A comparison of maxillofacial trauma before and after implementation of lockout laws in Sydney

Shiv Chopra MBBS BSc,1 Rhys Gordon van der Rijt MBBS,1 Quan Ngo FRACS1
Frederick K Clarke FRACS,1 James Peter Southwell-Keely FRACS,1 Kristy Robledo M Biostat,2
Elias Moisidis FRACS1

1 St Vincent's Hospital
   Plastic and Reconstructive Surgery Sydney,
   Darlinghurst, New South Wales
   AUSTRALIA
2 NHMRC Clinical Trials Centre
   University of Sydney
   Camperdown, New South Wales
   AUSTRALIA

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 am venue lockouts and the 3 am 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 two-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: One hundred and forty-five 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%) versus 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.

Keywords: plastic surgery, reconstructive surgical procedures, maxillofacial injuries, violence, Australia
Introduction

Thousands of people each weekend visit the plethora of bars, clubs and restaurants within Sydney's entertainment precincts. 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.

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.

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 5000 assaults.

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 central business district (CBD). The entertainment precinct is approximately 22km² in size with an estimated resident population of 66,200.

The precinct includes the highest density of licensed premises in Sydney and in 2014 contained 1314 licensed premises, including 425 premises authorised to trade after midnight and 210 authorised to trade after 3 a.m. The Plastic Surgery and Reconstruction Department at SVH 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. Maxillofacial trauma constitutes a significant proportion of all trauma cases in NSW and the maxillofacial region is by far the most targeted area from assaults. Maxillofacial trauma related to drug and alcohol use usually occurs on weekends and are associated with parties, bars, and other similar activities. 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 two-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 two-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 Glasgow Coma Score (GCS) 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 per cent. There were a similar number of cases reported from the Eastern suburbs—20 (18%) versus 26 (50%) over the two-year comparison period.

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

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

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 two years—sic pre (4.3%) and three 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 per cent. The only fracture pattern that increased was frontal sinus injuries from three to four (Table 2).

Approximately half of cases (57%) in the last two 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
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 per cent.

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

Analysis of the assault subgroup within the high alcohol time period (from 6 pm Friday to 6 am Sunday) demonstrates that the majority of cases continue to occur during the weekend period—68/88 (77.3%) versus 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 per cent 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

Table 1: Summary of all maxillofacial fracture events identified

|                                | Two years prior (%) | Post-reforms (%) | p-value |
|--------------------------------|---------------------|-----------------|---------|
| Total surgical cases           | 1254                | 1141            |         |
| Total maxillofacial cases      | 145††               | 58††            | <0.001  |
| Patient description            |                     |                 |         |
| Age                            | 30 (16-89)          | 30 (17-77)      | 0.12    |
| Sex                            |                     |                 |         |
| Male                           | 126 (89.4)          | 40 (86)         | 0.50    |
| Female                         | 15 (9.6)            | 4 (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 (27.9)       |         |
| MVA                            | 6 (4.3)             | 3 (5.2)         |         |
| Sport                          | 6 (4.3)             | 4 (5.2)         |         |
| Cycling                        | 4 (2.8)             | 3 (5.2)         |         |
| Other                          | 4 (3.3)             | 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 (17.4)           | 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                          | 144                 | 58              |         |

Statistics have been presented as N(%) or median (min-max) † Note that there were four instances of two events in the same patient prior to the lockout laws. After the lockout laws, there was only one person who presented twice. ‡ Non ‘king hit’ related assaults documentation of the patient’s alcohol status or formal blood alcohol count measured were regarded as ‘unknown’ (Table 3).
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 per cent of assaults prior to the reforms were linked to alcohol and remained high at 81 per cent 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 per cent pre and 80 per cent 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 per cent (six-fold) drop in cases from 30 to just five.
Overall the majority of all maxillofacial injuries were associated with alcohol regardless of the mechanism of injury—119/145 (70%) versus 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 reported that in Newcastle, where both a lockout time and a mandatory closing time were also introduced, there was an estimated 37 per cent reduction in reported assaults between 10 pm and 6 am. 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 am with little impact evident between 1 am and 3 am. 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. 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.

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 conducted a control trial on the impact of extended trading hours in two of five entertainment precincts in Amsterdam (Leidseplein and Rembrandtplein). Compared to the controlled areas, there was a 34 per cent 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 per cent change in reported assaults with each one-hour adjustment in trading hours.

The significant drop of operative cases from 145 to just 58 in two years will also have had a positive impact on the burden of healthcare cost and resources. Given that only 13 per cent 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 postoperatively), 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 two 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.

Disclosure
The authors have no conflicts of interest to disclose.

Funding
The authors received no financial support for the research, authorship, and/or publication of this article.

References
1 City of Sydney. Late Night Management Areas Research-Phase 3 Report December 2012. [Cited 30 September 2017.]
Available from: http://www.cityofsydney.nsw.gov.au/__data/assets/pdf_file/0014/200129/Late-Night-Management-Areas-Research-Phase-3-report-December-2012.PDF
2 Menéndez P, Weatherburn D, Kypri K, Fitzgerald J. Lockouts and last drinks: the impact of the January 2014 liquor licence reforms on assaults in NSW, Australia. Crime and Justice Bulletin, 2015: 183. [Cited 30 September 2017.]
Available from: http://www.bocsar.nsw.gov.au/Documents/CJB/CJB183.pdf
3 Briscoe S, Donnelly N. Temporal and regional aspects of alcohol-related violence and disorder. Alcohol Studies Bulletins, 2001. [Cited 30 September 2017.]
Available from: http://www.bocsar.nsw.gov.au/Documents/BB/ab01.pdf
4 Doherty SJ, Roche AM. Alcohol and licensed premises: Best practice in policing. A monograph for police and policy makers. Commonwealth of Australia, 2003. [Cited 30 September 2017.]
Available from: http://nceta.flinders.edu.au/files/7312/5548/1448/EN34.pdf
5 Poynton S, Donnelly N, Weatherburn D, Fulde G, Scott L. The role of alcohol in injuries presenting to St Vincent’s Hospital emergency department and the associated short-term costs. Alcohol Studies Bulletins, 2005. [Cited 30 September 2017.]
Available from: http://www.bocsar.nsw.gov.au/Documents/BB/ab06.pdf
6 Roth L. Liquor licencing restrictions to address alcohol-related violence in NSW: 2008 to 2014. NSW Parliamentary Service. 2014. [Cited 30 September 2017.]
Available from: https://www.parliament.nsw.gov.au/researchpapers/Documents/liquor-licensing-restrictions-to-address-alcohol-1/Liquor%20licensing%20reforms.pdf
7 Kypri K, McElduff P, Miller P. Restrictions in pub closing times and lockouts in Newcastle, Australia five years on. Drug Alcohol Rev. 2014; 33: 323-26. https://doi.org/10.1111/dar.12123
8 Australian Bureau of Statistics. 2011 Census Quick Stats. 2012. [Cited 30 September 2017.]
Available from: http://www.gov.au/census_services/getproduct/census/2011/quick-stat/POA2000/opendocument&navpos=220
9 City of Sydney. Plan of Management for the Sydney CBD Entertainment Precinct. 2014. [Cited 30 September 2017.]
Available from: http://www.justice.nsw.gov.au/Pages/media-news/media-releases/2014/plan-of-management-released.aspx
10 Telfer MR, Jones GM, Shepherd JF. Trends in the aetiology of maxillofacial fractures in the United Kingdom (1977-1987). Br J Oral Maxillofac Surg. 1991; 29: 256-58. https://doi.org/10.1016/0266-4356(91)90192-8
11 Lynham A, Tuckett J, Warnke P. Maxillofacial trauma. Aust Fam Physician. 2012; 41: 172-80.
12 Moncrieff NJ, Qureshi C, Deva AK. A comparative cost analysis of maxillofacial trauma in Australia. J Craniofac Surg. 2004; 15: 686-91. https://doi.org/10.1097/00001665-200407000-00030
13 Warburton AL, Shepherd JF. Alcohol-related violence and the role of oral and maxillofacial surgeons in multi-agency prevention. Int J Oral Maxillofac Surg. 2002; 31: 657-63. https://doi.org/10.1054/jiom.2002.0245
14 Goulart DR, Durante L, de Moraes M, Asprino L. Characteristics of maxillofacial trauma among alcohol and drug users. J Craniofac Surg. 2015; 26(8): e783–86. https://doi.org/10.1097/SCS.0000000000002055
15 Fulde GW, Smith M, Forster SL. Presentations with alcohol-related serious injury to a major Sydney trauma hospital after 2014 changes to liquor laws. Med J Aust. 2015; 203(9): 366. https://doi.org/10.5694/mja15.00637
16 Donnelly N, Weatherburn D, Routledge K, Ramsey S, Ma-honey N. Did the ‘lockout law’ reforms increase assaults at The Star casino, Pyrmont? Sydney: NSW Bureau of Crime Statistics and Research, 2016. [Cited 30 September 2017.]
Available from: http://www.bocsar.nsw.gov.au/Pages/bocsar_media_releases/2016/plan-of-management-released.aspx
17 De Goeij MCM, Veldhuijzen EM, Buster MCA, Kunst AE. The impact of extended closing times of alcohol outlets on alcohol-related injuries in the nightlife areas of Amsterdam: a controlled before-and-after evaluation. Addiction. 2015; 110(6): 955-64. https://doi.org/10.1111/add.12886
18 Rossow I, Norström T. The impact of small changes in bar closing hours on violence. The Norwegian experience from 18 cities. Addiction. 2012; 107(3): 530-37. https://doi.org/10.1111/j.1360-0443.2011.03643.x