

Trauma trends during COVID-19 alcohol prohibition at a South African regional hospital

KATHRYN M. CHU¹ , JENNA-LEE MARCO¹ , EYITAYO OMOLARA OWOLABI¹ ,
RIAAN DUVENAGE^{2,3} , MUKHETHWA LONDANI⁴ , CARL LOMBARD^{5,6}  &
CHARLES D. H. PARRY^{4,7} 

¹Centre for Global Surgery, Department of Global Health, Stellenbosch University, Tygerberg, South Africa, ²Department of Surgery, Worcester Regional Hospital, Worcester, South Africa, ³Ukwanda Centre for Rural Health, Stellenbosch University, Tygerberg, South Africa, ⁴Alcohol Tobacco and Other Drug Research Unit, South African Medical Research Council, Pretoria, South Africa, ⁵Biostatistics Unit, South African Medical Research Council, Tygerberg, South Africa, ⁶Division of Epidemiology and Biostatistics, Department of Global Health, Stellenbosch University, Tygerberg, South Africa, and ⁷Department of Psychiatry, Stellenbosch University, Tygerberg, South Africa

Abstract

Introduction. The objective of this study was to examine the relationship between trauma volume and alcohol prohibition during the COVID-19 lockdown in South Africa. **Methods.** This was a retrospective analysis of trauma volume from Worcester Regional Hospital in South Africa from 1 January to 28 December 2020. We compared total volume and incidence rates during five calendar periods; one when alcohol sales were allowed as per normal and four when alcohol sales were completely or partially banned. Poisson regression was used to model differences between alcohol ban and non-ban periods. **Results.** During the first period (pre-COVID-19, no ban), the trauma admission rate was 95 per 100 days, compared to 39 during the second period (complete ban 1), 74 during the third period (partial ban 1), 40 during the fourth period (complete ban 2) and 105 during the fifth period (partial ban 2). There was a 59–69% decrease in trauma volume between the no ban and complete ban 1 periods. When alcohol sales were partially reinstated, trauma volume significantly increased by 83–90% then dropped again by 39–46% with complete ban 2. By the second half of 2020, when alcohol sales were partially allowed again (partial ban 2), trauma volume increased by 163–250%, thus returning to pre-COVID-19 levels. **Discussion and Conclusions.** Our study demonstrates a clear trend of decreased trauma volume during periods of complete alcohol prohibition compared to non- and partial alcohol bans. This finding suggests that temporary alcohol bans can be used to decrease health facility traffic during national emergencies. [Chu KM, Marco J-L, Owolabi EO, Duvenage R, Londani M, Lombard C, Parry CDH. Trauma trends during COVID-19 alcohol prohibition at a South African regional hospital. *Drug Alcohol Rev* 2022;41:13–19]

Key words: trauma, COVID-19, alcohol prohibition, South Africa.

Introduction

Alcohol consumption is a major risk factor for unintentional and intentional injury worldwide and contributes substantially to trauma-related deaths [1,2]. Homicide and less fatal forms of intentional injury are also causally related to alcohol [3]. Likewise, burn injuries have been associated with alcohol consumption globally [4].

In South Africa (SA), traumatic injuries are seven times higher than the global average and contribute to a

large proportion of the national burden of disease [5,6]. Intentional injury and road traffic accidents are the two main causes of traumatic injury in SA and are large contributors to trauma-related mortality [7]. Among persons 20–39 years of age, 90% of road traffic accidents are attributable to alcohol use [8]. Alcohol-related traumatic injuries consume health-care resources and are responsible for up to 40% of emergency department visits [9]. In SA, limiting the sale of alcohol has been considered a public health measure to reduce traumatic injury during the COVID-19 pandemic [10].

Kathryn M. Chu MD, Director, Jenna-Lee Marco MA, Research Assistant, Eytayo Omolara Owolabi PhD, Postdoctoral Fellow, Riaan Duvenage MMed, Head of Clinical Unit and Lecturer, Mukhethwa Londani MSc, Senior Data Manager, Carl Lombard PhD, Chief Specialist Statistician and Biostatistician, Charles D. H. Parry PhD, Director. Correspondence to: Professor Kathryn M. Chu MD, Department of Global Health, Stellenbosch University, Francie Van Zijl Drive, Tygerberg Hospital, Cape Town 7505, South Africa. Tel: +27 837770678; Fax: +27 21 938 9723; E-mail: kchu@sun.ac.za

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The first COVID-19 case in SA was confirmed on 5 March 2020 and on 27 March 2020, the national government declared a national state of disaster and instituted a hard (level 5) lockdown in an attempt to flatten the pandemic curve. This limited movement of non-essential persons, as well as decreased traffic into hospitals, freeing up beds for COVID-19 patients [11]. Throughout 2020, there were five lockdown levels all with varying limitations in movement and included social distancing measures [12]. In addition, up until December 2020, a national prohibition on the sale and purchase of alcohol was instituted twice, to reduce the volume of trauma in South African hospitals [13].

While several studies have confirmed trauma volume decreases during the first 6 months of the pandemic compared to pre-COVID-19 time periods, few have reported on the effect of alcohol prohibition on trauma [14–18]. The objective of this study was to examine the relationship between COVID-19 alcohol prohibition and trauma volume at a South African regional hospital.

Methods

Setting

The study site was Worcester Regional Hospital (WRH), a 277-bed, regional hospital, serving a catchment of over 600 000 persons in the Cape Winelands-Overberg region of the Western Cape province, SA [19]. WRH receives trauma referrals from seven surrounding rural health districts, each with its own district hospital, as well as from local health facilities from the Worcester geographic service area.

Design

This was a retrospective analysis of secondary data from the WRH electronic database, which is prospectively maintained for routine monitoring and evaluation. Patient information, including demographic, diagnoses, procedures and outcomes, were entered by the surgical team and checked weekly for accuracy.

Participants

General surgery trauma-related admissions and operations by the Department of Surgery from 1 January to 28 December 2020 of patients of all ages were included. Non-trauma admissions and operations were not included.

Alcohol ban period, lockdown levels and curfews

From 1 January to 28 December 2020, there were five lockdown levels restricting social movement with varying curfew times (Table 1). In addition, there were different restrictions on alcohol sales throughout the year. From 1 January to 26 March 2020, there were no restrictions on alcohol sales beyond the usual pre-COVID-19 regulations. There were two periods when alcohol sales were completely banned which were 27 March–31 May 2020 (levels 3–5 lockdown) and 13 July–16 August 2020 (level 3 lockdown) [13]. There were two periods of limited alcohol sales from 1 June–12 July 2020 (level 3 lockdown) and 17 August–28 December 2020 (level 2 and 1 lockdown) [20].

Data analysis

De-identified data were extracted from the WRH electronic database and imported into Stata 15 (College Park, TX, USA) for analysis. Trauma-related admissions and operations were coded by medical doctors. The primary outcomes of interest were total volume and incidence rates of trauma admissions and operations during the five calendar periods related to alcohol sales: (i) no ban (1 January–26 March 2020); (ii) complete ban 1 (27 March–31 May 2020); (iii) partial ban 1 (1 June–12 July 2020); (iv) complete ban 2 (13 July–16 August 2020); and (v) partial ban 2 (17 August–28 December 2020). Total volume of admissions and operations at three-weekly intervals were calculated and mapped onto lockdown periods. The time period 23–28 December 2020 was excluded because these dates fell outside the final 3-week interval. Since each time period had a different number of days, standardised rates were calculated by dividing the number of cumulative admissions or operations in each period by the number of days in each period and multiplying by 100 to give a rate per 100 days. Stab wound admission rates were compared across time periods as a proxy for intentional injury.

Poisson regression was used to model differences in trauma admission, stab wound admission and trauma-related operation rates for 2020. The incidence rate ratio (IRR) of alcohol ban periods were compared in three ways. Firstly, the no ban and partial ban periods were compared to the complete ban periods to determine differences between no/partial alcohol and complete alcohol prohibition. Secondly, the 5 periods were compared in chronologic order. Finally, the no ban (pre-COVID-19) period was compared to each of the four COVID-19 ban periods. *P* values <0.05 were considered statistically significant. In addition, Poisson regression was used to model differences in trauma admission, stab wound admission and trauma-related

Table 1. South African COVID-19 lockdown levels, curfews and alcohol ban periods for 1 January–28 December 2020

| Lockdown | Pre-COVID-19 No lockdown | Level 5 | Level 4 | Level 3 | Level 3 (modified) | Level 2 | Level 1 |
|---------------------|--|------------------|------------------|--|--------------------|---|---|
| Dates 2020 | 1 Jan–26 Mar | 27 Mar–30 Apr | 1 May –31 May | 1 Jun–12 Jul | 13 Jul–17 Aug | 18 Aug–20 Sep | 21 Sep–28 Dec |
| Curfew | None | 20:00–05:00 h | 20:00–05:00 h | 21:00–04:00 h | 21:00–04:00 h | 22:00–04:00 h | 00:00–04:00 h |
| Alcohol sales | Unrestricted alcohol sales subject to usual laws | No alcohol sales | No alcohol sales | Alcohol sales Monday to Thursday 09:00–17:00 h | No alcohol sales | Alcohol sales for off-site consumption Monday to Thursday 09:00–17:00 h | Alcohol sales for off-site consumption permitted Monday to Friday from 09:00–17:00 h; on-site consumption Monday to Sunday until curfew |
| Alcohol ban periods | No ban | Complete ban 1 | Complete ban 1 | Partial ban 1 | Complete ban 2 | Partial ban 2 | |

operation rates between 2019 and 2020 by time period.

Ethical approval

Ethics approval was obtained from Stellenbosch University Human Research and Ethics Committee (N20/08/044_COVID-19), as well as the Western Cape Department of Health (WC 202008_058). Since this was a secondary analysis of de-identified data, and there was no patient contact, informed consent was waived.

Results

There were 294 trauma admissions, 166 stab wound admissions and 178 trauma-related operations from 1 January to 28 December 2020. Figure 1 shows total admission and operation volume at WRH in 3-week intervals and their relationship with lockdown levels.

Total trauma admission rates

During the first period (no ban), there were 95 admissions per 100 days, 39 during the second period (complete ban 1), 74 during the third period (partial ban 1), 40 during the fourth period (complete ban 2) and 105 during the fifth period (partial ban 2) (Figure 2a). During COVID-19 periods, total trauma admission rates were significantly higher for the partial ban periods (partial ban 1 IRR = 1.88, $P < 0.001$; partial ban 2 IRR = 2.67, $P < 0.001$) compared to the complete alcohol ban periods (Table 2). Trauma admission rates decreased by 59% between the no ban and complete ban 1 periods, increased by 90% during partial ban 1, decreased by 46% during complete ban 2 and increased by 163% to pre-COVID-19 rates during partial ban 2 (Table 3). The no ban trauma admission rate was not significantly different from partial ban rates (partial ban 1 IRR = 0.78, $P = 0.107$; partial ban 2 IRR = 1.11, $P = 0.480$), but was significantly higher than the complete ban periods (complete ban 1 IRR = 0.41, $P < 0.001$; complete ban 2 IRR = 0.42, $P < 0.001$) (Table S1, Supporting Information).

Stab wound admission rates

During the no ban period, there were 53 stab wound admissions per 100 days, 23 during complete ban 1, 45 during partial ban 1, 17 during complete ban 2 and

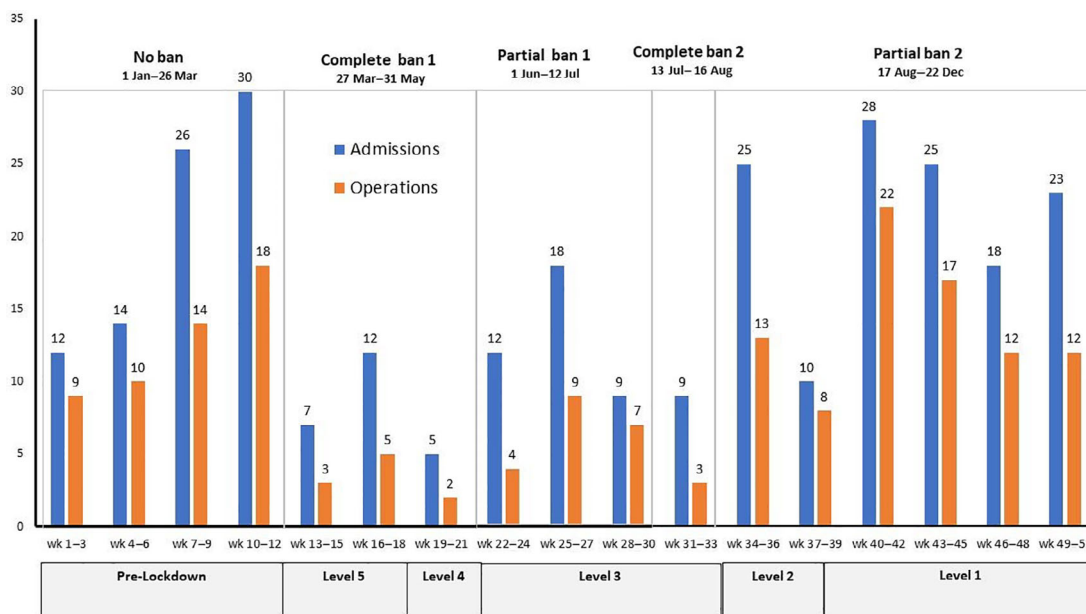


Figure 1. 2020 trauma admission and operation volumes by COVID-19 alcohol ban periods at Worcester Regional Hospital, South Africa.

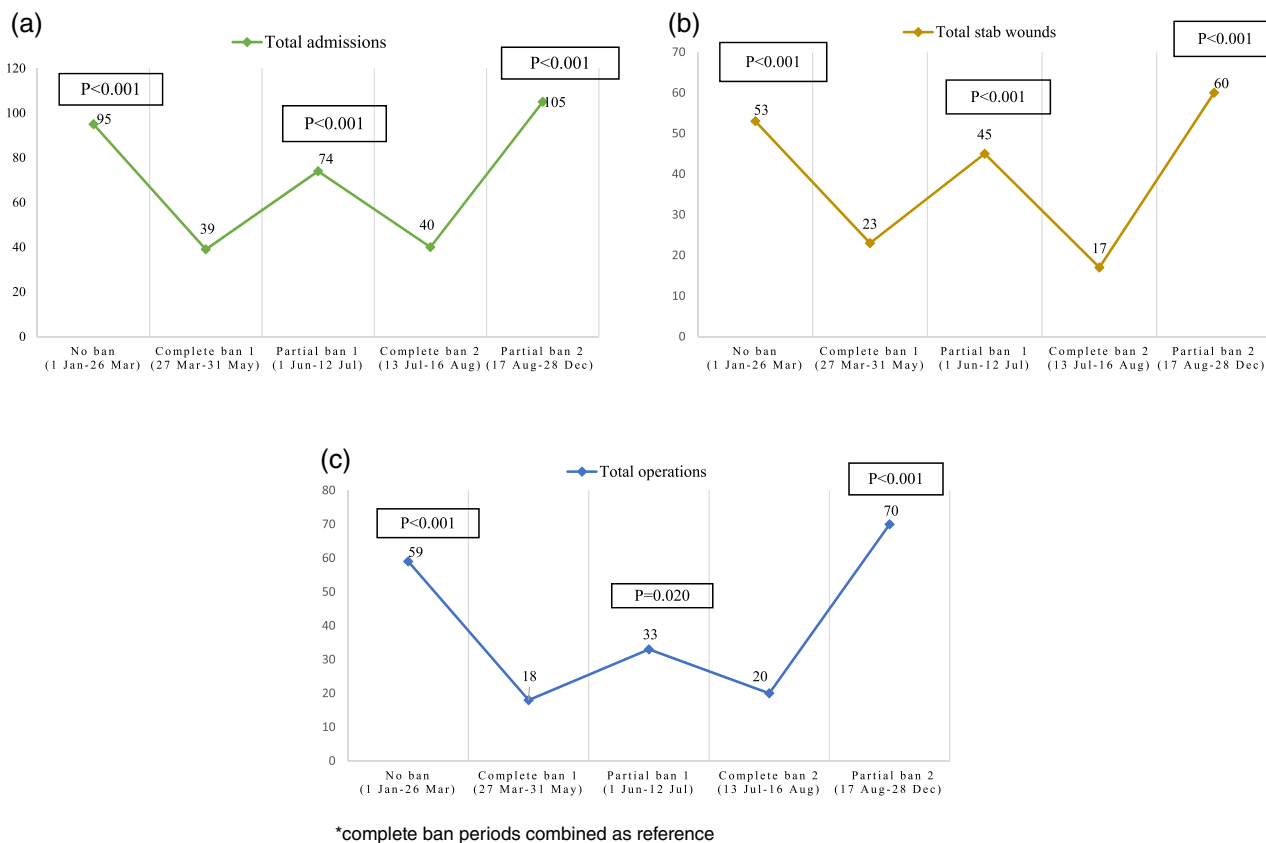


Figure 2. (a-c) Trauma volume rates per 100 days by COVID-19 alcohol ban periods*. [Correction added on 24 March 2021, after first online publication: Figures 2C has been replaced].

60 during partial ban 2 (Figure 2b). During COVID-19 periods, stab wound admission rates were significantly higher for the partial ban periods (partial ban 1

IRR = 2.25, $P < 0.020$; partial ban 2 IRR = 3.00, $P < 0.001$) as compared to the complete alcohol ban periods (Table 2). Stab wound admission rates

Table 2. Poisson regression models for trauma admission and operation rates per 100 days comparing complete COVID-19 alcohol ban with no/partial ban periods

| Time period | IRR ^a | 95% CI | P value |
|----------------------------------|------------------|------------|------------------|
| <i>Total trauma admissions</i> | | | |
| No ban | 2.41 | 1.78, 3.24 | <0.001 |
| Partial ban 1 | 1.88 | 1.36, 2.57 | <0.001 |
| Partial ban 2 | 2.67 | 1.98, 3.56 | <0.001 |
| <i>Stab wound admissions</i> | | | |
| No ban | 2.65 | 1.76, 3.99 | <0.001 |
| Partial ban 1 | 2.25 | 1.47, 3.44 | 0.020 |
| Partial ban 2 | 3.00 | 2.01, 4.48 | <0.001 |
| <i>Trauma-related operations</i> | | | |
| No ban | 3.11 | 2.07, 4.67 | <0.001 |
| Partial ban 1 | 1.74 | 1.09, 2.77 | <0.001 |
| Partial ban 2 | 3.68 | 2.48, 5.47 | <0.001 |

^aReference, complete alcohol ban periods. Statistically significant differences are marked in bold ($P < 0.05$). CI, confidence interval; IRR, incidence rate ratio. [Correction added on 24 March 2021, after first online publication: Tables 2 and 3 notes have been modified]

Table 3. Comparison of sequential calendar alcohol ban periods for trauma admission and operation rates per 100 days using Poisson regression

| Time period | IRR ^a | 95% CI | P value |
|----------------------------------|------------------|------------|------------------|
| <i>Total trauma admissions</i> | | | |
| Complete ban 1 | 0.41 | 0.28, 0.60 | <0.001 |
| Partial ban 1 | 1.90 | 1.29, 2.80 | 0.001 |
| Complete ban 2 | 0.54 | 0.36, 0.79 | 0.002 |
| Partial ban 2 | 2.63 | 0.82, 3.78 | <0.001 |
| <i>Stab wound admissions</i> | | | |
| Complete ban 1 | 0.43 | 0.27, 0.71 | 0.001 |
| Partial ban 1 | 1.96 | 1.18, 3.23 | 0.009 |
| Complete ban 2 | 0.38 | 0.22, 0.66 | 0.001 |
| Partial ban 2 | 3.53 | 2.06, 6.05 | <0.001 |
| <i>Trauma-related operations</i> | | | |
| Complete ban 1 | 0.31 | 0.18, 0.52 | <0.001 |
| Partial ban 1 | 1.83 | 1.03, 3.26 | 0.039 |
| Complete ban 2 | 0.61 | 0.35, 1.06 | 0.077 |
| Partial ban 2 | 3.50 | 2.13, 5.75 | <0.001 |

^aReference group is the prior period, that is, period 2 versus 1 (ref); period 3 versus 2 (ref); period 4 versus 3 (ref); period 5 versus 4 (ref). Statistically significant differences are marked in bold ($P < 0.05$). CI, confidence interval; IRR, incidence rate ratio.

decreased by 57% between the no ban and complete ban 1 periods, increased by 96% during partial ban 1, decreased by 62% during complete ban 2 and increased by 253% to pre-COVID-19 rates during partial ban 2 (Table 3). The no ban (pre-COVID-19) stab wound admission rate was not significantly different from partial ban rates (partial ban 1 IRR = 0.56, $P = 0.420$; partial ban 2 IRR = 1.13, $P = 0.510$) but was significantly higher than complete ban periods

(complete ban 1 IRR = 0.31, $P < 0.001$; complete ban 2 IRR = 0.32, $P < 0.001$) (Table S1).

Trauma-related operation rates

During the no ban period, there were 59 trauma-related operations per 100 days, 18 during complete ban 1, 33 during partial ban 1, 20 during complete ban 2 and 70 during partial ban 2 (Figure 2c). During COVID-19 periods, trauma-related operation rates were significantly higher for partial ban periods (partial ban 1 IRR = 1.74, $P < 0.001$; partial ban 2 IRR = 3.68, $P < 0.001$) as compared to the complete alcohol ban periods (Table 2). Trauma-related operation rates decreased by 69% between the no ban period and complete ban 1 periods, increased by 83% during partial ban 1, decreased by 39% during complete ban 2 and increased by 250% to pre-COVID-19 rates during partial ban 2 (Table 3). The no ban (pre-COVID-19) trauma-related operations rate was significantly higher than partial ban 1 (third period IRR = 0.56, $P = 0.008$) and complete ban periods (complete ban 1 IRR = 0.31, $P < 0.001$; complete ban 2 IRR = 0.34, $P < 0.001$) but not different compared to partial ban 2 (IRR = 1.19, $P = 0.333$) (Table S1).

Comparison to 2019

Overall, when compared to the 2019 data, total trauma admission, stab wound admission and operation incidence rates in 2020 were significantly less for complete ban and partial ban 1 periods but not for the no ban and partial ban 2 periods (Table S2, Supporting Information).

Discussion

This study demonstrated lower trauma admission and operation rates during alcohol prohibition compared to non-prohibition during the COVID-19 pandemic over a 1-year period. Each time a complete ban was instituted, there was a significant drop in trauma volume which was lost by allowing alcohol (even partial sales). Specifically, there was a 59–69% decrease in trauma volume between pre-COVID-19 and the first complete ban period. When alcohol sales were partially reinstated, trauma volume significantly increased by 83–90% then dropped again by 39–46% with the second alcohol ban. By the second half of 2020, when alcohol sales were partially allowed again, trauma volume increased by 163–250%, thus returning to pre-COVID-

19 levels. The pattern for intentional injury (using stab wounds as a proxy for intentional injury) was similar to the overall trauma admission and operation trends.

It could be argued that the relationship of the alcohol bans on trauma admissions and operations was merely the effect of restrictions or curtailment of mobility or the lifting of curfews/relaxing of hours. The effect of the changes in hours of curfew has, however, been shown to be negligible or moderate in a time series analysis of the effect of the alcohol sales ban on mortality. When the curfew was shortened during the complete alcohol ban, there was no change in the number of unnatural deaths. However, when the alcohol ban was subsequently partially lifted, unnatural deaths increased even with the same curfew hours [21]. While restrictions on mobility are important, particularly in terms of vehicular trauma, anecdotal evidence regarding what happened when the first complete alcohol ban was lifted further indicates that the availability of alcohol directly increases trauma volume, and then in mid-July 2020 when alcohol sales were prohibited, trauma presentations dropped sharply [22]. Our study also shows that partial bans have substantially less effect on reducing trauma volume compared to complete alcohol prohibition.

The COVID-19 pandemic has resulted in unprecedented national policy changes throughout SA. A major rationale for alcohol prohibition during the COVID-19 lockdown was to decrease the volume of persons with injury needing non-COVID-19 medical intervention, to create beds for COVID-19 patients [11]. In the USA where alcohol was not banned, there was an increase in alcohol-related trauma with risk factors possibly being stress and stay at home orders [23]. Since alcohol-related trauma can account for up to 40% of emergency department visits in SA, identifying policies to reduce injuries is paramount to free up space for hospitals to treat patients with COVID-19 who are also competing for ward beds, intensive care unit beds, ventilators, medical supplies and attention from doctors, nurses and other hospital staff [9]. Alcohol is known to be associated with intentional and unintentional injury and this study demonstrates that alcohol prohibition correlates with a decrease in health seeking behaviour for injury. For future pandemics or other situations where a reduction in traffic to health facilities is needed, this type of policy can be considered. However, given the hardships experienced by persons involved in the liquor manufacturing trade and retail sectors as a result of the prohibition on alcohol sales and also the difficulties experienced by persons with alcohol dependence who can no longer access alcohol, it might be preferable to also look at investigating the impact of a basket of less restrictive temporary interventions to try to achieve the same goal [24,25].

This study had several limitations. The first was that the national lockdown, which started the same day as the first complete alcohol ban, may have been a confounder in the initial decrease in trauma admission and operation volumes. However, our study showed that the lifting of the alcohol ban resulted in an immediate increase in trauma admissions suggesting alcohol prohibition likely had an independent effect. In addition, as SA moved from level 3 to level 1 lockdown, both trauma admission and operation incidence returned to pre-COVID-19 rates. The type and severity of all injuries were not captured and thus could not be compared across study periods. In addition, the absolute numbers of admissions and operations may have been too low to show a possible true effect of partial bans decreasing trauma volume. Finally, this was a single centre study, which could limit the generalisability of its findings. However, our findings are supported by Navsaria *et al.* who using data from five hospitals in the Western Cape compared trauma volume in the pre-lockdown period to the level 5 lockdown (complete alcohol ban) and found a greater than 50% decrease in trauma visits, which was not sustained after alcohol sales were partially allowed [16].

Conclusions

Our study demonstrates a clear trend of decreased trauma admissions and operations during complete alcohol prohibition compared to when alcohol sales were allowed or only partially restricted. These findings suggest that temporary, complete bans on alcohol sales can be used to decrease health facility traffic during national emergencies. Multi-centre studies are needed to better understand the specific contribution of alcohol prohibition compared to other public health measures such as social distancing, and lockdown restrictions.

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Conflict of Interest

The authors declared they have no conflicts of interest.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Table S1. Poisson regression models for trauma admission and operation rates per 100 days comparing pre-COVID-19 no alcohol ban with COVID-19 partial and complete ban periods.

Table S2. Comparison of trauma admission and operation rates per 100 days by time period, using Poisson regression, 2019–2020.