ADDICTION   SSA

An overlooked effect: domestic violence and alcohol policies in the night-time economy

Michala Kowalski[1] | Michael Livingston[2,3] | Claire Wilkinson[1,3] | Alison Ritter[1]

[1]Drug Policy Modelling Program, Social Policy Research Centre, UNSW Sydney, Kensington, Australia

[2]National Drug Research Institute and enAble Institute, Faculty of Health Sciences, Curtin University, Perth, WA, Australia

[3]Centre for Alcohol Policy Research, La Trobe University, Bundoora, Victoria, Australia

Correspondence
Michala Kowalski, Drug Policy Modelling Program, Social Policy Research Centre, UNSW Sydney, Kensington, Australia.
Email: m.kowalski@unsw.edu.au

Abstract

Background and Aims: Restrictive late-night alcohol policies are aimed at reducing alcohol-related violence but, to date, no evaluations of their impact on family and domestic violence have been conducted. This study aimed to measure whether modifying the drinking environment and restricting on-site trading hours affected reported rates of family and domestic violence.

Design, Setting and Participants: This study used a non-equivalent control group design with two treatment sites and two matched control sites with pre- and postintervention data on rates of family and domestic violence assaults within local catchment areas of four late-night entertainment precincts in New South Wales, Australia, covering a population of 27 309 people. Participants comprised monthly counts of police-recorded incidents of domestic violence assaults from January 2001 to December 2019.

Interventions and comparators: Two variations of restrictive late-night interventions were used: restricted entry to late-night venues after 1:30 a.m., trading ceasing at 3:30 a.m. and other restrictions on alcohol service (Newcastle); and restricted entry to late-night venues after 1 a.m. and a range of restrictions on alcohol service (Hamilton). The comparators were no restrictions on late-night trading or modifications of the drinking environment (Wollongong and Maitland).

Measurements: Measurements involved the rate, type and timing of reported family and domestic violence assaults.

Findings: Reported rates of domestic violence assaults fell at both intervention sites, while reported domestic violence assaults increased over time in the control sites. The protective effects in Newcastle were robust and statistically significant across three main models. The relative reduction associated with the intervention in Newcastle was 29% (incidence rate ratio = 0.71, 95% confidence interval: 0.60–0.83) and an estimated 204 assaults were prevented across the duration of the study. The protective effects found in Hamilton were not consistently supported across the three main models.

Conclusions: Increases to late-night alcohol restrictions may reduce rates of domestic violence.

INTRODUCTION

Background

Consumption of alcohol has been linked to both the risk of perpetrating violence and the risk of being victimized [1]. On-premise alcohol outlets have been linked with acts of aggression [2–4] and an increased risk of domestic [5, 6] and non-domestic violence [7, 8] in many countries [9–12] within a substantial body of evidence. Few alcohol policy evaluations focus upon family and domestic violence [13], despite it representing more than half of all recorded assaults in Australia in 2020 [14].

Minimizing alcohol-related violence in the night-time economy [15, 16] has been a policy priority in New South Wales (NSW). The state government and affiliated bodies introduced policies across multiple sites that restricted late-night access to venues and reduced permitted trading hours. As such, they aimed to modify the drinking environment and control the supply of alcohol [17] to reduce late-night violence and disorder. Late-night restrictions were implemented in Newcastle [18], Hamilton [19] and Sydney's Kings Cross and Central Business District (CBD) [20].

Measures of family and domestic violence have been notably absent from evaluations of these interventions to date [21–28]. Alcohol control interventions are likely to affect rates of family and domestic violence [13, 29–31]. Although few studies have addressed this question directly [13], suggestive evidence from Australia [6, 32–35] and America [36–38] indicates that alcohol interventions affect domestic violence rates. Exploratory studies have found that the composition of the types of on-premises alcohol outlets in late-night entertainment precincts have been associated with reported rates of domestic violence among multiple sites [35, 38]. Building upon the growing evidence examining the effects of alcohol control policies on domestic violence [30] and the well-documented effect of late-night on-premise trading hours on non-domestic violence [21, 22], this study assessed whether late-night restrictions that modified the drinking environment and trading hours of on-premise alcohol outlets affected reported rates of family and domestic violence. As the restrictions of interest were introduced in interventions designed to curtail violence, their effectiveness should be measured in regard to family and domestic violence as well as non-domestic violence. We assumed that the mechanism linking the restrictions to domestic violence rates was via direct impacts upon late-night alcohol consumption of the resident population in the treatment sites. Obviously, many people who came to the precinct on Friday and Saturday night would reside elsewhere. However, we know from studies of young people's movements and drinking behaviours that young people who live within or in close proximity to the central business district described their commutes to late-night venues as quick and direct [39]. We also know that young people who live within or in proximal areas to the central business district consume more alcohol in licensed venues than young people who live in distal areas [40]. Therefore, extrapolating from these studies, we assumed that while the residents of the treatment sites did not make up the only patrons of the studied entertainment precincts, many of the treatment site's residents patronized their local entertainment precinct, and did so frequently. Therefore, their late-night access to alcohol, and subsequent behaviours, were probably affected by the introduction of the intervention. We hypothesized that modifying the drinking environment and restricting trading hours would affect rates of family and domestic violence. However, the direction of the effects was uncertain. If the interventions reduced overall alcohol consumption and lowered the incidence of heavy episodic drinking [31], reported rates of domestic violence were likely to decrease. However, if these interventions increased time spent in the home [41, 42], shifted drinking to off-premise settings [6, 43] and reduced employment opportunities [42, 44, 45], reported rates of domestic violence were likely to increase.

METHODS

Design

We used a non-equivalent control group design to assess the effects of the interventions on reported family and domestic violence assaults [46]. This design replicated the study design used by Kypri *et al.*'s [25, 26] evaluations of the same set of policy interventions on non-domestic violence. To control for selection bias, this design allowed for both pre- and post-intervention testing within a site and comparative evaluations across sites [25, 26]. We added a positive control site and two negative control sites. To test the intervention effects, we conducted interrupted time-series analyses using negative binomial regressions and autoregressive integrated moving average (ARIMA) models. We pre-registered the study's design, desired sample size, variables, hypotheses and planned analysis on Open Science Framework prior to any data being collected [46].

Setting

The study was set in the local catchment areas of four different entertainment precincts in NSW, Australia. These are the CBD of Newcastle, the CBD of Wollongong, the suburb of Hamilton and the City of Maitland. Our two treatment sites were the CBD of Newcastle and Hamilton. Newcastle introduced restrictive late-night policies in 2008, known as the Newcastle intervention [18]. Hamilton introduced restrictive late-night policies in 2010, known as the Hamilton conditions [19]. Control sites were selected to be similarly sized regional locations, with similar entertainment precincts and alcohol policies in line with the rest of the state: i.e. late-night trading and no additional

restrictions on entry. Control sites were matched to the treatment sites according to the size and layout of their entertainment precincts [46]. Accordingly, we matched the CBD of Newcastle with the CBD of Wollongong, and Hamilton with the City of Maitland. For more detail, please see the pre-registration for this study [46].

The interventions

The Newcastle intervention

In 2008, the then NSW's Liquor Administration Board imposed the following conditions on 14 late-night trading licensed premises in Newcastle (these included all the venues that traded past 2 a.m. in Newcastle [47]), effective from midnight 20th March 2008 [18]:

- No entries into licensed premises past 1 a.m., referred to as a 1 a.m. curfew
- Restricted late-night trading hours: venues that traded until 5 am were required to close at 3 a.m. Venues that traded until 3 a.-m. were required to close at 2:30 a.m.

These measures were challenged by the hoteliers in July 2008 and subsequently amended to [48]:

- No entries into licensed premises past 1:30 a.m., referred to as a 1:30 a.m. lockout
- Trading hours that were restricted to 3 a.m. were extended to 3:30 a.m.

In addition to trading hours restrictions, the Newcastle intervention also comprised management plans, compliance audits and restrictions on the types of alcohol that could be served past 10 p.m., behavioural monitoring and harm reduction measures (see Supporting information, Data S1).

The intervention had an immediate strong effect on non-domestic violence: a 37% reduction in non-domestic assaults was measured 6 months following the intervention [25]. These effects have been largely attributed to the restrictions on trading hours, with the lockout mechanism (curfew) in place thought to be far less influential in comparison [21, 49]. None of the aforementioned evaluations have attributed any impacts to the additional administrative and service-related measures [21, 25, 26, 49].

The Hamilton conditions

In 2010 the then NSW's Casino Liquor and Gaming Control Authority determined that the following conditions were to be imposed on six licensed venues, effective from 27 August 2010 [19]:

- No entries into licensed premises past 1:00 a.m., referred to as 1:00 a.m. lockout on Saturday and Sunday mornings.

Additional measures were imposed regarding management plans, compliance audits, restricted service of alcohol past 10 p.m., behavioural monitoring and harm reduction measures (see Supporting information, Data S1). The authority decided not to impose restrictions on trading hours noting a variety of reasons, including voluntary reductions of late-night trading by a number of venues [19].

Following pre-registration of our study design [46], we reviewed the decision documents of the Board and Authority (respectively), instead of relying solely on the published literature, to clarify details regarding the implementation of the measures of interest. We note two discrepancies between our descriptions of the intervention in Hamilton in the study pre-registration [46] and our description here: trading hours were not reduced in Hamilton (by any means), and the restriction on entry was only in place at the weekend [19].

Case definition

We collected all domestic violence assault apprehensions that were reported within the postcodes of the CBD of Newcastle, the CBD of Wollongong, the suburb of Hamilton and the City of Maitland, covering a population of 27,309. Cases were provided by the NSW Bureau of Crime Statistics and Research (BOCSAR) for the period of January 2001 to December 2019. BOCSAR mapped incidents into four time-periods based on time of incident: 12.00–5.59 a.m., 6.00–11.59 a.m., 12.00–5.59 p.m. and 6.00–11.59 p.m. All domestic violence assaults were linked to at least one victim (e-mail from S. Ramsey (stephanie.ramsey@justice.nsw.gov.au in April 2022). Incidents were at the 'apprehension level'. These are recorded by police irrespective of any further action, such as filing charges or convictions [25]. Following Kypri et al. [25, 26], we used all apprehensions in scope, not just those flagged as alcohol-related, to overcome any bias in reporting [25]. In NSW, the only determining factor between a domestic violence assault and a non-domestic violence assault is the nature of the relationship between the offender and the victim. The following incidents were defined as cases: actual bodily harm, common assault, grievous bodily harm (including malicious wounding), shoot with intent other than to murder or spike drink/food offences (*NSW Crimes Act 1900*) when there was a domestic relationship between the offender and the victim [*NSW Crimes (Domestic and Personal Violence) Act 2007 No. 80*]. A domestic relationship is defined as: 'if the person:

(1) is or has been married to the other person, or
(2) is or has been a *de-facto* partner of that other person, or
(3) has or has had an intimate personal relationship with the other person, whether or not the intimate relationship involves or has involved a relationship of a sexual nature, or
(4) is living or has lived in the same household as the other person, or
(5) is living or has lived as a long-term resident in the same residential facility as the other person and at the same time as the other person (not including a correctional centre or a detention centre), or

(6) has or has had a relationship involving his or her dependence on the ongoing paid or unpaid care of the other person, or

(7) is or has been a relative of the other person, or

(8) in the case of Aboriginal and Torres Strait Islander people, if the person is or has been part of the extended family or kin of the other person according to the Indigenous kingship system of the person's culture'.

We constructed two relationship categories to differentiate between intimate partner violence and other types of family and domestic violence: 'intimate partner violence' (spouse/partner, ex-spouse/ex-partner, boy/girlfriend, ex-boy/girlfriend) and 'all other' (parent/guardian of victim, child/step/foster-child of victim, sibling, member of family—other, carer, household member, person in authority, other known person—no relationship, not known to victim, unknown not stated).

Measures

We analysed monthly counts of family and domestic violence assault incidents reported to or detected by police for the period of January 2001 through December 2019. We tested the effects of the introduction of restrictions to modify the drinking environment. There were two variations of this intervention: (a) restricted access to a venue past a specific time together with a mandatory reduction in late-night trading hours introduced in Newcastle in 2008, and (b) restricted access to a venue past a specific time at weekends along with voluntary reductions in late-night trading hours introduced in Hamilton in 2010. We included three additional variables in our analyses: time (in months) elapsed since the start of the study (to control for secular trends in the data), month of year (to control for seasonality) and time elapsed since the intervention (to assess slope change).

Analysis

Our two main models examined the overall effects of the interventions on reported rates of family and domestic violence assaults in the CBD of Newcastle (using the CBD of Wollongong as a control site) and in Hamilton (using Maitland as a control site).

$$
\begin{aligned}
\text{Effects}_t^{(i)} = \text{assaults}_t^{(i)} \sim &\ \beta_0^{(i)} + \beta_1^{(i)}\text{intervention} \\
&\times \beta_2^{(i)}\text{control\_assaults}_t^{(i)} + \beta_3^{(i)}\text{time}_t^{(i)} \\
&+ \beta_4^{(i)}\text{month}_t^{(i)} + \beta_5^{(i)}\text{slope}_t^{(i)} + \varepsilon_t^{(i)}
\end{aligned}
$$

Further models were estimated examining impacts in each of the four time-periods and for the two types of domestic and family violence under consideration. A total of 14 negative binomial regression models were fitted.

All analyses were conducted using R Statistical Software [50]. Please see Supporting information, Data S1–R script for more detail.

RESULTS

We collected 228 observations of reported family and domestic violence assaults at each of the four study sites (see Table 1).

Negative binomial and ARIMA models for the main model effects are presented in Table 2 (Newcastle) and Table 3 (Hamilton). Results of each site's time-series analyses are represented in Figure 1. Reported rates of domestic violence assaults fell at both treatment sites following the intervention, while reported domestic violence assaults increased over time in the corresponding control sites. Following tests to assess goodness-of-fit we found evidence of seasonality in the main models. Therefore, as per Kypri *et al.* [25, 26], we further estimated univariable and controlled ARIMA models to address seasonality in the models that tested the overall effects of the interventions while adjusting for temporal autocorrelation. The protective effects of the intervention in Newcastle were robust and statistically significant across the negative binomial generalized linear model, univariable ARIMA model and controlled ARIMA model (Table 2). The relative reduction associated with the intervention in Newcastle in the negative binomial model was 29% [incidence rate ratio (IRR) = 0.71, 95% confidence interval (CI) = 0.60–0.83, Table 2]. The ARIMA models calculated a lower relative reduction associated with the intervention: the univariable model indicated a 23.6% reduction and the controlled model indicated a 21.8% reduction. These are both within the confidence interval indicated by the negative binomial model.

The reduction in Hamilton was statistically significant in the negative binomial model (46% reduction IRR = 0.54, 95% CI = 0.46–0.63); however, the result was not statistically significant in either of the ARIMA models (see Table 3). This raises concerns that the results found in the negative binomial model may be unduly influenced by the increase in reported assaults observed in the control site.

Negative binomial models examining the effects within each of the four time-periods are presented in Table 4. The strongest reduction effect in Newcastle was observed between 12 and 5:59 a.m., with a relative reduction associated with the intervention in this period of 57% (IRR = 0.43, 95% CI = 0.30–0.61), suggesting that reported late-night domestic violence assaults were more than halved. In Hamilton, reductions in family and domestic violence assaults were observed during all four time-periods, with reductions ranging from 42 to 51%. However, as the results of the main model were not robust throughout the ARIMA models we interpret these results with caution.

Negative binomial models examining the effects among the different types of family and domestic violence are presented in Table 5. The quality of the relationship data collected prior to 2002 was poor (e-mail from S. Ramsey (stephanie.ramsey@justice.nsw.gov.au in April 2022); therefore, we dropped these observations and used a reduced sample of 209 observations on these models. In Newcastle, reductions in assaults associated with the intervention were found for both intimate partner violence (23% reduction IRR = 0.77, 95% CI = 0.63–0.93) and all other types of domestic relationship between the

TABLE 1 Family and domestic violence assaults January 2001–December 2019.

	Site	n observations	Mean	Min	0.25	0.75	Max
Pre-intervention	Newcastle	87	6	2	4	7	15
Postintervention	Newcastle	141	4	0	3	6	19
Pre-intervention	Hamilton	115	6	1	4	8.5	15
Postintervention	Hamilton	113	5	0	4	7	12
19-year average							
	Site	n observations	Median	Min	0.25	0.75	Max
All family and domestic violence assaults at site	Newcastle	228	5	0	3	7	19
	Wollongong	228	13	4	10	16	30
	Hamilton	228	6	0	4	8	15
	Maitland	228	12	2	9	17	31
Time of day							
12–5:59 a.m.	Newcastle	228	1	0	0	2	4
	Wollongong	228	2	0	1	3	7
	Hamilton	228	1	0	0	2	6
	Maitland	228	1	0	0	3	6
6–11:59 p.m.	Newcastle	228	1	0	0	2	6
	Wollongong	228	3	0	2	4	13
	Hamilton	228	1	0	0	2	6
	Maitland	228	2	0	1	4	8
12–5:59 p.m.	Newcastle	228	1	0	0	2	8
	Wollongong	228	4	0	3	5	11
	Hamilton	228	1	0	0	2	6
	Maitland	228	3.5	0	2	5	14
6–11:59 p.m.	Newcastle	228	2	0	1	3	10
	Wollongong	228	4	0	3	6	14
	Hamilton	228	2	0	1	3	10
	Maitland	228	5	0	3	6	14
Relationship							
Relationship: intimate partner	Newcastle	209*	4	0	2	5	13
	Wollongong	209*	9	1	7	12	22
	Hamilton	209*	4	0	3	5	13
	Maitland	209*	8	1	5	11	20
Relationship: family and other	Newcastle	209*	1	0	0	2	6
	Wollongong	209*	4	0	3	6	13
	Hamilton	209*	1	0	1	3	7
	Maitland	209*	5	0	3	7	15
Relationship: unknown	Newcastle	209*	0	0	0	0	1
	Wollongong	209*	0	0	0	0	1
	Hamilton	209*	0	0	0	0	1
	Maitland	209*	0	0	0	0	1

Abbreviations: Max, maximum; Min, minimum.
*P < 0.05.

perpetrators and the victims (44% reduction IRR = 0.56, 95% CI = 042–0.74), with the larger reduction observed in the 'all other' group (Table 5). This pattern is reproduced in Hamilton with the reduction in intimate partner violence (42% reduction IRR = 0.58, 95% CI = 0.48–0.70) eclipsed by the reduction in the 'all other' group (53% reduction IRR = 0.47, 95% CI = 0.36–0.60).

TABLE 2 Family and domestic violence in Newcastle.

Predictors	Negative binomial			Controlled ARIMA			Univariable ARIMA		
	IRR	CI	P-value	Estimates	CI	P-value	Estimates	CI	P-value
(intercept)	11.69***	(10.15, 13.45)	< 0.001	4.86***	(3.58, 6.14)	<0.001	6.05***	(5.36, 6.74)	< 0.001
Intervention	1.03	(0.88, 1.21)	0.711	−1.43**	(−2.35, −0.52)	0.002	−1.32**	(−2.19, −0.44)	0.003
Intervention × site (Newcastle)	0.71***	(0.60, 0.83)	< 0.001						
Site (Newcastle)	0.48***	(0.43, 0.54)	< 0.001						
Month of the year	1.01	(1.00, 1.02)	0.271						
Time elapsed since start of the study	1.00	(1.00, 1.00)	0.452						
Time elapsed since the intervention	1.00	(1.00, 1.00)	0.744						
ar1							0.15[a]	(0.02, 0.28)	0.023
ma1				0.12	(−0.01, 0.25)	0.073			
ma2				0.11	(−0.01, 0.24)	0.082			
intercept									
Control site (Wollongong)				0.09[a]	(0.01, 0.18)	0.029			
Observations	456			228			228		
R^2 Nagelkerke	0.826			0.098			0.070		

Abbreviations: ARIMA, autoregressive integrated moving average; ar1, autoregression parameter 1; CI, confidence interval; IRR, incidence rate ratios; ma1, moving average parameter 1; ma2, moving average parameter 2.
[a]Observations from 2002 onwards.
**$P < 0.01$; ***$P < 0.001$.

TABLE 3 Family and domestic violence in Hamilton.

Predictors	Negative binomial			Contorlled ARIMA			Univariate ARIMA		
	IRR	CI	P-value	Estimates	CI	P-value	Estimates	CI	P-value
(Intercept)	9.87***	(8.60, 11.31)	< 0.001	5.97***	(4.67, 7.26)	< 0.001			
Intervention	1.28**	(1.09, 1.50)	0.003	−0.95	(−2.53, 0.62)	0.236			
Intervention × site (Hamilton)	0.54***	(0.46, 0.63)	< 0.001*						
Site (Hamilton)	0.62***	(0.55, 0.69)	< 0.001						
Month of the year	1.00	(0.99, 1.01)	0.564						
Time elapsed since start of the study	1.00	(1.00, 1.00)	0.335						
Time elapsed since the intervention	1.00	(1.00, 1.00)	0.268						
ar1				−0.11	(−0.28, 0.07)	0.227	−0.99***	(−1.02, −0.96)	< 0.001
ar2				0.87***	(0.70, 1.04)	< 0.001			
ma1				0.18	(−0.04, 0.40)	0.114	0.05	(−0.04, 0.14)	0.263
ma2				−0.72***	(−0.93, −0.50)	< 0.001	−0.84***	(−0.93, −0.75)	< 0.001
Control site (Maitland)				0.03	(−0.04, 0.11)	0.400			
Observations	456			228			227		
R^2 Nagelkerke	0.772			0.138			0.132		

Abbreviations: ARIMA, autoregressive integrated moving average; ar1, autoregression parameter 1; ar2, autoregression parameter 2; CI, confidence interval; IRR, incidence rate ratios; ma1, moving average parameter 1; ma2, moving average parameter 2.
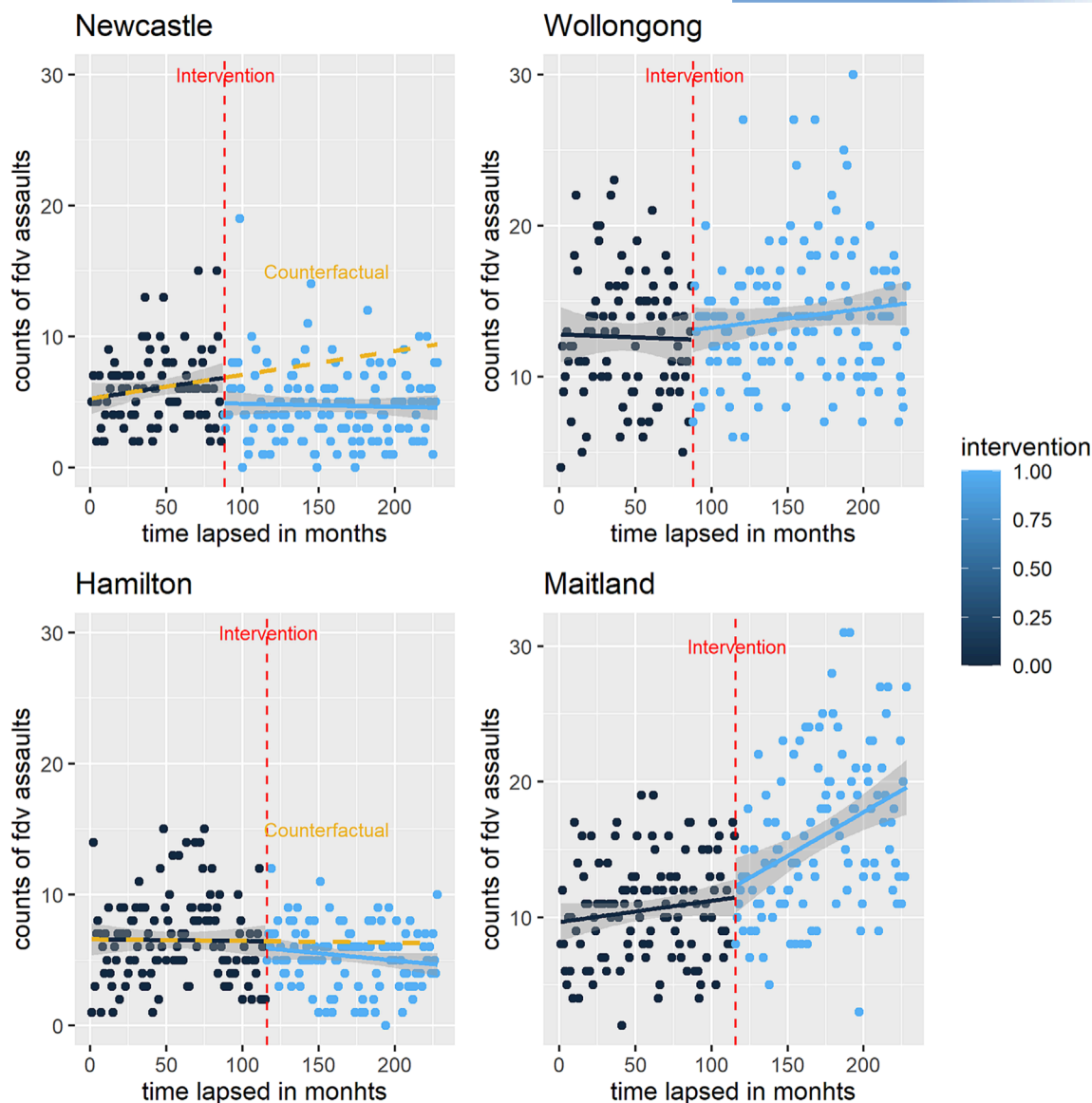*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

FIGURE 1   Effects of restricted late-night access to licensed venues and reduced trading hours on family and domestic violence.

In all, we estimate that 1.45 reported family and domestic violence assaults were prevented per month in Newcastle since the implementation of the intervention [(6.06 × 1.02*)−4.73 = 1.45], or 204 assaults (1.45 monthly reduction × 141 months postintervention) for the total duration of the study.

DISCUSSION

The introduction of restrictive policies that modified the late-night drinking environment and restricted trading hours of licensed

premises in Newcastle was associated with a reduction in family and domestic violence assaults. We estimate that the intervention prevented a total of 204 reported family and domestic violence assaults during the span of 11.75 years. This represents an overall reduction of 29% of family and domestic violence assaults, with a 57% reduction at night and a 44% reduction in family and (non-intimate partner) domestic violence. We further found a reduction of 44% of family and domestic violence assaults in Hamilton following the introduction of policies that modified the late-night drinking environment. However, the Hamilton result was not supported across all three of the main models, suggesting that these measures were not as impactful as restricting trading hours. Our results mirror previous findings of the studies of non-domestic violence in Newcastle and Hamilton [25, 26]. In essence, we found that domestic violence was affected by the same intervention (restricted trading hours [26]) that affected non-domestic violence at the same site in the same way. More research is needed to

---

*To calculate the rate of increase, we ran a negative binomial regression model on family and domestic violence assaults in Wollongong, controlling for time elapsed since the start of the study and the month of the year. We found a non-significant increase of 1.02 in the rate of monthly family and domestic violence assaults in Wollongong (see Table 6: rate of increase of family and domestic violence assaults in Wollongong).

TABLE 4 Temporal changes in Newcastle and Hamilton.

Predictors	Newcastle late-night			Newcastle morning			Newcastle day			Newcastle night		
	IRR	CI	P-value	IRR	CI	P-value	IRR	CI	P-value	IRR	CI	P-value
(intercept)	1.29	(0.90, 1.83)	0.154	2.75***	(2.06, 3.64)	< 0.001	3.95***	(3.17, 4.88)	< 0.001	3.82***	(3.03, 4.82)	< 0.001
Intervention	1.05	(0.73, 1.54)	0.779	1.01	(0.73, 1.39)	0.972	1.28*	(1.00, 1.64)	0.049	0.89	(0.69, 1.15)	0.366
Intervention × site (Newcastle)	0.43***	(0.30, 0.61)	< 0.001	0.73	(0.52, 1.02)	0.068	0.75*	(0.57, 0.97)	0.031	0.84	(0.65, 1.08)	0.169
Site (Newcastle)	0.82	(0.62, 1.09)	0.171	0.40***	(0.31, 0.52)	< 0.001	0.38***	(0.31, 0.47)	< 0.001	0.49***	(0.40, 0.60)	< 0.001
Intervention × site (Hamilton)												
Site (Hamilton)												
Month of the year	0.99	(0.97, 1.01)	0.385	1.01	(0.98, 1.03)	0.634	1.01	(0.99, 1.02)	0.422	1.02	(1.00, 1.03)	0.088
Time elapsed since start of the study	1.00	(1.00, 1.01)	0.081	1.00	(0.99, 1.00)	0.843	1.00	(0.99, 1.00)	0.205	1.00	(1.00, 1.01)	0.281
Time elapsed since the intervention	1.00	(0.99, 1.00)	0.269	1.00	(1.00, 1.01)	0.586	1.00	(1.00, 1.01)	0.234	1.00	(0.99, 1.00)	0.376
Observations	456			456			456			456		
R² Nagelkerke	0.244			0.440			0.635			0.419		

Abbreviations: CI, confidence interval; IRR, incidence rate ratios.
*P < 0.05;
**P < 0.01;
***P < 0.001.

TABLE 4 (Continued)

Predictors	Hamilton late-night			Hamilton morning			Hamilton day			Hamilton night		
	IRR	CI	P-value	IRR	CI	P-value	IRR	CI	P-value	IRR	CI	P-value
(intercept)	0.99	(0.70, 1.40)	0.966	2.25***	(1.73, 2.90)	< 0.001	2.66***	(2.08, 3.39)	< 0.001	3.99***	(3.24, 4.90)	< 0.001
Intervention	1.13	(0.75, 1.69)	0.563	1.25	(0.91, 1.71)	0.169	1.21	(0.92, 1.60)	0.177	1.39**	(1.09, 1.77)	0.008
Intervention × site (Newcastle)												
Site (Newcastle)												
Intervention × site (Hamilton)	0.49***	(0.33, 0.71)	< 0.001	0.58***	(0.43, 0.79)	0.001	0.51***	(0.38, 0.67)	< 0.001	0.56***	(0.44, 0.70)	< 0.001
Site (Hamilton)	0.90	(0.69, 1.17)	0.424	0.58***	(0.46, 0.72)	< 0.001	0.56***	(0.46, 0.69)	< 0.001	0.60***	(0.50, 0.70)	< 0.001
Month of the year	1.02	(0.99, 1.05)	0.139	1.00	(0.98, 1.02)	0.749	1.00	(0.98, 1.02)	0.822	1.00	(0.99, 1.02)	0.805
Time elapsed since start of the study	1.00	(1.00, 1.01)	0.470	1.00	(1.00, 1.00)	0.450	1.00	(1.00, 1.01)	0.069	1.00	(1.00, 1.00)	0.866
Time elapsed since the intervention	1.00	(1.00, 1.01)	0.465	1.01**	(1.00, 1.01)	0.006	1.00	(1.00, 1.00)	0.666	1.00	(1.00, 1.00)	0.830
Observations	456			456			456			456		
R² Nagelkerke	0.139			0.384			0.481			0.488		

Abbreviations: CI, confidence interval; IRR, incidence rate ratios.
*P < 0.05; **P < 0.01; ***P < 0.001.

TABLE 5 Relationship effects in Newcastle and Hamilton.

Predictors	Newcastle intimate partner			Newcastle family and other			Hamilton intimate partner			Hamilton family and other		
	IRR	CI	P-value	IRR	CI	P-value	IRR	CI	P-value	IRR	CI	P-value
(intercept)	9.90***	(8.26, 11.84)	< 0.001	3.83***	(2.93, 4.97)	< 0.001	7.82***	(6.56, 9.31)	< 0.001	3.28***	(2.62, 4.10)	< 0.001
Intervention	1.19	(0.98, 1.46)	0.079	0.94	(0.71, 1.25)	0.672	1.30*	(1.06, 1.59)	0.012	1.39**	(1.09, 1.77)	0.008
Intervention × site (Newcastle)	0.77**	(0.63, 0.93)	0.008	0.56***	(0.42, 0.74)	< 0.001						
Site (Newcastle)	0.47***	(0.40, 0.55)	< 0.001	0.52***	(0.41, 0.65)	< 0.001						
Intervention × site (Hamilton)							0.58***	(0.48, 0.70)	< 0.001	0.47***	(0.36, 0.60)	< 0.001
Site (Hamilton)							0.68***	(0.59, 0.78)	< 0.001	0.52***	(0.43, 0.63)	< 0.001
Month of the year	1.01	(0.99, 1.02)	0.259	0.99	(0.97, 1.01)	0.299	1.00	(0.98, 1.01)	0.723	1.01	(0.99, 1.02)	0.384
Time elapsed since the start of the study	1.00	(0.99, 1.00)	0.116	1.00	(0.99, 1.01)	0.902	1.00	(1.00, 1.00)	0.218	1.00	(1.00, 1.00)	0.492
Time elapsed since the intervention	1.00	(1.00, 1.01)	0.308	1.00	(1.00, 1.01)	0.259	1.00	(1.00, 1.01)	0.054	1.00	(1.00, 1.01)	0.228
Observations	418			418			418			418		
R^2 Nagelkerke	0.721			0.591			0.548			0.729		

Abbreviations: CI, confidence interval; IRR, incidence rate ratios.
*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

test whether similar interventions that were introduced in other entertainment precincts were also associated with similar reductions in reported family and domestic violence. Our results, and previous research [6, 32–38], indicate that there is scope to consider family and domestic violence alongside non-domestic violence in the planning for night-time regulations and night-time economies. Evaluations of interventions designed to reduce violence in the night-time economy and alcohol-related violence should include measures of both domestic and non-domestic violence. There is also a need to extend research efforts to evaluate the effects of interventions such as these on reported sexual assault violence. Reported rates of sexual assault violence have increased by more than 30% in Australia since 2010 [14]. It is estimated that alcohol or other drugs contribute to half of all sexual assaults with either the offender or the victim or both affected [14].

This study has four limitations: first, we used non-equivalent control sites in our study. As the sites have slightly different demographics, they are approximate rather than perfect matches. Therefore, we used the control sites as controls for trends, alongside pre–post-tests of the intervention within each treatment site. While we have confidence in the CBD of Wollongong as an appropriate control for the CBD of Newcastle, the city of Maitland may be a less adequate control for the suburb of Hamilton. Although both control sites reflect the state-wide increase in reported family and domestic violence incidences during the study period [51, 52], assaults rose in Maitland at a greater rate when compared to Wollongong (1.66 versus 1.02). The use of Maitland as a control may be skewing the results of the Hamilton models. Therefore, those results should be interpreted with caution. Secondly, our time-series analyses examining the effects of the interventions on the different types of family and domestic violence used 209 observations (instead of 228). As we had multiple years of observations, these models are still sufficiently powered. Thirdly, our study was limited to highly localized catchment areas that were also home to entertainment precincts. We know that many of the patrons of these entertainment precincts did not live in these catchment areas. As such, the studied interventions may have had broader effects on reported rates of family and domestic violence in the greater Newcastle area that were not measured here. More research is needed to study whether interventions such as these can affect reported rates of family and domestic violence assaults in areas that extend beyond entertainment precincts. Finally, we did not model the effects of other policies or strategies that were introduced to affect domestic violence during the study period [53]. For example, regional domestic violence coordinators in region command offices, Safer Pathway and Staying Home Leaving Violence Services were all introduced in Newcastle and Wollongong [53]. However, as these strategies affected both the treatment site and its matched control site, their effects are unlikely to diminish the explanatory power of this study.

In conclusion, this study indicates that more research is warranted on the effects of interventions that modify late-night drinking environments and restrict trading hours on family and domestic violence. Our research, together with the growing body of research on the relationship between alcohol policy and domestic violence, demonstrates that family and domestic violence are potentially affected by these policies and these effects should be rigorously evaluated even when they are not the

TABLE 6 Rate of increase in Wollongong.

Predictors	Negative binomial		
	IRR	CI	*P*-value
(Intercept)	11.73*	(10.46, 13.14)	< 0.001
Intervention	1.02	(0.87, 1.20)	0.774
Time elapsed since start of the study	1.00	(1.00, 1.00)	0.255
Month of the year	1.01	(0.99, 1.02)	0.272
Observations	228		
R^2 Nagelkerke	0.053		

Abbreviations: CI, confidence interval; IRR, incidence rate ratios.
*$P < 0.001$.

primary focus of intervention. Policymakers, researchers, industry and the community at large would do well to recognize that alcohol policies can have overlooked effects—in this case, interventions in the night-time economy can affect rates of family and domestic violence.

AUTHOR CONTRIBUTIONS

Michala Kowalski: Conceptualization (equal); data curation (equal); formal analysis (equal); funding acquisition (equal); investigation (equal); methodology (equal); project administration (equal); resources (equal); software (equal); visualization (equal); writing—original draft (equal); writing—review and editing (equal). **Michael Livingston:** Conceptualization (equal); formal analysis (equal); methodology (equal); supervision (equal); writing—review and editing (equal). **Claire Wilkinson:** Conceptualization (equal); supervision (equal); writing—review and editing (equal). **Alison Ritter:** Conceptualization (equal); project administration (equal); resources (equal); supervision (equal); writing - review and editing (equal).

DECLARATION OF INTERESTS

None to declare.

PRE-REGISTRATION

https://doi.org/10.17605/OSF.IO/7MYAE.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from BOCSAR. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from BOCSAR upon request as per BOCSAR's guidelines to access unit record criminal incident data.

ORCID

Michala Kowalski https://orcid.org/0000-0002-3175-808X
Michael Livingston https://orcid.org/0000-0002-8995-9386
Claire Wilkinson https://orcid.org/0000-0002-4815-5840
Alison Ritter https://orcid.org/0000-0001-9540-1920

REFERENCES

1. Cafferky BM, Mendez M, Anderson JR, Stith SM. Substance use and intimate partner violence: a meta-analytic review. Psychol Violence. 2018;8:110–31.
2. Green J, Plant MA. Bad bars: a review of risk factors. J Subst Abuse. 2007;12:157–89.
3. Miller P, Wells S, Hobbs R, Zinkiewicz L, Curtis A, Graham K. Alcohol, masculinity, honour and male barroom aggression in an Australian sample. Drug Alcohol Rev. 2014;33:136–43.
4. Menéndez P, Tusell F, Weatherburn D. The effects of liquor licensing restriction on alcohol-related violence in NSW, 2008–13. Addiction. 2015;110:1574–82.
5. Kajeepeta S, Theall KP, Kondo MC, Branas CC, Wallace ME, Jacoby SF, et al. The association between blighted property remediation and domestic crime by alcohol availability. Health Place. 2020;64:102364.
6. Livingston M. A longitudinal analysis of alcohol outlet density and domestic violence. Addiction. 2011;106:919–25.
7. Morrison C, Mair CF, Lee JP, Gruenewald PJ. Are barroom and neighborhood characteristics independently related to local-area assaults? Alcohol Clin Exp. Res. 2015;39:2463–70.
8. de Andrade D, Homel R, Mazerolle L. Boozy nights and violent fights: perceptions of environmental cues to violence and crime in licensed venues. J Interpers Violence. 2019;34:1820–42.
9. Snowden AJ. Alcohol availability and violence: a closer look at space and time. Int Regional Sci Rev. 2018;41:657–78.
10. Moore SC, O'Brien C, Alam MF, Cohen D, Hood K, Huang C, et al. All-Wales licensed premises intervention (AWLPI): a randomised controlled trial to reduce alcohol-related violence. BMC Public Health. 2014;14:21.
11. Hadfield P. Bar Wars: Contesting the Night in Contemporary British Cities Oxford, UK: Oxford University Press; 2009.
12. Rossow I. Alcohol-related violence: the impact of drinking pattern and drinking context. Addiction. 1996;91:1651–61.
13. Wilson IM, Graham K, Taft A. Alcohol interventions, alcohol policy and intimate partner violence: a systematic review. BMC Public Health. 2014;14:881.
14. Australian Institute of Health and Welfare (AIHW). Family, Domestic and Sexual Violence Data in Australia Canberra, Australia: AIHW Australian Government; 2022.

15. Callinan I. Review of Amendments to the Liquor Act 2007 (NSW). Reviews under clause 47 to Schedule 1 of the Liquor Act, clause 5O of the Liquor Regulation 2008, and at the request of the Executive Government. Brisbane, Australia: 2016; 13.09.2016.

16. Horton J. Review of liquor licence conditions in the Newcastle Central Business District and surrounging areas New South Wales, Australia: Independent Liquor and Gaming Authority; 2018.

17. Babor TF, Caetano R, Casswell S, Edwards G, Giesbrecht N, Graham K, et al. Alcohol: No Ordinary Commodity: Research and Public Policy Oxford, UK: Oxford University Press; 2010.

18. Armati DB. *Decision: S104 conference Newcastle*. Sydney, NSW: Liquor Administration Board; 2008.

19. Sidoti C. *Final Decision on Applications for Review under section 153 of the Liquor Act 2007 Disturbance Complaint regarding numerous licensed premises in Hamilton, NSW*. C.L.a.G.C.A. NSW; 2010.

20. Liquor Amendment Act 2014 (NSW).

21. Wilkinson C, Livingston M, Room R. Impacts of changes to trading hours of liquor licences on alcohol-related harm: a systematic review 2005–2015. Public Health Res Pract. 2016;26:1644.

22. Nepal S, Kypri K, Pursey K, Attia J, Chikritzhs T, Miller P. Effectiveness of lockouts in reducing alcohol-related harm: systematic review. Drug Alcohol Rev. 2018;37:527–36.

23. Nepal S, Kypri K, Tekelab T, Hodder RK, Attia J, Bagade T, et al. Effects of extensions and restrictions in alcohol trading hours on the incidence of assault and unintentional injury: systematic review. J Stud Alcohol Drugs. 2020;81:5–23.

24. Kypri K, Livingston M. Incidence of assault in Sydney, Australia, throughout 5 years of alcohol trading hour restrictions: controlled before-and-after study. Addiction. 2020;115:2045–54.

25. Kypri K, Jones C, McElduff P, Barker D. Effects of restricting pub closing times on night-time assaults in an Australian city. Addiction. 2011;106:303–10.

26. Kypri K, McElduff P, Miller P. Restrictions in pub closing times and lockouts in Newcastle, Australia five years on. Drug Alcohol Rev. 2014;33:323–6.

27. Kypri K, McElduff P, Miller P. Night-time assaults in Newcastle 6–7 years after trading hour restrictions. Drug Alcohol Rev. 2016;35: E1–2.

28. Athanasopoulos G, Sarafidis V, Weatherburn D, Miller R. Longer-term impacts of trading restrictions on alcohol-related violence: insights from New South Wales, Australia. Addiction. 2022;117: 1304–11.

29. Markowitz S, Grossman M. Alcohol REGULATION and domestic violence towards children. Contemp Econ Policy. 1998;16:309–20.

30. World Health Organization (WHO), Medicine LSoHaT. Preventing intimate partner and sexual violence against women: taking action and generating evidence Geneva, Switzerland: WHO; 2010.

31. Holder H. Alcohol and violence: a complex nexus of drinking environment and drinking pattern. Addiction. 2008;103:78–9.

32. Douglas M. Restriction of the hours of sale of alcohol in a small community: a beneficial impact. Aust NZ J Public Health. 1998;22: 714–19.

33. Wang JJ, Fung T, Poynton S. Takeaway Alcohol Sales and Violent Crime: the Implications of Extended Trading Hours NSW, Australia: NSW Bureau of Crime Statistics and Research; 2022.

34. Sun W, Jian L, Xiao J, Akesson G, Somerford P. The impact of alcohol restriction on hospital and emergency department service utilizations in two remote towns in the Kimberley region of Western Australia. Front Public Health. 2019;7:17.

35. Livingston M. The ecology of domestic violence—the role of alcohol outlet density. Geospat Health. 2010;5:139–49.

36. Kilmer B, Nicosia N, Heaton P, Midgette G. Efficacy of frequent monitoring with swift, certain, and modest sanctions for violations: insights from South Dakota's 24/7 sobriety project. Am J Public Health. 2013;103:e37–43.

37. Ngo QN, Eisman AB, Walton MA, Kusunoki Y, Chermack ST, Singh V, et al. Emergency department alcohol intervention: effects on dating violence and depression. Pediatrics. 2018;142:e20173525.

38. Cunradi CB, Mair C, Ponicki W, Remer L. Alcohol outlet density and intimate partner violence-related emergency department visits. Alcohol Clin Exp Res. 2012;36:847–53.

39. Duff C, Moore D. Going out, getting about: atmospheres of mobility in Melbourne's night-time economy. Soc Cult Geogr. 2015;16: 299–314.

40. MacLean S, Ferris J, Livingston M. Drinking patterns and attitudes for young people in inner-urban Melbourne and outer-urban growth areas: differences and similarities. Urban Policy Res. 2013;31: 417–34.

41. Berniell I, Facchini G. COVID-19 lockdown and domestic violence: evidence from internet-search behavior in 11 countries. Eur Econ Rev. 2021;136:103775. https://doi.org/10.1016/j.euroecorev.2021.103775

42. Deloitte. Play Deloitte: NSW C; 2019.

43. Finlay I, Gilmore I. Covid-19 and alcohol—a dangerous cocktail. BMJ. 2020;369:m1987.

44. Aizer A. The gender wage gap and domestic violence. Am Econ Rev. 2010;100:1847–59.

45. Anderberg D, Rainer H, Wadsworth J, Wilson T. Unemployment and domestic violence: theory and evidence. Econ J. 2015;126:1947–79.

46. Kowalski M. Exploring possible unintended effects of late-night restrictions on licensed venues on family and domestic violence. OSF 2021. https://doi.org/10.1002/add.16192

47. Planning and Regulatory. *CCL 23/01/18 - Review of Newcastle CBD Liquor Licence Conditions*. City of Newcastle, NSW: 2018.

48. Legal and Constitutional Affairs References Committee. *Need for a nationally-consistent approach to alcohol-fuelled violence: The City of Newcastle Submission*. Canberra, ACT: Commonwealth of Australia; 2016.

49. Sanchez-Ramirez DC, Voaklander D. The impact of policies regulating alcohol trading hours and days on specific alcohol-related harms: a systematic review. Inj Prev. 2018;24:94–100.

50. R Core Team. R: A Language and Environment for Statistical Computing 4.2.1 ed. Vienna, Austria: R Foundation for Statistical Computing; 2022.

51. Freeman K. Has the rate of domestic and family violence changed in NSW? Victim survey results from July 2008 to June 2020 NSW, Australia: NSW Bureau of Crime Statistics and Research; 2022.

52. Grech K, Burgess M. Trends and Patterns in Domestic Violence Assaults: 2001 to 2010 Sydney, Australia: NSW Bureau of Crime Statistics and Research; 2011.

53. NSW Police Force. Code of Practice for the NSW Police Force Response to Domestic and Family Violence. Operational Programs; 2018 1/06/2018. Contract no.: D/2018/32771.

SUPPORTING INFORMATION

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

How to cite this article: Kowalski M, Livingston M, Wilkinson C, Ritter A. An overlooked effect: domestic violence and alcohol policies in the night-time economy. Addiction. 2023;118(8):1471–81. https://doi.org/10.1111/add.16192