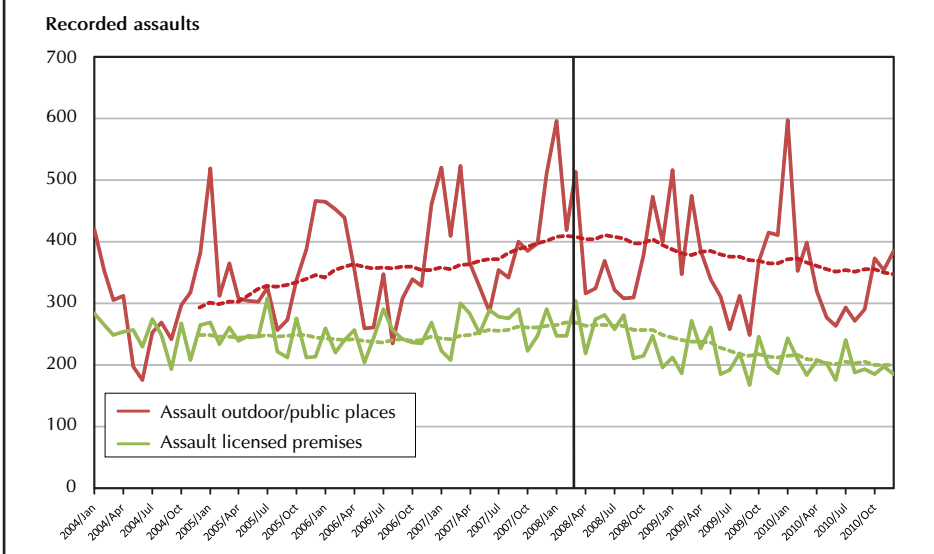
Results<sup>6</sup> for all series are given in Table 2. Residuals for all models were free of autocorrelation and passed normality tests, that is, they were independent and identically distributed with zero mean and constant variance.

The first column shows the variables included in the model. The first term measures any underlying trend, the second term measures the change in the assault trend after March 2008, the third term measures the 'weekend' effect and the remaining terms control for seasonal fluctuations in the incidence of assault. Separate models are constructed for assaults on each premises type. The three columns labelled 'Coef', 'Std. err.' and 'p-val' show, respectively, the sign and magnitude of any change, the standard error of the estimate of change and whether or not the change is statistically significant.

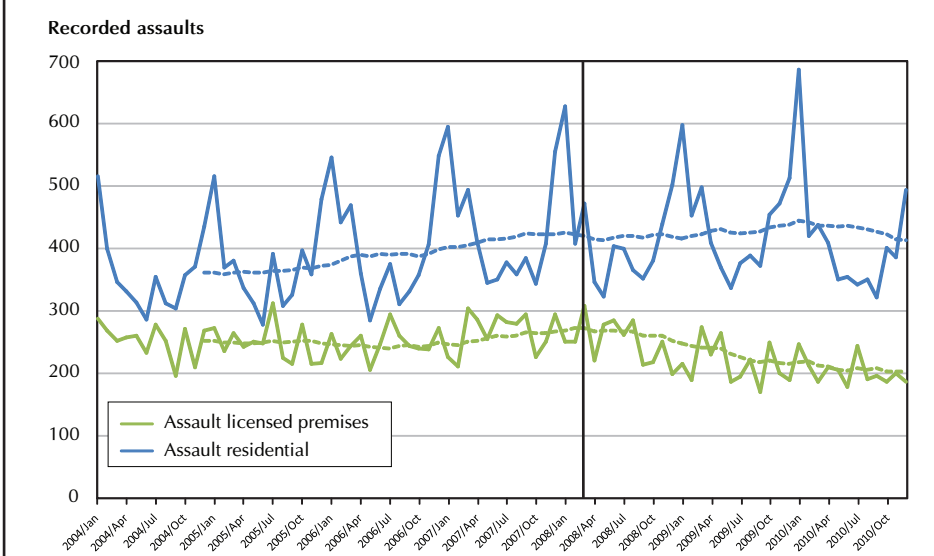
**Table 1. Descriptive statistics for assaults recorded as occurring between midnight and 5:00 a.m., January 2004 to December 2010**

Type of premises	No. months	Monthly recorded assaults for NSW			
		Mean	Std. Dev.	Min	Max
Licensed premises	84	237.7	34.8	167	308
Outdoor/public places	84	357.2	86.2	175	597
Business/commercial	84	39.1	8.8	18	58
Residential	84	398.5	82.2	275	680
Public transport	84	25.2	6.6	8	45
Total	84	1,104.10	186.3	774	1,667
Total non-licensed	84	866.3	176.8	545	1,424

*Figure 1. Recorded assaults occurring at outdoor/public places and licensed premises between midnight and 5:00 a.m., NSW, January 2004 to December 2010*



*Figure 2. Recorded assaults occurring at residential premises and licensed premises between midnight and 5:00 a.m., NSW, January 2004 to December 2010*



Inspection of the first row in the table indicates a significant underlying upward trend for all assault series except those occurring on licensed premises, where the upward trend is non-significant ( $p = .30$ ). Inspection of the second row shows a significant change in trend after March 2008 in all premises types except business/commercial (which did nevertheless get a sign change from the significantly positive underlying trend of 0.18 extra assaults per month to a non-significant negative coefficient). The size of the marginal effect for outdoor/public places is roughly double that for licensed premises (a drop of 4.80 assaults per month compared with a drop of 2.35 assaults per month respectively). The marginal effect for assaults on residential premises is slightly less than that of licensed premises (a drop of 2.09 assaults per month).

The output in Table 2 shows the strong seasonal effects for assaults in residential and outdoor/public places which is also evident as a flow-on to the output for the two aggregate series 'all premises types' and 'non-licensed premises'. In fact almost every month can be distinguished by the models for these series. Licensed premises, business/commercial and public transport show the least amount of seasonality. The weekend time variable is significant in all series except for business/commercial premises, and has a larger marginal effect for licensed premises than for outdoor/public places or residential premises, even though these two series are higher in monthly counts. Note also that the model for residential assaults was able to detect a change in slope after March 2008, even though the series in Figure 2 does not appear to have a turning point.

The magnitude of the change in trend since the liquor licensing policy changes is indicated by the second row term in the Table 2 column labelled 'Coef'. We can gauge the relative size of the change in trend for different premises types by dividing the second row 'Coef' entries by the mean of the series in Table 1. The relative effect size of this change in trend is estimated at around 1 per cent per month for licensed premises and greater than 1 per cent per month for outdoor/public places and public transport since March 2008.

The results given in Table 2 show strong evidence of trend change in recorded assaults over the period following the policy changes. This may be because some external factor was exerting similar influence over all the premises types after midnight or because the policy initiatives implemented on licensed premises had some spill-over effect outside licensed premises. To take this analysis further, a test of the direction of influence between assault levels at licensed premises and at other premises types has been reported in Appendix Table A1. The mutual relationship between assaults on licensed premises and on other premises types were examined using vector autoregression models. Exogenous variables used in the Table 2 models were included as controls. The results are briefly summarised in the  $p$ -values obtained from Granger tests

**Table 2. Recorded assaults occurring between midnight and 5:00 a.m. by premises types, January 2004 to December 2010: Maximum likelihood estimation in levels for monthly data**

	Licensed premises			Outdoor/public places			Business/commercial			Residential			Public transport			Total			Total non-licensed		
	Coef.	Std. Err.	p-val.	Coef.	Std. Err.	p-val.	Coef.	Std. Err.	p-val.	Coef.	Std. Err.	p-val.	Coef.	Std. Err.	p-val.	Coef.	Std. Err.	p-val.	Coef.	Std. Err.	p-val.
Underlying trend	0.21	0.21	.30	2.41	0.27	<.01	0.18	0.05	<.01	1.66	0.24	<.01	0.21	0.06	<.01	4.79	0.51	<.01	4.54	0.42	<.01
Trend change since Mar08	-2.35	0.47	<.01	-4.80	0.82	<.01	-0.22	0.14	.12	-2.09	0.63	<.01	-0.44	0.14	<.01	-10.35	1.44	<.01	-7.92	1.23	<.01
Weekend time	32.57	5.49	<.01	25.55	9.81	.01	1.79	2.29	.44	18.20	8.67	.04	5.12	1.12	<.01	97.80	17.35	<.01	63.77	16.74	<.01
Jan	11.00	9.27	.24	94.27	18.77	<.01	4.75	5.23	.36	88.92	12.80	<.01	5.19	4.05	.20	217.28	37.64	<.01	204.19	31.17	<.01
Feb	5.58	10.84	.61	-33.31	19.18	.08	2.86	4.11	.49	-63.23	15.33	<.01	0.01	2.28	>.99	-80.11	43.64	.07	-88.46	37.06	.02
Mar	30.83	11.06	.01	12.50	21.23	.56	4.70	4.33	.28	-47.80	15.63	<.01	0.65	2.71	.81	2.41	42.51	.96	-31.30	34.57	.37
Apr	14.05	9.82	.15	-81.87	23.13	<.01	-5.67	4.24	.18	-119.16	16.78	<.01	-1.90	2.69	.48	-199.28	38.41	<.01	-216.35	35.26	<.01
May	11.76	10.96	.28	-135.02	17.48	<.01	-1.44	4.26	.74	-165.93	16.84	<.01	-3.60	2.81	.20	-296.60	43.64	<.01	-311.13	39.12	<.01
Jun	14.86	11.32	.19	-135.71	19.33	<.01	-5.73	4.61	.21	-154.92	18.15	<.01	-2.90	2.77	.30	-287.42	45.69	<.01	-305.48	37.68	<.01
Jul	29.55	11.91	.01	-121.41	18.70	<.01	3.56	4.56	.44	-124.82	17.03	<.01	-5.67	2.50	.02	-224.63	39.96	<.01	-256.67	35.52	<.01
Aug	18.22	11.48	.11	-137.96	20.02	<.01	-4.44	5.05	.38	-151.84	20.64	<.01	-1.24	2.59	.63	-276.12	46.29	<.01	-297.10	38.63	<.01
Sep	-7.13	10.76	.51	-123.79	22.30	<.01	-5.24	5.34	.33	-153.04	20.01	<.01	-4.55	2.75	.10	-298.65	44.21	<.01	-294.54	42.22	<.01
Oct	4.22	12.55	.74	-77.76	27.45	.01	-4.41	5.09	.39	-116.88	15.36	<.01	-3.44	2.59	.19	-197.85	59.66	<.01	-205.34	48.36	<.01
Nov	4.01	11.53	.73	-35.00	22.69	.12	-0.86	5.79	.88	-87.72	17.96	<.01	0.56	2.60	.83	-115.77	49.20	.02	-122.81	40.03	<.01
constant	221.76	10.15	<.01	342.52	18.46	<.01	33.35	3.96	<.01	427.06	15.27	<.01	18.79	3.02	<.01	1082.16	39.48	<.01	864.72	33.95	<.01
AR terms	ar(1)			ar(3 4 5)			ar(1)			ar(1 4)			ar(2)			ar(1 2)			ar(1 2)		
Regression diagnostics	Statistic		p-val.	Statistic		p-val.	Statistic		p-val.	Statistic		p-val.	Statistic		p-val.	Statistic		p-val.	Statistic		p-val.
Wald Chi-square for model	132.55		<.01	898.89		<.01	52.36		<.01	678.52		<.01	73.18		<.01	981.82		<.01	1114.41		<.01
Mackinnon approx. p-val for Phillips-Perron unit root test on dependent variable	-7.13		<.01	-5.25		<.01	-9.14		<.01	-5.13		<.01	-7.24		<.01	-5.73		<.01	-5.10		<.01
Portmanteau test for white noise residuals Prob >Chi-square (30)	32.99		.32	26.65		.64	19.28		.93	25.46		.70	22.71		.83	28.45		.55	33.78		.29
Bartlett's Cumulative Periodogram white noise test	0.51		.96	0.52		.95	0.64		.80	0.53		.94	0.30		>.99	0.40		>.99	0.53		.94
Log likelihood for model	-369.8			-406.5			-284.3			-391.0			-244.6			-464.0			-450.2		

on these vector autoregression models in Appendix Table A1. The tests suggest that the reduction in assaults on licensed premises may have flowed on, to some extent, to assaults in outdoor/public places, business/commercial premises and residential premises. There is also some suggestion of a flow-on in the reduction of assaults on licensed premises to those on public transport and all non-licensed premises.

## Discussion

The decline in assaults after midnight since March 2008 is now detectable at the NSW level and is equivalent to a drop of about 1 per cent per month since the liquor licensing policy changes were implemented. Our results show that the underlying upward trend of 4.8 extra recorded assaults each month across the aggregate of all premises types in the period leading up to the policy changes has been reversed by the downward trend of 10.4 fewer assaults each month after March 2008. The downward trend is significant in all premises types other than non-licensed business/commercial premises. This is the first downward trend in assault recorded in NSW since 1988. However the effect may be moderating with the flattening in the series for assaults on licensed premises over the last six months of 2010.

Although it is impossible to pinpoint the precise reason for this decline in assault across NSW, there is little doubt it is a response to one or more of the measures taken from March 2008 onward to reduce the number of assaults on licensed premises. Prior to those measures the number of assaults on licensed premises in NSW was increasing. Since the policy changes were implemented this trend reversed. The shift in trend is entirely consistent with the results obtained from a recent natural experiment in Newcastle (Kypri, Jones, McElduff, & Barker, 2011) which found that the introduction of liquor licensing restrictions reduced the incidence of assaults in Newcastle but not in a nearby area where restrictions were not in force.

## Acknowledgements

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## Notes

- 1 As some premises had the same number of assaults the top 100 list actually contained 109 licensed premises.
- 2 The Star City Casino was not included in the list of premises on which restrictions were imposed.
- 3 Weekend time is a variable that assumes a value of one for any month with more than 13 days total for Fridays, Saturdays and Sundays and zero otherwise. This variable has been found to be a good predictor of assault levels along with month, which controls for the seasonal factors as well as variation in month length.

- 4 Phillips-Perron unit root tests were performed on all the assault series used in models and returned a MacKinnon approximate  $p$ -value for  $Z(t) < .01$  for all series. Since the presence of unit roots could be rejected for all the series, the analysis was conducted in levels. STATA 10 output is shown in Table 2 Regression diagnostics.
- 5 Maximum likelihood estimation was used to estimate monthly assault counts. Along with the months, used as seasonal controls, an autoregressive error structure (for example AR terms at lags 3, 4 and 5 for assaults in outdoor/public places) was found to be effective in controlling for residual autocorrelation in the models and  $e_t$  is white noise.
- 6 The  $p$ -values for the Box-Ljung Q statistics were considered for each model before a final form was selected. All models reported had a non-significant set of  $p$ -values for their Box-Ljung Q statistics to lag 40, but only one result from the Portmanteau test as well as the result of Bartlett's Cumulative Periodogram test for white noise residuals is given towards the bottom of the results tables. The log likelihood statistics and other diagnostics for each model are shown at the bottom of the appendix tables. The Wald  $p$ -value from the STATA 10 output was  $< .001$  for all the models given in the appendices. The regression constant predicts the December level of assaults and all other months will be adjustments from the December level.

## References

- Kypri, K., Jones, C., McElduff, P., & Barker, D. (2011). Effects of restricting pub closing times on night-time assaults in an Australian city. *Addiction, 106*, 303-310.
- Moffatt, S., Mason, A., Borzycki, C., & Weatherburn, D. (2009). Liquor licensing enforcement and assaults on licensed premises. *Bureau Brief (No.40)*. Sydney: NSW Bureau of Crime Statistics and Research.

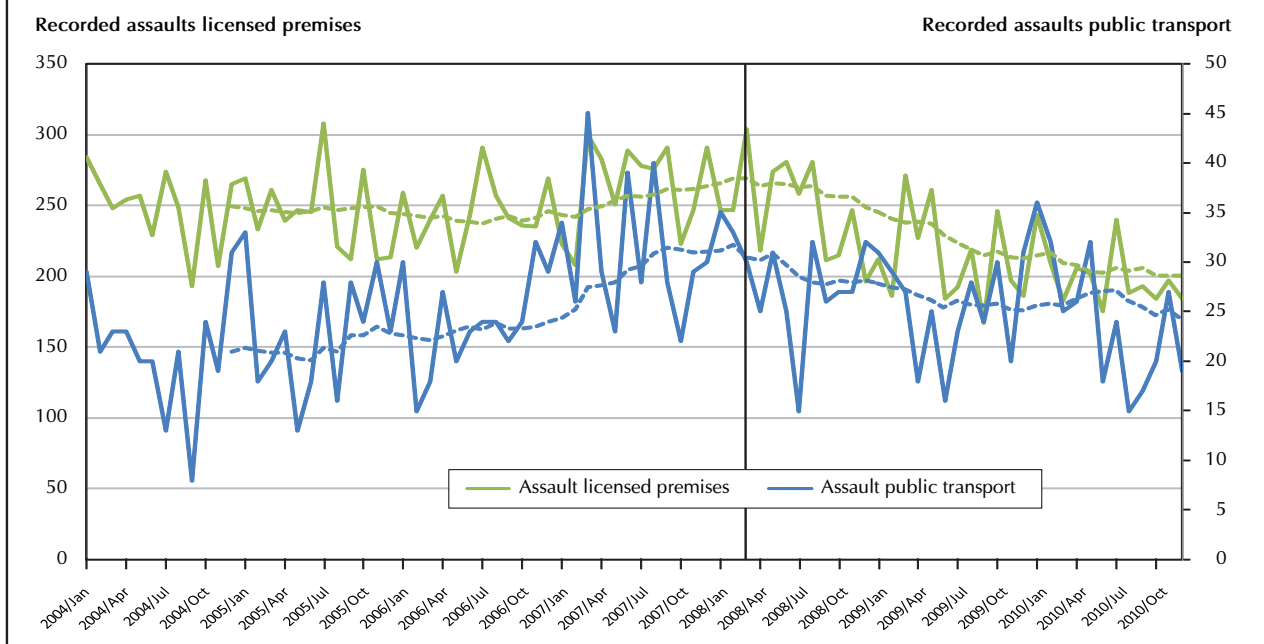
# Appendix

**Table A1. Recorded assaults at licensed premises (LPs) after midnight and influence on recorded assaults at other premises: Granger causality p-values for joint tests of assaults on licensed premises and other premises**

Type of premises	Causality: LPs on other premises type		Causality: Other premises type on LPs	
	VAR(1)	VAR(2)	VAR(1)	VAR(2)
Outdoor/public places	.018	.121	.660	.646
Business/commercial	.007	.039	.243	.151
Residential	.140	.006	.636	.079
Public transport	.071	.191	.305	.175
Total non-licensed	.128	.066	.940	.115

Note. Null hypothesis: Can non-causality be rejected?; VAR= vector autoregression. VAR(1) refers to the use of a one month lag of both assault series as regressors in the VAR model used for the Granger test and similarly VAR(2) refers to the use of two months of lags used as regressors. The smaller p-values for the 'Causality: LPs on other premises type' means that we are more likely to reject non-causality in this direction than the reverse.

**Figure A1. Recorded assaults occurring on public transport and licensed premises between midnight and 5:00 a.m., NSW, January 2004 to December 2010**



**Figure A2. Recorded assaults occurring at business/commercial premises and licensed premises between midnight and 5:00 a.m., NSW, January 2004 to December 2010**

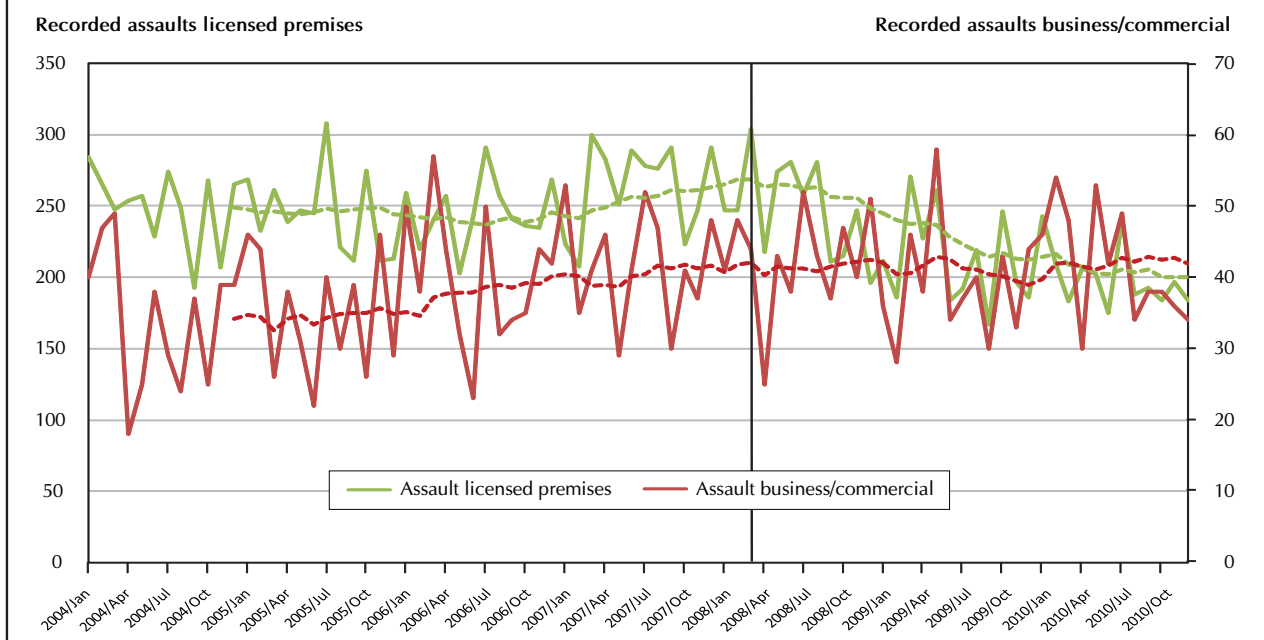


Figure A3. Recorded assaults total non-licensed and those occurring at licensed premises between midnight and 5:00 a.m., NSW, January 2004 to December 2010

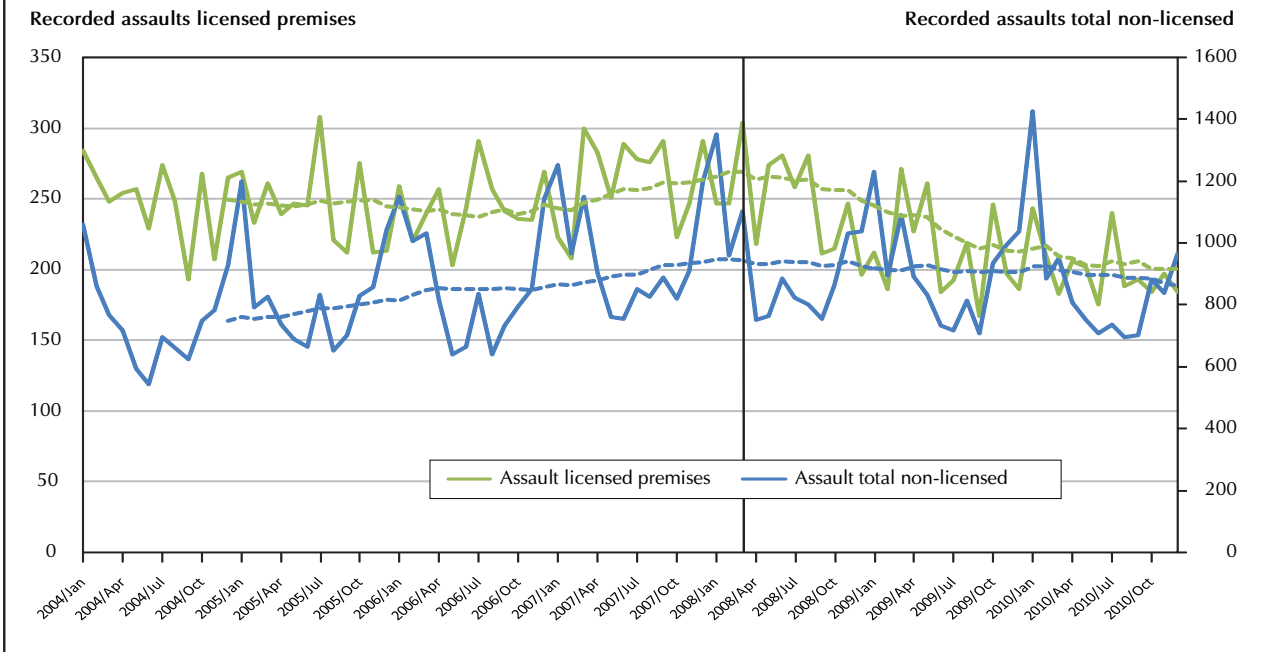


Figure A4. Recorded assaults total and those occurring at licensed premises between midnight and 5:00 a.m., NSW, January 2004 to December 2010

