ALCOHOL

Policies for alcohol restriction and their association with interpersonal violence: a time-series analysis of homicides in Cali, Colombia

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Background Cali, Colombia, has a high incidence of interpersonal violence deaths. Various alcohol control policies have been implemented to reduce alcohol-related problems. The objective of this study was to determine whether different alcohol control policies were associated with changes in the incidence rate of homicides.

Methods Ecologic study conducted during 2004–08 using a time-series design. Policies were implemented with variations in hours of restriction of sales and consumption of alcohol. Most restrictive policies prohibited alcohol between 2 a.m. and 10 a.m. for 446 non-consecutive days. Moderately restrictive policies prohibited alcohol between 3 a.m. and 10 a.m. for 1277 non-consecutive days. Lax policies prohibited alcohol between 4 a.m. and 10 a.m. for 104 non-consecutive days. In conditional autoregressive negative binomial regressions, rates of homicides and unintentional injury deaths (excluding traffic events) were compared between different periods of days when different policies were in effect.

Results There was an increased risk of homicides in periods when the moderately restrictive policies were in effect compared with periods when the most restrictive policies were in effect [incidence rate ratio (IRR) 1.15, 90% confidence interval (CI) 1.05–1.26, $P = 0.012$], and there was an even higher risk of homicides in periods when the lax policies were in effect compared with periods when the most restrictive policies were in effect (IRR 1.42, 90% CI 1.26–1.61, $P < 0.001$). Less restrictive policies were not associated with increased risk of unintentional injury deaths.

Conclusion Extended hours of sales and consumption of alcohol were associated with increased risk of homicides. Strong restrictions on

alcohol availability could reduce the incidence of interpersonal violence events in communities where homicides are high.

Introduction

Colombia has higher homicide rates compared with other countries.[1] In 2008, Colombia's homicide rate was 34 cases per 100 000 population, the lowest in 10 years. However, homicides remain a public health problem, with the majority of interpersonal violence deaths concentrated in the largest cities.[2–4]

Cali is Colombia's third largest city. During 1983–92, homicide rates increased from 23 to 92 cases per 100 000 population and became the leading cause of death. In 1993, a fatal injury surveillance system was developed.[5,6] The system was maintained and expanded under the name 'Crime Observatories'.[7,8] This multi-institutional effort has shown some benefits.[4,9] However, Cali has continued reporting high homicide rates, reaching 67 cases per 100 000 population in 2008. This was the highest among Colombia's largest cities.[2]

Alcohol is a contributory cause for intentional injuries and its consumption has been associated with increased risk of violent deaths.[10–13] In Cali, alcohol consumption has been associated with increased numbers of homicides.[5] As a result, policies aimed at curbing violence were implemented to restrict sales and consumption of alcohol in public places after certain hours.[9] Restricting alcohol-trading hours has been shown to lead to fewer alcohol-related problems in other settings.[14,15]

In Cali, variations of homicide rates associated with these policies have not been objectively evaluated. Cali's socio-economic, political and cultural conditions precluded maintaining these policies over time. In addition, alcohol restrictions have been publicly criticized by bar owners, arguing that restrictions would increase unemployment. This has fuelled ongoing debates about the benefits of policies that restrict hours of alcohol availability. The objective of this study was to determine whether these alcohol control policies were associated with changes in the incidence rate of interpersonal violence deaths in Cali, Colombia.

Methods

Study design and settings

This ecologic study focused on the entire population of Cali, Colombia, between 1 January 2004 and 31 December 2008. During these 1827 days, policies that restricted alcohol sales and consumption were continuously in effect, but with variations in hours of restrictions. These variations were applied intermittently during non-consecutive periods of days. Therefore, a time-series design was used to compare periods under different policies. Aggregated daily counts of interpersonal violence deaths were obtained from a fatal injury surveillance system. Aggregated daily counts of unintentional injury deaths were obtained as a control event to assess any policies' association with non-violent injury deaths. Mortality rates were computed using population estimates to adjudicate person-years of exposure. Conditional autoregressive negative binomial regressions were built to compare mortality rates between periods of days with different policies.

Study data

The Cali Crime Observatory's fatal injury surveillance system collects demographic and injury-related information of all deaths from external causes (homicides, suicides, traffic deaths and unintentional injury deaths). It is coordinated by the Mayor's office and composed of diverse governmental entities.[7] We requested de-identified information that includes age and sex of the victim, intent and mechanism of injury and place and date of injury. Information was analysed only when the injury that caused the death occurred in the urban and rural areas of Cali and between 1 January 2004 and 31 December 2008. Policies information was obtained from the Mayor's office and archives of public media announcements.

Alcohol control policies

Three policies prohibited alcohol sales and consumption from 2 a.m. to 10 a.m. during 446 non-consecutive days and were grouped into a most restrictive category. Four policies prohibited alcohol from 3 a.m. to 10 a.m. during 1277 non-consecutive days and were grouped into a moderately restrictive category. During the end of December through the beginning of January, alcohol was prohibited by special decrees (lax policies) from 4 a.m. to 10 a.m. during 104 non-consecutive days (Figure 1).

The policies were implemented through coordinated efforts from the mayor's office and law enforcement institutions. They intended to restrict the hours of sales and consumption of alcohol in public places including a total prohibition of sales to children
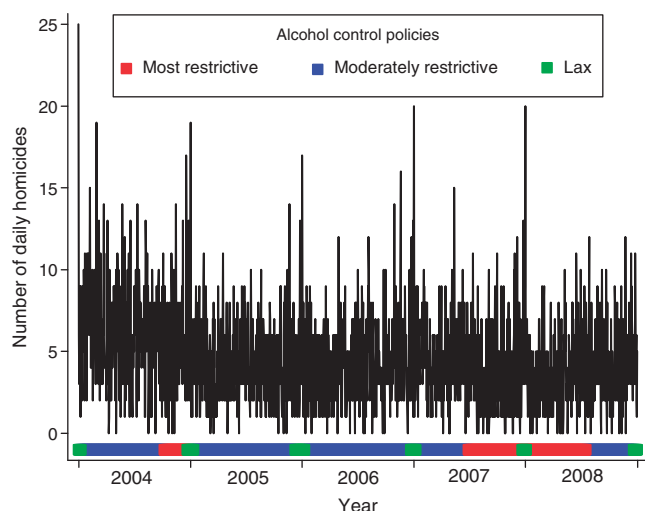
Figure 1 Time-series plot of alcohol control policies and aggregated daily counts of interpersonal violence deaths in Cali, Colombia, 2004–08. The most restrictive policies prohibited alcohol sales and consumption between 2 a.m. and 10 a.m. and were in effect during 446 non-consecutive days from 7 October to 20 December 2004; 28 June to 20 December 2007; and 4 January to 16 July 2008. The moderately restrictive policies prohibited alcohol consumption and sales between 3 a.m. and 10 a.m. and were in effect during 1277 non-consecutive days from 9 January to 6 October 2004; 11 January to 8 December 2005; 9 January to 21 December 2006; 8 January to 27 June 2007; and 17 July to 18 December 2008. The lax policies prohibited alcohol consumption and sales between 4 a.m. and 10 a.m. and were in effect during 104 non-consecutive days from 1 to 8 January 2004; 21 December 2004 to 10 January 2005; 9 December 2005 to 8 January 2006; 22 December 2006 to 7 January 2007; 21 December 2007 to 3 January 2008; and 19–31 December 2008. This figure appears in colour in the online version of the *IJE*

(<18 years of age). During the restriction hours, police officers enforced and established random checkpoints throughout the city; at their discretion, they were directed to fine and arrest individuals who were vending or consuming alcohol and to fine and close places where alcohol was sold. The public was notified about the policies through the media, making it unlikely that citizens were uninformed.

Outcome measures
The main outcomes were aggregated daily counts of interpersonal violence deaths (homicides) and aggregated daily counts of firearm and stab/knife homicides. The non-violent control outcome was aggregated daily counts of unintentional injury deaths. Interpersonal violence death (homicide) was defined as any intentional killing of a person by another regardless of the method. Unintentional injury death was defined as any death produced by external causes that was not deliberately self-inflicted or perpetrated by another person[16] and did not occur in a traffic event. Traffic-related deaths were not included because there were other prevention strategies during 2004–08 aimed at addressing such injuries.[17]

Statistical analyses
Aggregated daily counts of deaths were collapsed by 5-year age groups and sex. The population of Cali was 2 119 908 in 2005.[18] Mortality rates were computed using population estimates by age, sex and year to adjudicate person-years of exposure. The main analyses compared mortality rates during the moderately restrictive and lax policies with mortality rates during the most restrictive policies and compared mortality rates during the lax policies with mortality rates during the moderately restrictive policies.

Homicide rates are more common on weekends.[5,19] Days of the week were categorized into weekdays (Monday–Thursday) and weekends (Friday–Sunday). Alcohol consumption and alcohol-related death rates are increased during holidays.[20] In Colombia, official holidays are decreed by the government. An additional variable indicated the 90 official holidays during 2004–08.

Sporting events have been associated with excessive alcohol consumption and increased number of assaults and arrests.[21–23] Football is a major event in Colombia and commonly associated with late-night alcohol drinking following football matches. We identified the days when the two city's professional football teams and the national football team played national or international matches (327 days during 2004–08). An additional variable indicated the days following football matches.

In Colombia, mayors are elected to serve 4-year terms. The Cali mayor elected for 2004–07 was deposed after 1224 days. There was an interim administration for 14 days followed by a new one delegated by the Governor for 223 days. In 2007, a new mayor was elected for 2008–11. Dummy variables of these administrations were created as proxies for the socio-political context reflecting different government programmes that could affect mortality.

In order to evaluate the risk of death associated with different policies, we built conditional autoregressive negative binomial regressions.[24] These regressions account for the non-normality and over-dispersion of count data and use an autoregressive structure to account for temporal correlation. Some homicides could influence the probability of death in subsequent days (i.e. gang retaliation). Bayesian information criterions were used to select the order of the autoregression, whereas deviance residuals were used to assess the goodness-of-fit; we used lags of 7, 14 and 21 days.

We accounted for intra-year trends by including five marginal splines, we accounted for overall trends during 2004–08 by including two fractional polynomials, and we accounted for seasonality by including sine–cosine pairs with annual periodicity. This was

performed separately for homicides, firearm homicides, stab/knife homicides and unintentional injury deaths.

The homicide rate was higher during 2004 compared with 2005–08. This could be explained by factors not accounted in our analyses. Sensitivity analyses were performed using the 2005–08 period. Mortality rates comparisons between policies were repeated to evaluate the robustness of the associations.

Regressions were fitted using Stata (Version 11) software separately for homicides, firearm homicides, stab/knife homicides and unintentional injury deaths. Following the recommendations for the reporting and interpretation of statistical analyses,[25] results are presented as incidence rate ratios (IRRs) with 90% confidence intervals (CIs) and P-values.

Results

Interpersonal violence deaths

There were 8284 homicides (rate: 77.2 per 100 000 person-years). Firearm was the mechanism of injury in 85.8%; stab/knife was in 11.1%. Youths between 20 and 24 years had the highest homicide rates among age groups (175.5 per 100 000 person-years). Males had higher homicide rates than females (150.8 vs 9.7 per 100 000 person-years). These patterns were consistent among firearm and stab/knife homicides (Table 1).

Daily counts of homicides are depicted in Figure 1. Most of the homicides occurred on Sundays (median = 7/day). Wednesdays and Thursdays had the lowest median number (3/day). Homicide rates were higher during weekends than during weekdays (91.3 vs 66.7 per 100 000 person-years) and during holidays than during non-holidays (92.6 vs 76.4 per 100 000 person-years). Homicide rates during football days were higher than during non-football days (93.7 vs 73.6 per 100 000 person-years). Homicide rates were higher during the interim administration (88.9 per 100 000 person-years) (Table 1).

Policies' association with interpersonal violence deaths

We observed the lowest homicide rates during the most restrictive policies and the highest during the lax policies (65.2 and 97.5 per 100 000 person-years, respectively). Similar patterns were observed in firearm and stab/knife homicides (Figure 2).

Unadjusted comparisons indicated higher risk of homicides during the moderately restrictive (IRR 1.23, 90% CI 1.17–1.28, $P < 0.001$) and lax policies (IRR 1.50, 90% CI 1.38–1.62, $P < 0.001$) compared with the most restrictive policies. The risk of homicides was higher during the lax policies than during the moderately restrictive policies (IRR 1.22, 90% CI 1.14–1.31, $P < 0.001$). Similar patterns were observed among firearm and stab/knife homicides (Table 2).

Regression analyses

Conditional autoregressive negative binomial regressions were performed separately for all homicides, firearm homicides and stab/knife homicides and adjusted for age, sex, weekends, holidays, football days, days following football matches, administrations, autocorrelations, trends and seasonality.

For all homicides, the moderately restrictive (IRR 1.15, 90% CI 1.05–1.26, $P = 0.012$) and lax policies (IRR 1.42, 90% CI 1.26–1.61, $P < 0.001$) were associated with increased risk of homicides compared with the most restrictive policies. The lax policies (IRR 1.24, 90% CI 1.12–1.37, $P = 0.001$) were also associated with increased risk of homicides compared with the moderately restrictive policies (Table 2).

Similar patterns were observed in firearm homicides. The moderately restrictive (IRR 1.14, 90% CI 1.03–1.26, $P = 0.030$) and lax policies (IRR 1.36, 90% CI 1.20–1.55, $P < 0.001$) were associated with increased risk of firearm homicides compared with the most restrictive policies. The lax policies (IRR 1.20, 90% CI 1.07–1.34, $P = 0.007$) were also associated with increased risk of firearm homicides compared with the moderately restrictive policies (Table 2).

Policies' associations demonstrated greater magnitude with stab/knife homicides. The moderately restrictive (IRR 1.41, 90% CI 1.12–1.77, $P = 0.014$) and lax policies (IRR 2.30, 90% CI 1.72–3.10, $P < 0.001$) were associated with higher risk of stab/knife homicides compared with the most restrictive policies. The lax policies (IRR 1.64, 90% CI 1.28–2.09, $P = 0.001$) were also associated with higher risk of stab/knife homicides compared with the moderately restrictive policies (Table 2).

Sensitivity analyses

Unadjusted comparisons indicated that policies were associated with interpersonal violence death rates variations. Conditional autoregressive negative binomial regressions indicated that the moderately restrictive (IRR 1.33, 90% CI 1.18–1.21, $P < 0.001$) and lax policies (IRR 1.60, 90% CI 1.36–1.88, $P < 0.001$) were associated with increased risk of homicides compared with the most restrictive policies and the lax policies (IRR 1.20, 90% CI 1.03–1.40, $P = 0.021$) were associated with increased risk of homicides compared with the moderately restrictive policies. There were associations of greater magnitude with stab/knife homicides (Table 3).

Unintentional injury deaths

There were 668 unintentional injury deaths (rate: 6.2 per 100 000 person-years). The elderly (>79 years of age) had the highest mortality rates among age groups (43.4 per 100 000 person-years). Males had higher mortality rates than females (10.5 vs 2.3 per 100 000 person-years). Mortality rates were higher during weekends than during weekdays

Table 1 Numbers and crude incidence rates per 100 000 person-years of interpersonal violence deaths and unintentional injury deaths in Cali, Colombia, 2004–08

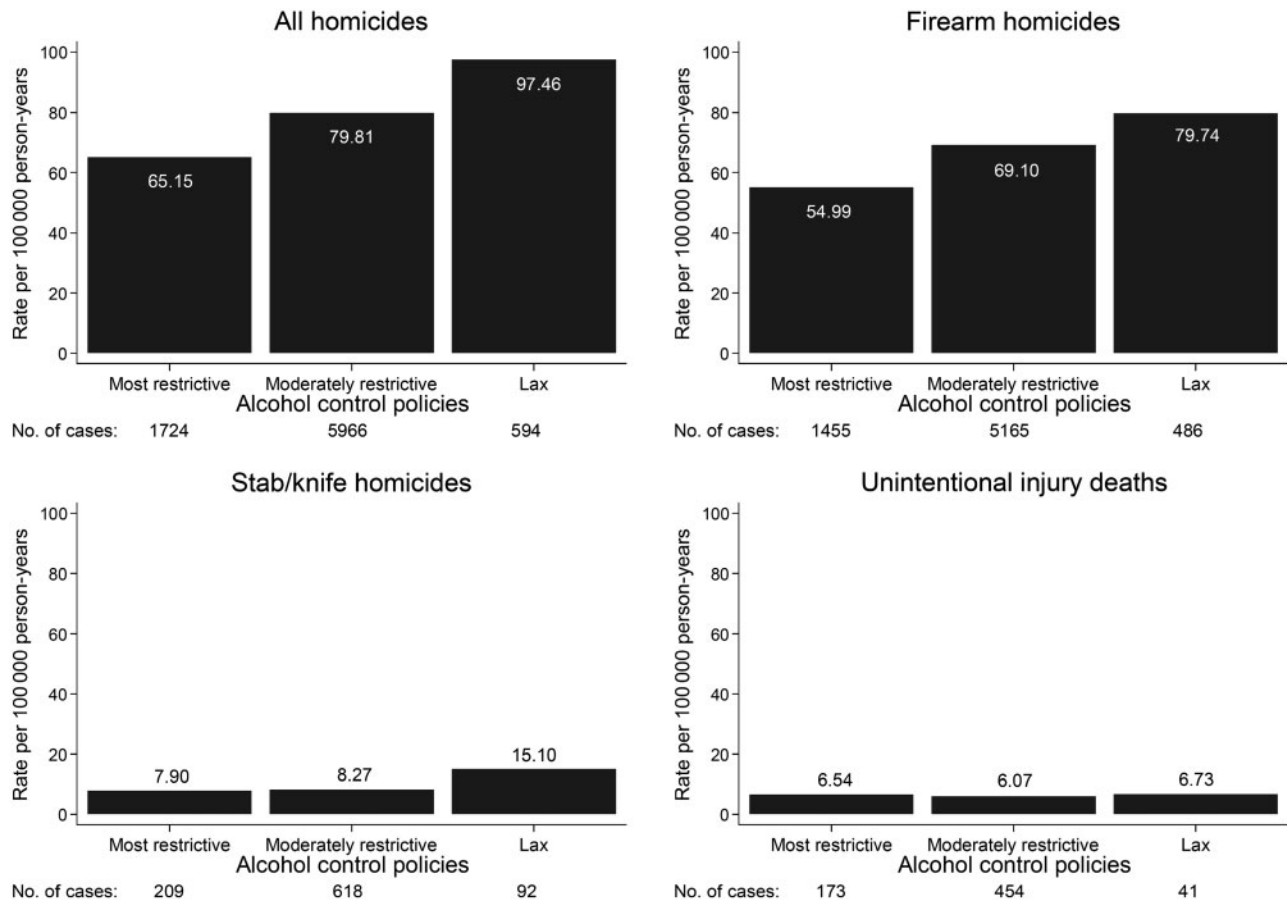|	Interpersonal violence deaths						Unintentional injury deaths	
	All homicides		Firearm homicides		Stab/knife homicides			
	Cases	Rate[a]	Cases	Rate[a]	Cases	Rate[a]	Cases	Rate[a]
Study period								
2004–08	8284	77.20	7106	66.22	919	8.56	668	6.23
Years								
2004	2165	103.04	1911	90.95	186	8.85	132	6.28
2005	1586	74.81	1356	63.97	185	8.73	131	6.18
2006	1547	72.12	1336	62.29	150	6.99	134	6.25
2007	1524	70.24	1290	59.45	197	9.08	133	6.13
2008	1462	66.62	1213	55.27	201	9.16	138	6.29
Age of the victim (in years)								
<5	26	2.93	12	1.35	4	0.45	53	5.97
5–9	23	2.44	17	1.80	1	0.11	25	2.65
10–14	113	11.43	94	9.51	15	1.52	11	1.11
15–19	1285	130.05	1127	114.06	140	14.17	49	4.96
20–24	1717	175.47	1523	155.65	163	16.66	48	4.91
25–29	1490	164.23	1300	143.29	145	15.98	39	4.30
30–34	1039	129.10	919	114.19	92	11.43	41	5.09
35–39	831	105.49	719	91.27	87	11.04	41	5.20
40–44	568	73.14	478	61.55	68	8.76	41	5.28
45–49	423	63.39	335	50.21	71	10.64	42	6.29
50–54	295	55.25	236	44.20	47	8.80	36	6.74
55–59	138	33.14	106	25.46	27	6.48	31	7.45
60–64	98	31.31	74	23.64	15	4.79	31	9.90
65–69	56	21.93	39	15.28	14	5.48	36	14.10
70–74	23	11.55	16	8.03	5	2.51	42	21.08
75–79	20	14.29	10	7.14	4	2.86	27	19.29
>79	14	9.79	5	3.50	3	2.10	62	43.37
Sex								
Female	540	9.65	419	7.49	74	1.32	127	2.27
Male	7743	150.84	6687	130.27	845	16.46	541	10.54
Day of the week								
Weekdays	4088	66.67	3537	57.68	413	6.74	344	5.61
Weekends	4196	91.25	3569	77.61	506	11.00	324	7.05
Holidays								
Non-holidays	7789	76.39	6700	65.71	835	8.19	624	6.12
Official holidays	495	92.64	406	75.98	84	15.72	44	8.23
Football match days								
Non-football days	6486	73.62	5593	63.48	685	7.77	542	6.15
Football days	1798	93.65	1513	78.80	234	12.19	126	6.56
Days following football matches								
Other days	6861	77.87	5904	67.01	744	8.44	549	6.23
Days following matches	1423	74.12	1202	62.61	175	9.11	119	6.20
Administrations								
First elected	5860	82.22	5077	71.24	593	8.32	454	6.37
Interim	74	88.92	60	72.09	13	15.62	5	6.01
Delegated	888	66.99	756	57.03	112	8.45	71	5.36
Last elected	1462	66.62	1213	55.27	201	9.16	138	6.29

[a]Rate per 100 000 person-years.

Figure 2 Numbers and crude incidence rates per 100 000 person-years of interpersonal violence and unintentional injury deaths during the periods of days when the alcohol control policies were in effect. Cali, Colombia, 2004–08. (The most restrictive policies prohibited alcohol consumption and sales between 2 a.m. and 10 a.m. The moderately restrictive policies prohibited alcohol consumption and sales between 3 a.m. and 10 a.m. The lax policies prohibited alcohol consumption and sales between 4 a.m. and 10 a.m.)

(7.1 vs 5.6 per 100 000 person-years) and during holidays than during non-holidays (8.2 vs 6.1 per 100 000 person-years). Mortality rates were higher during football days than during non-football days (6.6 vs 6.2 per 100 000 person-years) (Table 1).

Policies' association with unintentional injury deaths

Numbers and crude rates of unintentional injury deaths are depicted in Figure 2. Unadjusted comparisons indicated that the moderately restrictive (IRR 0.93, 90% CI 0.80–1.08, $P = 0.409$) and lax policies (IRR 1.03, 90% CI 0.76–1.38, $P = 0.856$) were not associated with unintentional injury death rates variations compared with the most restrictive policies. After adjusting for age, sex, weekends, holidays, football days, days following football matches, administrations, autocorrelation, trends and seasonality, there were lower mortality rates during the moderately restrictive (IRR 0.79, 90% CI 0.61–1.03, $P = 0.136$) and lax policies (IRR 0.85, 90% CI 0.59–1.23, $P = 0.469$) compared with the most restrictive policies (Table 2).

In the sensitivity analysis, the conditional autoregressive negative binomial regression indicated lower mortality rates during the moderately restrictive (IRR 0.55, 90% CI 0.36–0.84, $P = 0.020$) and lax policies (IRR 0.60, 90% CI 0.36–1.00, $P = 0.100$) compared with the most restrictive policies (Table 3).

Discussion

During 2004–08, different policies restricting the hours of alcohol sales and consumption were implemented in Cali, Colombia. We found an increased risk of homicides on days when the less restrictive policies were in effect (more hours of sale) compared with days when the most restrictive policies were in effect (less hours of sale). This was consistent for firearm and stab/knife homicides. Extended hours of sales and consumption of alcohol were not associated with increased risk of unintentional injury mortality.

Table 2 IRRs of interpersonal violence and unintentional injury deaths associated with alcohol control policies, Cali, Colombia, 2004–08

Alcohol control policies' comparisons[a]	Unadjusted analyses[b]		Regression analyses[c]	
	IRR (90% CI)	*P*-value	IRR (90% CI)	*P*-value
All homicides				
Moderately restrictive vs most restrictive	1.23 (1.17–1.28)	<0.001	1.15 (1.05–1.26)	0.012
Lax vs most restrictive	1.50 (1.38–1.62)	<0.001	1.42 (1.26–1.61)	<0.001
Lax vs moderately restrictive	1.22 (1.14–1.31)	<0.001	1.24 (1.12–1.37)	0.001
Firearm homicides				
Moderately restrictive vs most restrictive	1.26 (1.20–1.32)	<0.001	1.14 (1.03–1.26)	0.030
Lax vs most restrictive	1.45 (1.33–1.58)	<0.001	1.36 (1.20–1.55)	<0.001
Lax vs moderately restrictive	1.15 (1.07–1.25)	0.003	1.20 (1.07–1.34)	0.007
Stab/knife homicides				
Moderately restrictive vs most restrictive	1.05 (0.92–1.20)	0.571	1.41 (1.12–1.77)	0.014
Lax vs most restrictive	1.91 (1.54–2.36)	<0.001	2.30 (1.72–3.10)	<0.001
Lax vs moderately restrictive	1.82 (1.51–2.20)	<0.001	1.64 (1.28–2.09)	0.001
Unintentional injury deaths				
Moderately restrictive vs most restrictive	0.93 (0.80–1.08)	0.409	0.79 (0.61–1.03)	0.136
Lax vs most restrictive	1.03 (0.76–1.38)	0.856	0.85 (0.59–1.23)	0.469
Lax vs moderately restrictive	1.11 (0.83–1.46)	0.523	1.08 (0.79–1.48)	0.679

[a]The most restrictive policies prohibited alcohol consumption and sales between 2 a.m. and 10 a.m. The moderately restrictive policies prohibited alcohol consumption and sales between 3 a.m. and 10 a.m. The lax policies prohibited alcohol consumption and sales between 4 a.m. and 10 a.m.
[b]Unadjusted analyses were performed separately for all homicides, firearm homicides, stab/knife homicides and unintentional injury deaths computing the crude mortality IRRs.
[c]Regression analyses were performed separately for all homicides, firearm homicides, stab/knife homicides and unintentional injury deaths using conditional autoregressive negative binomial regressions adjusting for age, sex, weekends, holidays, football days, days following football matches, administrations, lag 14 days autoregressive terms, and mortality trends with marginal splines, fractional polynomials and sine–cosine pairs with annual periodicity.

Mortality rates could be affected by other temporal changes and societal or economic conditions. We attempted to address these using time-series that accounted for serial correlations, time trends and seasonality. We controlled for known socio-political and cultural factors and we evaluated policies implemented in different intermittent periods.

The policies' constantly changing hours of alcohol restriction could lead to differences of enforcement over time and throughout the city. Sales and consumption could happen at early forbidden hours immediately at or time after the implementation of a new policy. How late individuals were vending or consuming alcohol or how well the entire city was enforced, remained unmeasured.

Alcohol can harm the health of non-drinkers.[13] Homicide victims may not be under the influence of alcohol, but perpetrators might be. In Cali, perpetrators are determined in 20% of the homicides and only 10% of them are charged,[5] making it difficult to test alcohol among them around the time of an event. We were unable to determine the causal mechanism in which the policies' modification of alcohol consumption resulted in the variation of mortality at the individual or neighbourhood level.

Nevertheless, the interventions we analysed targeted the entire population. They attempted to control the determinants of the incidence of homicides in the population as a whole. Ecologic studies testing the effect of the interventions on population rates are an important public health approach.[26,27]

The current analysis provided an opportunity to separate the policies' associations from changes in mortality attributed to other factors. Unmeasured variables may provide alternative explanations, especially in the associations observed during the lax policies. However, it seems unlikely that additional factors would have changed the mortality selectively for homicides, following the same pattern of the alcohol control policies implementation. We also used a reliable fatal injury surveillance system previously useful in other studies.[4,7] Mortality is the best documented form of violence and clearly portrays the magnitude of severe events.[3]

Alcohol causes a large proportion of deaths by increasing the likelihood of violence. Previous studies

Table 3 Sensitivity analyses—IRRs of interpersonal violence and unintentional injury deaths associated with alcohol control policies, Cali, Colombia, 2005–08

Alcohol control policies' comparisons[a]	Unadjusted analyses[b]		Regression analyses[c]	
	IRR (90% CI)	*P*-value	IRR (90% CI)	*P*-value
All homicides				
Moderately restrictive vs most restrictive	1.20 (1.14–1.27)	<0.001	1.33 (1.18–1.21)	<0.001
Lax vs most restrictive	1.53 (1.40–1.67)	<0.001	1.60 (1.36–1.88)	<0.001
Lax vs moderately restrictive	1.27 (1.17–1.38)	<0.001	1.20 (1.03–1.40)	0.021
Firearm homicides				
Moderately restrictive vs most restrictive	1.23 (1.16–1.30)	<0.001	1.32 (1.16–1.51)	0.001
Lax vs most restrictive	1.48 (1.34–1.64)	<0.001	1.33 (1.11–1.60)	0.011
Lax vs moderately restrictive	1.20 (1.10–1.32)	0.001	1.01 (0.84–1.21)	0.941
Stab/knife homicides				
Moderately restrictive vs most restrictive	1.01 (0.87–1.18)	0.893	1.41 (1.06–1.87)	0.047
Lax vs most restrictive	1.84 (1.45–2.33)	<0.001	2.57 (1.77–3.73)	<0.001
Lax vs moderately restrictive	1.82 (1.46–2.24)	<0.001	1.83 (1.28–2.62)	0.001
Unintentional injury deaths				
Moderately restrictive vs most restrictive	0.94 (0.79–1.11)	0.515	0.55 (0.36–0.84)	0.020
Lax vs most restrictive	1.08 (0.78–1.49)	0.660	0.60 (0.36–1.00)	0.100
Lax vs moderately restrictive	1.16 (0.84–1.56)	0.411	1.10 (0.73–1.65)	0.653

[a]The most restrictive policies prohibited alcohol consumption and sales between 2 a.m. and 10 a.m. The moderately restrictive policies prohibited alcohol consumption and sales between 3 a.m. and 10 a.m. The lax policies prohibited alcohol consumption and sales between 4 a.m. and 10 a.m.
[b]Unadjusted analyses were performed separately for all homicides, firearm homicides, stab/knife homicides and unintentional injury deaths computing the crude mortality IRRs.
[c]Regression analyses were performed separately for all homicides, firearm homicides, stab/knife homicides and unintentional injury deaths using conditional autoregressive negative binomial regressions adjusting for age, sex, weekends, holidays, football days, days following football matches, administrations, lag 14 days autoregressive terms and mortality trends with marginal splines, fractional polynomials and sine–cosine pairs with annual periodicity.

in England and Wales showed that alcohol was responsible for ~47% deaths from assaults and 44% deaths from fire-related injuries.[28] Previous studies have mostly evaluated interventions targeted to individuals, especially those considered at high risk of alcohol-related problems, and more recently to moderate drinkers who occasionally drink to intoxication, a strong risk factor for injuries and violence.[28]

Alcohol policy evaluation is challenging because of societal factors that impact drinking patterns and levels of related harms. Updated evidence regarding the impact of relaxation of trading hours on a variety of indices of alcohol consumption and related harms has suggested that, under most circumstances, increasing trading hours will result in increased alcohol consumption and related harms such as violence.[15]

Our study results are consistent with studies that link alcohol availability and violence.[14,15,28] We found a higher risk of homicides during the less restrictive policies. This suggests that longer alcohol trading hours could lead to more alcohol consumption and subsequently more violence. This also suggests that restricting alcohol availability could reduce

alcohol consumption and associated problems. By calculating the population attributable fraction[29] we estimated that Cali could have prevented approximately 892 homicides if the most restrictive policies were maintained consecutively over a 5-year period.

Alcohol is recognized as a risk factor for unintentional injuries,[13,30] but we did not find an increased risk of unintentional injury deaths with extended hours of sales and consumption. Unintentional injuries are less common during the hours of these alcohol restrictions. This additional analysis provided us with means to assess whether these policies affected the events they intended to affect. It is possible that unintentional injuries were also affected but we did not observe it on mortality. Studying morbidity could provide additional information.

Our study results might be generalizable to other communities if drinking patterns and levels of violence are considered cautiously. A study conducted in Slovenia found an immediate and permanent reduction in male suicide and a study conducted in Brazil found a decrease in murders, both after the implementation of policies that limited alcohol availability.[31,32] Nonetheless, these policies may not have

similar associations in places where alcohol and violence are less common.

Conclusions

The approach used in Cali allowed the evaluation of these alcohol control policies and could further contribute to the design and evaluation of injury and violence prevention strategies, based on scientific evidence rather than only political or economic interests.

Our study suggests that strong restrictive policies, implemented and enforced to reduce the time of alcohol sales and consumption, were associated with reductions in the risk of homicides in a community where homicides are very high. Since mortality almost certainly underestimates the true burden of interpersonal violence,[33] it is possible that strong restrictive policies also reduced non-fatal violent events, providing additional benefits to the community.

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KEY MESSAGES

- Policies that allowed more hours of sales and consumption of alcohol were associated with increased risk of interpersonal violence deaths compared with policies with fewer hours of alcohol availability.

- Given the high incidence rates of homicides in Cali, Colombia, policies aimed at restricting alcohol availability might have a relevant impact on public health, reducing the incidence of interpersonal violence deaths.

- It is possible that strong restrictive policies might provide additional benefits to the community by reducing non-fatal violent events.

- The design and evaluation of injury and violence prevention strategies should be based on scientific evidence rather than only political or economic interests.

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