

A Comparison of Maxillofacial Trauma Before and After Implementation of Lockout Laws in Sydney

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Abstract

Background: Lockout reforms were introduced in February 2014 by the New South Wales government in an attempt to curb alcohol-related violence in Sydney, following a number of fatalities. Changes include 1.30 a.m. venue lockouts and the 3 a.m. cessation of alcohol service. This study aims to assess the results of these reforms through analysis of departmental treatment data. All maxillofacial fractures that required operative management at St Vincent's Hospital, Sydney, over a two-year period pre and post reforms were analysed.

Methods: Medical information, from multiple sources, of patients that required operative management for maxillofacial fractures over a 2-year period (2012-2014) were compared to those between (2014-2016). Data collected included age, gender, demographics, mechanism of injury, pattern of injury, treatment required, association with alcohol, time and place of injury, and long-term complications.

Results: 145 maxillofacial fractures were operatively treated prior to the reforms compared to only 58 ($p<0.001$) post. Reported incidents occurring in the city significantly fell from 54 to 15 ($p<0.001$), with no change in peripheral locations. The operated cases associated with alcohol dropped post reforms (102/145 (70%) vs 33/58 (57%)). The number of assaults related to 'king hits' significantly reduced from 30 (33%) to just 5 (19.2%).

Conclusion: This study demonstrates a clear correlation with the reduction in maxillofacial trauma, alcohol and violence in a localised region of Sydney since the arrival of the lockout reforms. As such, it can provide guidance to other regions in Australia into the effects of such laws and its repercussions on patient care and service.

Key words: Trauma; Plastic and Reconstructive Surgery; Maxillofacial Surgery; Maxillofacial Trauma; Alcohol Reforms

Introduction

Thousands of people each weekend visit the plethora of bars, clubs and restaurants within Sydney's entertainment precincts.^{1, 2} The majority of patrons peacefully enjoy the broad spectrum of entertainment that Sydney has to offer yet alcohol-related violence has been on the increase in recent years.

While the relationship between alcohol and violence is complex, a high blood alcohol concentration level is a risk factor for violence. Australian research suggests that alcohol is a factor in 23-73 per cent of assaults.^{3, 4, 5}

Alcohol-related violence has long been an issue of public concern in Australia, particularly in the state of New South Wales (NSW) following a number of fatalities from 'coward punches' or 'king hits' (a single punch to the head knocking someone unconscious or down to the ground). These recent fatalities have prompted the NSW State Government to announce new restrictions on licensed premises in an attempt to curb the violence. The new restrictions (contained in the *Liquor Amendment Act 2014* (NSW)) took effect on 24 February 2014.⁶

Some of the key restrictions included in the reforms were:

1. 1.30 a.m. Lockouts at hotels, registered clubs, nightclubs and karaoke bars in two designated areas: the Sydney CBD Entertainment and Kings Cross Precincts;
2. 3.00 a.m. Cessation of alcohol service in venues in these Precincts;
3. A freeze on new liquor licences and approvals for existing licences across the Sydney CBD Entertainment Precinct and continuation of the existing freeze in the Kings Cross Precinct;
4. A ban on takeaway alcohol sales after 10 p.m. across NSW;
5. The extension of temporary and long-term banning orders issued to designated alcohol/trauma convicted or known felons to prevent them entering most licensed premises in the two precincts.⁶

Restrictions to last drink timings have been enforced in many metropolitan cities around the world with good results in the reduction of alcohol-related violence. Locally in Australia, reforms have occurred in both Brisbane (Queensland) and in Newcastle (also within NSW). The Newcastle model demonstrated a reduction in reported assaults by 64% since 2008 with an estimated prevention of more than 5,000 assaults.⁷

St Vincent's Hospital (SVH) is a busy Level II Trauma Centre located in the heart of Sydney's Entertainment Precinct in Darlinghurst. The hospital provides care to over 10,000 patients each year within South Eastern Sydney and the many workers and visitors to Sydney's CBD. The Entertainment Precinct is approximately 22km² in size with an estimated resident population of 66,200.^{8, 9}

The precinct includes the highest density of licensed premises in Sydney and in 2014 contained 1,314 licensed premises, including 425 premises authorised to trade after midnight and 210 authorised to trade after 3 a.m.⁹ The Plastic Surgery and Reconstruction Department is just one of the many specialties that comprises the hospital's trauma service. A facet that the Department provides exclusively in an acute setting is the management of maxillofacial trauma.

Maxillofacial trauma in Australia is on the rise with an increasing percentage of presentations being due to alleged assaults with a decreasing presentation to motor vehicle accidents.^{10, 11} Maxillofacial trauma constitutes a significant proportion of all trauma cases in NSW¹² and the maxillofacial region is by far the most targeted area from assaults.¹² Maxillofacial trauma related to drug and alcohol use usually occurs on weekends and are associated with parties, bars, and other similar activities.¹² The cost of treating these injuries poses a great burden on the health care system in NSW.

The study aims were to assess the impact of the 2014 alcohol reforms in the treatment of maxillofacial fractures that required operative management at SVH (comparing a 2-year period pre and post reforms). Furthermore, the study examined the association between maxillofacial trauma and alcohol.

Methods

A retrospective review was conducted on all patients with maxillofacial fractures that required operative treatment at SVH from the period of 21 February 2012 to 23 February 2014 (pre reforms). A prospective collection of data occurred in the 2-year period following the alcohol reforms and ceased for the study on 21 February 2016.

Cross validation of results occurred through analysis of multiple data sources from emergency electronic records to theatre lists to ensure that all patients were collected.

Ambulance transfer sheets, medical records, blood tests and radiographs were all reviewed. Data collected included patient demographics, mechanism and pattern of injury, treatment required, association with alcohol, time and place of injury, and long-term complications.

Regarding the association with alcohol if blood alcohol levels were not measured then clinical documentation from emergency staff or ambulance crew at presentation was sought. If evidence of intoxication was not clear it was reported as 'unknown'.

Patients who presented as a result of an assault had further information collected, particularly on the cause of the assault as a 'coward punch' or 'king hit'. For the purpose of this study we defined a 'coward punch/king hit' as an unexpected knockout blow causing loss of consciousness. 'Loss of consciousness' was determined by clinical history or GCS (Glasgow Coma Score) status on presentation.

Statistical comparisons were by Mann-Whitney test (non-parametric) for continuous variables and chi-squared tests for categorical variables.

If cell counts were low, a conditional binomial test was performed. Ethics approval was obtained for the study from the St Vincent's Hospital Human Research Ethics Committee.

Results

A significant decline in the number of events occurred after the implementation of the alcohol reforms. The majority of cases were of men (89.4% vs 86%) in both cohorts with an average age of 30.

In the city/CBD the observed cases dropped from 54 (50%) to just 15(29%). Injuries occurring in the Kings Cross Entertainment Precinct also fell from 22% to 5.7%. There were a similar number of cases reported from the Eastern Suburbs (20 (18%) vs 26 (50%)) over the two-year comparison period.

A large proportion of the actual locations of events were not recorded in the first 2 years (36). Overall significance without testing of the unknowns was $p < 0.001$ (Table 1).

Table 1 Summary of all maxillofacial fracture events identified

	2 yrs Prior	Post reforms	p-value
Total Surgical cases	1,254	1,141	
Total Maxillofacial cases	145†	58†	<0.001
Patient Description			
Age	30 (16-89)	30 (17-77)	0.12
Sex			
Male	126 (89.4)	49 (86)	0.50
Female	15 (9.6)	8 (14)	
Cases related to method of injury			
Assault‡	61 (43.3)	21 (36.2)	0.02
King Hit	30 (21.2)	5 (8.6)	
Fall	28 (19.9)	22 (37.9)	
MVA	6 (4.3)	3 (5.2)	
Sport	6 (4.3)	4 (5.2)	
Cycling	4 (2.8)	3 (5.2)	
Other	6 (4.3)	0	
Unknown	4	0	
Location of Event			
City	54 (49.5)	15 (28.9)	<0.001
Intoxicated	37	10	
Sober	10	5	
Unknown	7	0	
Kings Cross	24 (22)	3 (5.7)	
Intoxicated	16	2	
Sober	3	1	
Unknown	5	0	
Eastern Suburbs	20 (18.4)	26 (50)	
Intoxicated	12	12	
Sober	3	14	
Unknown	5	0	
North Sydney	4 (3.7)	0	
South Sydney	2 (1.8)	0	
Other	5 (4.6)	8 (15.4)	
Unknown	36	6	
Place of injury			
Street	64	20	0.09
Bar/Club	27	12	
Restaurant	3	0	
Home	3	1	
Park	4	4	
Vehicle	6	3	
Work	1	4	
Other	6	14	
Unknown	31	0	
Total	145	58	

Statistics have been presented as N(%) or median (min-max)
† Note that there were 4 instances of 2 events in the same patient prior to the lockout laws. After the lockout laws, there was only 1 person who presented twice.

‡ Non 'king hit' related assaults

Most maxillofacial trauma happened outdoors, mainly on the street (64 (44%) vs 20 (34%) p-value 0.09). Establishments associated with alcohol such as bars, clubs and restaurants represented the second largest proportion being 20.7%.

Despite the introduction of the reforms, assault was still the most common method of injury in both periods (64.5% to 44.8% (p=0.02)) (Table 1). The number of operations secondary to a fall (such as alcohol-related or perhaps syncopal events etc.) fell slightly from 28 to 22. Motor vehicle accidents accounted for only a small proportion of known cases and did not change over the 2 years (6 pre (4.3%) and 3 post (5.2%).

Fracture patterns were also analysed between the two periods. Before the reforms the most common fracture operated on was on the mandible followed by nasal bones, which reversed in order post-reforms. Orbital fractures halved and zygomatic operations fell by 83.3%. The only fracture pattern that increased was frontal sinus injuries from 3 to 4 (Table 2).

Table 2 Comparison of the fracture patterns pre and post reforms

Method of injury	Alleged Assault		King Hit	Fall	MVA	Sport	Cycling	Other	Total							
	Prior	Post														
Fracture breakdown																
Mandible #	27	7	17	1	15	8	2	2	1	1	1	2	1	0	64	21
Nasal #	18	4	10	3	7	11	1	2	2	2	1	0	1	0	40	22
Zygoma #	12	3	9	1	8	0	1	1	2	0	2	1	2	0	36	6
Maxillary #	4	2	2	0	7	2	0	0	1	0	0	0	1	0	15	4
Orbital #	8	7	4	1	8	3	2	1	2	1	0	0	1	0	26	13
Frontal sinus #	2	1	0	0	1	2	0	1	0	0	0	0	0	0	3	4
Total number §	71	24	42	6	46	26	6	7	6	4	4	3	4	0	184	70

‡ Non 'king hit' related assaults

§ Note some patients had multiple fractures

Approximately half of cases (57%) in the last 2 years were related to alcohol compared to a higher proportion prior (70%). However, the fall in intoxicated cases had not statistically changed. These numbers included sober individuals that were assaulted by an intoxicated person, or who were sober at the time of presentation to the emergency department (typically the following

morning) but reported being intoxicated at the time. Alcohol/drug related injuries without clear documentation of the patient's alcohol status or formal blood alcohol count measured were regarded as 'unknown' (Table 3).

Table 3 Summary of cases related to alcohol

Alleged Assaults	2 yrs Prior (%)	Post reforms (%)
Intoxicated	41 (67.2)	15 (71.4)
Sober	12 (9.8)	5 (23.8)
Unknown/not done (Other person reported intoxicated)	8 (23.0)	1 (4.8)
King Hit	12	1
Intoxicated	26 (86.7)	4 (80)
Sober	1 (6.65)	1 (20)
Unknown/not done (Other person reported intoxicated)	3 (6.65)	0 (0)
Fall	2	1
Intoxicated	16 (57.2)	12 (100)
Sober	3 (10.7)	0 (0)
Unknown/not done	9 (32.1)	0 (0)
Other ETOH cases	5	0
Total	102/145 (70)	33/58 (57)

We also focused on those assaulted as a specific subgroup. As mentioned previously, assault was the most common method of injury (pre 91 (64.5%) and post 26 (44.8%)). This drop in post reforms assaults was also reflected in the specific subgroup of patients operated on having been king hit, falling from 21.2% to only 8.6%.

The majority of known assaults occurred between 10 p.m. and 6 a.m. for both cohorts (pre- 85.3%, post- 62.4%). Prior to the reforms there are two peaks of assault occurrence between 10 p.m. to 11.59 p.m. (17 cases) and 2 a.m. to 3.59 a.m. (23 cases) compared to post-reforms where there is a steady increase in assaults from 8 p.m. that peaks by 4 a.m. (6 cases). After 4 a.m. these numbers drop by a third whereas before the reforms assaults remained high until nearly 8 a.m. (Table 4).

Table 4 Timing distribution of assaults

Time	Assaults Prior	King Hit (%)	Assaults Post	King Hit (%)
0600-0759	2	2	2	0
0800-0959	1	0	0	0
1000-1159	0	0	1	0
1200-1359	0	0	1	0
1400-1559	1	0	0	0
1600-1759	0	1	0	0
1800-1959	3	0	2	0
2000-2159	1	2	1	0
2200-2359	9	8 (20.7)	2	1 (12.5)
2400-0159	8	2 (12.2)	2	2 (16.6)
0200-0359	16	7 (28)	5	1 (25)
0400-0559	13	6 (24.4)	2	0 (8.3)
Unknown	7	2	3	1
Total	61	30	21	5
Assault cases by day				
Day of the week	Assaults Prior	King Hit	Assaults Post	King Hit
Monday	4	2	1	0
Tuesday	2	2	2	1
Wednesday	3	1	2	0
Thursday	4	2	4	2
Friday	2	4	1	0
Saturday	22	11	6	1
Sunday	21	8	4	0
Unknown	3	0	1	1
Total	61	30	21	5

|| Percentage of total assaults

Analysis of the assault subgroup within the High Alcohol Time Period (from 6 p.m. Friday to 6 a.m. Sunday) demonstrates that the majority of cases continue to occur during the weekend period (68/88 (77.3%) vs 12/24 (50%). Following the reforms there appears to be no significant change in the number of assaults requiring operative management during the other weekdays, especially on a Thursday which maintained the same number of cases.

Discussion

Our study indicates a dramatic decline in the presentation of maxillofacial trauma, especially from within the entertainment and CBD precincts, since the 2014 alcohol reforms. The 60% fall in maxillofacial operations after the reforms was observed with no change to other local factors such as the emergency services provided by St

Vincent's Hospital or in the Department of Plastic Surgery's management of maxillofacial injuries. This local reduction in trauma was also echoed by the emergency department at SVH with a significant drop in all alcohol-related serious injury and trauma presentations in the 12 months after the reforms.¹⁵

The most common cause of maxillofacial injury in both periods was due to assault (64.6% and 44.8%) consistent with other studies findings of a decrease in the number of presentations from motor vehicle accidents over the last 30 years.^{10, 11} The rising trend of assaults in Australia has been associated with alcohol and this study demonstrates a strong relationship between the two (89% of assaults prior to the reforms were linked to alcohol and remained high at 81% in the two years post).

One major impetus for the alcohol reforms in Sydney was the recent high profile incidents of 'coward punch/king hits'. This study shows that those king hit consistently had the highest link with alcohol as a subgroup with 86.7% pre and 80% post reforms being intoxicated at the time. Therefore, it was not surprising to see that the greatest effect of the reforms was demonstrated with this cohort with an 83%/6-fold drop in cases from 30 to just 5.

Overall the majority of all maxillofacial injuries were associated with alcohol regardless of the mechanism of injury (119/145 (70%) vs 33/58 (57%)).

The alcohol reforms in Sydney were based on the successful results of restrictions in Newcastle, Australia's seventh largest city. Kypri *et al.*⁷ reported that in Newcastle, where both a lockout time and a mandatory closing time were also introduced, there was an estimated 37% reduction in reported assaults between 10 p.m. and 6 a.m.

Our study also demonstrated a staggering decline in the reported number of events during that time period (69 cases pre-reforms to just 15 - 79% fall). We have also demonstrated that the majority of this reduction occurred after 3 a.m. with little impact evident between 1 a.m. and 3 a.m. Therefore suggesting that the cessation time for drinking to be an effective policy measure for the reduction.

There has been speculation that the reduction in alcohol-related assaults is a consequence of patrons choosing to now drink in the peripheral suburbs of Sydney outside of the CBD. The NSW Bureau of Crime Statistics demonstrated a decline in reported assaults within the CBD and across Sydney (bar the Casino district) after the reform laws.^{2, 16} The results from our study also highlights that not only was there a significant drop in maxillofacial cases from the Kings Cross and CBD districts but that there was no increase in the number of maxillofacial injuries referred from other regions of Sydney. Thus suggesting, in a limited manner, that alcohol-related assaults has fallen and not simply dispersed. A claim supported by Donnelly *et al.* who also reported very little evidence of assault displacement to other regions of Sydney.¹⁶

There is growing evidence from the literature to suggest a strong relationship between alcohol trading restriction policies and the reduction of harm. Not only are these studies based locally in Australia but also supported by research from Europe. In 2015, de Goeij *et al.*¹⁷ conducted a control trial on the impact of extended trading hours in two of five entertainment precincts (Leidseplein and Rembrandtplein) in Amsterdam. Compared to the controlled areas, there was a 34% increase in alcohol-related ambulance requests and occurred later in the night. A robust Norwegian study by Rossow and Norström

evaluated the effects of both trading extensions and restrictions on the number of assaults. They found, in both directions, a 16% change in reported assaults with each 1-hour adjustment in trading hours.¹⁸

The significant drop of operative cases from 145 to just 58 in 2 years will also have had a positive impact on the burden of healthcare cost and resources. Given that only 13% of the maxillofacial patients treated at SVH had private health insurance, this improvement would have predominantly relieved the pressure on the local public health system. The reduction of nearly a third of cases led to a multitude of resource improvements to the Plastic Surgery Department: less trauma patients attending clinic (pre and post-operatively), reduced hospital admissions for maxillofacial trauma and more time/surgeons available for other urgent operative cases.

This is the first published paper on the effect of the reforms on maxillofacial surgery and by having a hospital uniquely placed in the centre of the two restriction zones also means that our results are the most indicative. Assault has now succeeded motor vehicle accidents as the most common cause of maxillofacial surgery occurring in the street or within establishments that serve alcohol. We hope that the results from this study will be used by key stakeholders and policy makers to amend and refine strategies on a complex and multi-factorial problem. Further, more targeted interventions may be necessary than reforms that restrict all.

Limitations

The limitation to this study is that this is just one specialty area within a broad scope of trauma. Even though the study was conducted over a 2 year period, ideally, it also needed to be statistically corrected for all potential variables

such as visitor trends to the Sydney Entertainment districts, number of licensed venues and the potential drift of trauma to other local hospitals within Sydney. The cohort of un-operated patients sustaining facial injury were not identified in this study given the difficulty in obtaining the true numbers in the retrospective review period. As there were no changes to the Consultants within the Department or their criteria on operative management, we are confident that the unoperative case load would have been similar and not biased by the reforms. The authors have also not addressed the potential impact or bias of other public health measures to the results. However, no dramatic change in alcohol taxation or beverage prices was reported. The principal author is currently researching the trend of operated maxillofacial trauma within all of Sydney's trauma hospitals in an attempt to review the wider effects of the reforms including the hypothesis of assault displacement to other regions of Sydney.

Conclusion

This study demonstrates a clear correlation with the reduction in maxillofacial trauma, alcohol and violence in a localised region of Sydney since the arrival of the lockout reforms. Yet, despite the reforms, alcohol still remains a significant factor in maxillofacial trauma. Our Department's findings can provide guidance to other regions in Australia into the effects of such laws and its repercussions on patient care and service.

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Chopra, van der Rijt, Ngo et al

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