INVESTIGATING BLOOD ALCOHOL CONCENTRATIONS IN INJURY-RELATED DEATHS BEFORE AND DURING THE COVID-19 NATIONAL LOCKDOWN IN WESTERN CAPE, SOUTH AFRICA: A CROSS-SECTIONAL RETROSPECTIVE REVIEW

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Abstract

In South Africa, alcohol is a significant contributor to the burden of injury-related morbidity and mortality. Our understanding of its impact in injury-related mortality in the country is limited. The COVID-19 lockdown period in South Africa introduced restrictions that limited the legal access to the sale and on-site consumption of alcohol and presented a unique opportunity for examination of the impact of such restrictions on injury-related mortality. This study aimed to examine the relationship between blood alcohol concentrations (BAC) and injury-related deaths and to investigate the effect of the COVID-19 lockdown periods and alcohol restrictions on injury-related mortality and post-mortem BAC levels.

A retrospective cross-sectional analysis of BACs in all injury-related death cases admitted to mortuaries in the Western Cape (WC) province between 1 January 2019 to 31 December 2020 (inclusive) was conducted. Descriptive and inferential statistics were performed using STATA 13 (StataCorp, TX, USA), to investigate BACs in injury deaths before and during the COVID-19 lockdown periods in South Africa.

A total of 16,027 injury-related cases were admitted to forensic mortuaries in the WC province in the study period out of a total of 21,797 cases, with significantly fewer cases admitted in 2020 during the first two COVID-19 lockdown periods compared to the same period in 2019 (p<0.001). Samples were collected for BAC levels in 12,077 (75.4%) of injury-related cases and were most frequently requested in suspected homicide cases (85.2% of 8190). A positive BAC (≥0.01 g/100 mL) was found in 5,078 (42.2%) of the study sample. No significant difference was observed in the mean positive BAC between 2019 (0.18±0.1%) and 2020 (0.17±0.09%), except in the months of level 5 lockdown between April and May 2020, when there was a decrease in the mean positive BAC to 0.13g/dL in 2020 compared to 0.18g/dL for the same period in 2019. There was a 47.7% reduction in injury-related cases seen year on

year in the WC during the period of level 5 lockdown and full alcohol restriction in 2020 compared to 2019 however trauma cases increased later in 2020 during full alcohol restrictions.

The data presented in this study shows a decrease in injury-related deaths in the WC during the lockdown periods that coincided with alcohol bans and an increase following relaxation of restrictions on movement and alcohol sales. The data shows that the mean concentrations were similar between all periods of alcohol restriction compared to 2019, however, there were significantly fewer individuals with positive BACs in 2020 during complete alcohol sales restrictions than in 2019. This did, however, coincide with a smaller mortuary intake during the level 5 lockdown. The findings of fewer injury-related deaths and fewer positive BACs during lockdown periods coinciding with complete alcohol sales restrictions in 2020 should be taken into consideration to inform future decisions on alcohol control policy in the country.

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Abbreviations

AL	alert level
BAC	blood alcohol concentration
BIMS	Business Information Management System
COVID-19	Coronavirus disease 2019
DALYS	disability adjusted life years
FCL	Forensic Chemistry Laboratory
Fig	Figure
FPO's	forensic pathology officers
FPS	Forensic Pathology Service
GDP	gross domestic product
HED	heavy episodic drinking
LIMS	Laboratory Information Management System
LMIC	low and middle-income countries
NHA	National Health Act
RTC	road traffic collisions
SA	South Africa
SAMRC	South African Medical Research Council
SANAS	South African National Accreditation System
SAPS	South African Police Service

SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SEGs	socioeconomic groups
UCT	University of Cape Town
UK	United Kingdom
WC	Western Cape
WHO	World Health Organisation

Chapter 1: Introduction and literature review

Background

The perilous effects of the consumption of alcohol have long been reported. Historically, alcohol consumption has been a large part of South African (SA) farm life since colonisation by Dutch settlers in the 17th century.[1] Inexpensive wine was used as payment for work performed by manual labourers on wine farms, colloquially known as the 'dop system'.[2] More recently, a complete prohibition of the sale and on-site consumption of alcohol[1] was instated in SA during the nationwide lockdown in March 2020, due to the pandemic caused by the Coronavirus disease of 2019 (COVID-19).[3] The World Health Organisation (WHO) lists alcohol as one of the leading risk factors for population health worldwide.[4] WHO further reports a negative relationship between socioeconomic status and alcohol-attributable mortality with the harm-per-litre of alcohol being much greater for drinkers who are poor.[4].

Alcohol and the economy

Organised crime and the informal economy impacted the sale and distribution of alcohol in the Western Cape (WC) province of SA.[5] The liquor industry was estimated to contribute 4.4% of the Gross Domestic Product (GDP) in SA in 2016, which amounted to an estimated R106.1 billion that year.[6] The illicit alcohol trade was estimated to account for 12% of the total industry market value in SA in 2021.[7] According to the World Health Organisation (WHO) Global Alcohol Action Plan released in June 2021, an estimated 25% of total alcohol consumption worldwide is due to informal and illegal alcohol production.[8] These informal practices are associated with significant health risks and are often embedded in cultural

[1] Alcohol refers to ethanol

traditions, thus presenting a challenge to regulatory attempts by the relevant government departments.[8]

Worldwide, the average consumption of pure alcohol (defined as 100% ethanol) is 6.2 litres per adult annually.[9] The consumption of alcohol has profound economic and social ill-consequences with a detrimental net effect on health accounting for 3.8% of all deaths and 4.6% of disability-adjusted life years (DALYS) globally.[9] The economic impact of excessive consumption of alcohol was estimated to be approximately US$746 per person in the United States in 2006,[10] and approximately R37.9 billion in SA in 2009.[11] Most of this was attributed to heavy episodic or 'binge' drinking. These cost estimates would have been substantially higher had the intangible costs like pain, suffering and bereavement been taken into consideration.[10] The economic impact of excessive alcohol consumption was shown to be comparable to two other social ills: smoking and physical inactivity,[10] however economic analysis by the WHO showed higher returns on investment in alcohol control, compared with tobacco control and prevention of physical inactivity.[8]

In SA, previous interventions fell short of addressing the greatest causes of harm from alcohol as the focus was on the contribution of alcohol to the economy rather than on the costs of alcohol-related harms.[11] Future policy should be guided by reliable evidence regarding the on-going realistic costs thereof.

Relationship of alcohol with trauma

Alcohol plays a significant role in trauma and injury in SA. Matzopoulos et al. (2015) reported high levels of alcohol-related harm and violence in the Northern and WC provinces of SA.[12] This was also observed internationally as reported by Macdonald et al. (2005) who found a significant dose-response relationship between BAC levels and violence in their study of

patients in emergency rooms across six countries.[13] A causal role of alcohol in violence-related injuries, which included homicide victims was reported by Slater et al. (2006), with a further report of half of all homicide victims being under the influence of alcohol at the time of their death.[14,15] Additionally, alcohol-attributable homicide rates were reported to be highest in low and middle-income countries (LMICs).[16]

The media's underreporting of the contribution of alcohol to serious and fatal injuries may reduce the perception of alcohol-related risks by the public, which may also influence the public's support of more stringent control policies.[14] The availability and attitudes towards alcohol, especially the acceptance of drinking as normal behaviour, represent the underlying problem and requires urgent attention.[17] This is also observed in SA, where heavy drinking on weekends is socially accepted for both men and women and is viewed as recreational.[18]

Drinking habits and violent behaviour may be linked to the 'night-time economies' phenomenon, which refers to the longer times available during after-hour periods and weekends which may be conducive for excessive drinking.[19] Countries with policies that reduced the availability and affordability of alcohol are reported to have fewer alcohol-attributable homicides.[16] This presents a strong argument for strategies such as increasing alcohol taxes and limiting days of sales in the response to curbing alcohol-related harms.

A study examining the effects of alcohol retail outlet density and harm in Victoria, Australia, found a strong positive association between packaged outlet density and incidence rates of hospital admissions caused by chronic diseases related to alcohol.[20] Positive associations were also found between rates of hospital assault admissions and density of general and packaged liquor outlets. This theory could apply in SA, especially considering the majority of liquor outlets in the country are informal shebeens operating in densely populated informal settlements.[21]

Alcohol use, socio-economic groups and gender

Alcohol consumption patterns differ between socioeconomic groups (SEGs).[22] This is particularly problematic in SA, where socioeconomic disparity is rife. Individuals from lower SEGs have a lower frequency of consuming alcohol but reportedly drink much more heavily than those in higher SEGs.[22] As mentioned previously, alcohol-attributable homicide rates are also highest in LMICs.[16] Probst et al. (2015) reported that one in every ten deaths in SA were attributable to alcohol, with 60% of cases in low SEGs, and 25% and 15% in middle and high SEGs respectively.[22]

Heavy drinking behaviour may further result in risky sexual behaviour, often with casual partners and without condom use, which contributes towards gender-based violence.[18] The link between alcohol and gender-based violence has been previously established,[18,23] and has been highlighted by President Cyril Ramaphosa during his national address in June 2020 as a 'war waged against women and children' in SA.[24] Here, he stressed the need to examine the effect of alcohol abuse on violence and its contribution to violent crimes against women and children. In examining the role of alcohol in female homicides in the WC PROVINCE of SA, Mathews et al. (2020) found that 62% of women who were murdered had high BACs at the time of their death.[25] It has been hypothesised that the intoxication rates between victims and offenders are comparable and are both important in gender-based violence.[19]

Injury-related death and post-mortem alcohol analyses

In SA, violent deaths as a result of accidental, homicidal or suicidal circumstances, as described by the National Health Act of 2003 (NHA),[26] and the medicolegal investigation thereof, as mandated by the Inquests Act of 1959,[27] require a post-mortem examination.[27] Ethanol analysis (usually in the form of blood alcohol concentration or BAC) is performed in the

majority of these cases to assess the possible role of alcohol intoxication or impairment in the death. While alcohol may play a role in any unnatural death; deaths due to road traffic collisions (RTCs), pedestrian vehicular accidents and railway accidents may particularly be influenced by alcohol impairment due to the inherent risks associated with these environments. Alcohol consumption was found to be a significant risk factor for both passenger and pedestrian rail fatalities during daylight hours in a study performed at two mortuaries in Cape Town, SA.[17] Pedestrian rail fatalities referred to those resulting from people accessing the railway lines illegally and at level crossings.[17] The increased alcohol-associated risks in rail fatalities highlighted the need to diversify interventions and not focus exclusively on motor vehicle drivers.[17] Similarly, in a retrospective study of RTCs that occurred between 2007 and 2012 in Ga-Rankuwa, SA, driver and pedestrian vehicular accident victims were found to be significantly more intoxicated compared to passenger victims, with a mean BAC of 0.20 ± 0.13 g/100 mL found in all subjects.[28]

In a recent WC Injury Mortality Profile, which described unnatural and injury-related deaths from 2010 to 2016, 45% of homicide cases in which BAC analysis was requested had positive alcohol concentrations equal to or above the current SA legal driving limit of 0.05 g/100 mL.[29] This report concluded that violence and alcohol abuse were key factors underlying the high injury mortality burden in the WC. Evidently, a further WC study showed 41% of violent death cases autopsied between August and October 2015 tested positive for alcohol,[30] while another study performed two years later on RTC cases in five mortuaries in the WC found 54% of cases were positive for alcohol. Of the positive cases in this study, most had a BAC between 0.15 and 0.29 g/100mL.[31] The limited research data in SA is emphasised by Govender et al. (2021) in their 3-year review of the extent of the contribution of alcohol to driver intoxication and risk for fatal crashes in SA.[32] They stressed an urgent need for review and revision of the measurement of driver intoxication in fatal crashes and highlighted the negative impact of such

limited data on the development of policy and control measures with consequences for individuals, families and society.[32] There are important shortcomings in the current measurement of alcohol intoxication as the attribution for fatal crashes, resulting in an arguably gross underestimate of its likely prevalence and impact on both crashes and fatalities.

Swart et al. (2015) also reported an association with alcohol and violent death, specifically in adolescent homicides in Johannesburg.[33] Kuhns et al. (2011) in a meta-analysis of alcohol study findings in homicide victims found 48% of homicide victims tested positive for alcohol.[19] In a 2019 toxicology study of violent fatalities in Cape Town, 92 of 104 cases (88%) were homicides.[30] Considering the high rate of homicide and other violence in SA, the extent of this relationship deserves further investigation and scrutiny.

SARS CoV-2 and the alcohol ban

In January 2020, a novel Coronavirus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS CoV-2), was identified following a report of cases of a respiratory disease of unknown aetiology from Wuhan City, Hubei Province, China.[34] The virus spread swiftly across the globe, resulting in the WHO declaring the outbreak a pandemic on 11 March 2020.[35] The first cases were identified in SA on 5 March 2020, resulting in the declaration of a State of Disaster on 15 March 2020.[36,37] A National Lockdown was declared consisting of five alert levels (AL) (Table 1)

Alert level 5	Drastic measures to contain the spread of the virus and save lives.
Alert level 4	Extreme precautions to limit community transmission and outbreaks, while allowing some activity to resume.
Alert level 3	Restrictions on many activities including at places of work and socially, to address a high risk of transmission.

Alert level 2	Physical distancing and restrictions on leisure and social activities to prevent a resurgence of the virus.
Alert level 1	Most normal activity can resume, with precautions and health guidelines followed at all times.

Table. 1. Lockdown alert levels and objectives in South Africa during the COVID-19 pandemic (adapted from SA National Government) [38]

All non-essential businesses aside from those declared emergency services were closed.[38] This included the restriction on the sale, on-site consumption and transportation of alcohol. This total restriction on alcohol remained in place for 11 weeks until 1 June 2020, when the sale of alcohol for home consumption was permitted under specified conditions.[39] Six weeks later, on 12 July 2020, during a presidential address to the nation, President Cyril Ramaphosa reported that there was clear evidence that the resumption of alcohol sales had resulted in substantial pressure being placed on hospital trauma and intensive care units due to violence-related trauma and motor vehicle collisions, and as a result, the full prohibition on the sale of alcohol was reinstated.[40] The President had highlighted this issue in his previous address on 17 June 2020, stating that while alcohol does not itself murder people, violent men do when intoxicated with alcohol.[24] The President explicitly highlighted the need to learn lessons from this lockdown period in order to protect our society from the abuse of alcohol, and address alcohol-related violent behaviour with urgency.[24] The reinstated full ban on the sale, on-site consumption and transport of alcohol remained in place for just over a month from 12 July 2020 to 17 August 2020. Alcohol sales subsequently resumed on 18 August 2020. Along with alcohol restrictions, curfews were instated that limited non-essential movement of people. A further temporary alcohol sales ban was instituted on 29 December 2020 until 2 February 2021. These periods of restriction of legal access to alcohol presented unique opportunities to study the relationship of alcohol to violent behaviour in the country.

Unexpectedly, since the start of the Coronavirus Disease 2019 (COVID-19) pandemic, alcohol has been drawn into the spotlight in many countries globally. One of the reasons for this is due to the ban of alcohol during periods of lockdown in countries including Thailand, India and Kenya.[41] The additional load placed by COVID-19 patients on hospitals has resulted in governments' attempts to reduce the trauma load by limiting the access to sales and consumption of alcohol. As a result, the relationship between alcohol and violence was brought into the spotlight during this time, particularly regarding the consequent impact on trauma units.[42]

The period of national lockdown and the alcohol restrictions presented an opportunity for trauma units to assess whether there was a relationship between alcohol use and trauma trends. In a study by Chu et al. (2022) conducted at Worcester regional hospital in SA, a 59-69% decrease in trauma volume in the initial period of a complete alcohol ban was observed with no significant change when the curfew was shortened.[43] Trauma volumes subsequently significantly increased by 83-90% (p<0.001) when alcohol sales were partially reinstated.[43] Similarly, a report by Navsaria et al. (2021) revealed an overall trend of reduced patient numbers visiting trauma units during the level 5 lockdown period of April and May 2020 with a general decrease in road traffic injury admissions between February and June 2020 at Groote Schuur Hospital, a large academic hospital in Cape Town.[42]

A recent report in priority areas in the WC stated that the most common perceived reason for decreases in homicides during the lockdown was the alcohol ban, with the majority of participants feeling the alcohol ban had contributed to a reduction in all violent crimes.[44] The rationale behind this was the reduced opportunity for social interactions combined with problematic alcohol consumption due to the closure of shebeens, bars and taverns.[44] Anecdotal evidence indicated that violent crime, especially homicide and attempted homicide, had shown a decrease during the level 5 lockdown period and had increased following

relaxation of restrictions on alcohol and movement at the beginning of June across the country.[24]

Similar alcohol related restrictive policies were implemented during lockdown in Mexico, including dry laws and the control of its availability; the rationale being the risk of violence and failure to follow social distancing guidelines associated with alcohol use.[45] In North America and Canada, where there were no alcohol bans, Stockwell et al. (2021) described the impact of alcohol, finding an increased risk of severe pulmonary infections, child abuse, domestic violence, depression and suicide. The authors recommended restrictions on alcohol prices, availability and marketing.[46] India, which also experienced a state of prohibition during their lockdown period, observed an increase in severe alcohol withdrawal syndrome in the city of Bangalore.[47] Mahadevan et al. (2021) thus argued against the recommendations of Stockwell et al. (2021), advocating for sustained incremental changes in restrictions on alcohol availability rather than quick changes in policy due to the experience in India.[48]

In sharp contrast to the alcohol bans and dry laws in Mexico, India and SA; Australia and the United Kingdom (UK) declared outlets selling alcohol for off-site consumption as essential services, and as such these outlets remained open, while bars, restaurants and pubs were closed during the lockdown in these two countries.[49] This resulted in increased drinking in the home with consequent negative impacts on health and social welfare which prompted Reynolds et al. (2020) to recommend the availability of alcohol for home consumption be critically examined, specifically referring to licensing and legislation.[49] A 2016 Home Office review in the UK showed that substance misuse was involved in more than half of domestic homicides.[50] This strong association between the use of alcohol and drugs and domestic violence makes the increasing alcohol sales during the pandemic in the UK particularly concerning.[51]

The COVID-19-enforced quarantines were noted to have a negative impact on social welfare, specifically relating to intimate partner violence. Van Gelder et al. (2020) reported that isolation, quarantine and associated financial and emotional stressors, increased the risk of intimate partner violence.[52] An online survey conducted in India found that 4.5% of respondents reported spousal violence beginning during the COVID-19 lockdown.[53] Of those who had reported violence preceding the lockdown, 77.6% reported an increase since lockdown had begun.[53] Similar results were found by Maji et al. (2021) who examined the reporting of domestic violence incidents in India during the lockdown period and found an increase in reports compared to previous years.[54]

In contrast to the findings of increasing domestic violence in India during lockdown periods, local data showed a decrease of 68.4% of reported domestic violence cases in the country during the lockdown period 27 March 2020 to 19 May 2020 when compared to the same period in the previous year.[44] Possible reasons for this stark difference may have been the inability of victims to report incidents during this period if they were unable to recognise domestic violence or disclose this to their abuser as a valid reason for leaving the house during the stringent lockdown regulations, if they faced fear of confrontation by police or fear of contracting COVID-19. .[44] Aside from domestic violence, which does disparately affect women, it is important to consider the general impact of the lockdown on women.

Parry et al. (2021) examined the early effects of the COVID-19 pandemic on women in the SA context and found women were negatively impacted in the home, workplace and the general economy due to inequitable gendered practices.[55] The psychological impact of COVID-19 and the lockdown has been examined by Stanton et al. (2020) via an online survey.[56] Physical activity, sleep, alcohol, and smoking were reported to have been impacted negatively and to have associations with depression, anxiety and stress[56]. Those who reported a negative change in alcohol intake were more likely to have higher depression, anxiety, and stress symptoms.

Conclusion

The evidence shows that alcohol is a notable contributor to violence and death in SA and indeed the world and needs to be addressed with urgency. Alcohol is reported to have a greater impact on people in low SEGs, especially those living in LMICs and women.

The SARS-CoV2 pandemic and resultant lockdown periods with limitation of legal access to alcohol sales provides us with a unique period to study the impact of alcohol and demands urgent and in-depth investigation. Our response to future health systems crises due to overloading from admissions due to acute COVID-19 infections and other pandemics require on-going public health management protocols and updated data to inform policy.

The aim of this study was to investigate the role of alcohol in injury-related deaths in the WC between 2019 and 2020 and to examine the effect of the restricted alcohol sales during the COVID-19 national lockdown period in 2020 on blood alcohol concentrations in injury-related deaths in the WC. The objective was to explore whether the alcohol ban in SA was associated with a reduction in injury-related mortality.

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Chapter 2:

Manuscript

Investigating blood alcohol concentrations in injury-related death before and during the COVID-19 national lockdown in Western Cape, South Africa: A cross-sectional retrospective review

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Abstract

Background: Alcohol[2] is a significant contributor to the burden of injury-related morbidity and mortality in South Africa. During the COVID-19 global pandemic, restrictions to movement and to the legal access of alcohol, were introduced in South Africa (SA). The COVID-19 lockdown presented a unique opportunity for examination of the impact of these restrictions on injury-related mortality. The aim of this study was to investigate the effect of alcohol bans during the COVID-19 lockdown periods on injury-related mortality and the blood alcohol concentrations (BAC) in these unnatural deaths.

Methods: A retrospective, cross-sectional analysis of unnatural deaths in Western Cape (WC) province between 1 January 2019 to 31 December 2020 was conducted to investigate injury-related mortality and BACs in the cases for which blood was submitted for ethanol analysis, during these periods. Injury-related deaths and BAC were examined according to the periods of lockdown and alcohol restrictions.

[2] Alcohol refers to ethanol

Results: A total of 16 027 injury-related cases were admitted to Forensic Pathology Service mortuaries in the WC over the two-year period. Of these, 12 077 (75.4%) had blood specimens collected for BAC. Where blood specimens were collected, a positive BAC (≥0.01 g/100 mL) was identified in 5 078 (42.2%) of cases. Significantly more individuals had no alcohol detected in 2020 (64.0%) compared to 2019 (57.9%) (p<0.001). No significant difference was observed in the mean positive BAC between 2019 and 2020, except in the months of April and May when there was a drop in the mean positive concentration of 0.13 g/100 mL in 2020 compared to 0.18 g/100 mL for the same period in 2019. There was a 47.7% reduction in injury-related cases seen year on year in the WC during the period of full alcohol restriction and level 5 and 4 lockdowns in 2020 compared to 2019.

Conclusion: The data shows that the mean concentrations were similar between all periods of alcohol restriction compared to 2019, however, there were significantly fewer individuals with positive BACs in 2020 during complete alcohol sales restrictions than in 2019. This did however coincide with a smaller mortuary intake during the level 5 and 4 lockdown periods. There was a clear decrease in injury-related deaths in the WC during the COVID-related lockdown periods that coincided with the alcohol ban and restriction of movement and an increase following relaxation of restrictions on alcohol sales and movement.

Keywords: Alcohol, blood alcohol concentration, COVID-19, lockdown, South Africa, violent death, Western Cape

Introduction

Alcohol is an important contributor to morbidity and mortality globally, with the World Health Organisation (WHO) reporting that significant health risks are associated with alcohol consumption.[1,2] In June 2021, the WHO declared the protection of health of populations and the prevention and reduction of the harmful use of alcohol a public health priority.[2] Locally,

the South African Government acknowledged alcohol as an important contributor to violent crime and domestic violence,[3] providing alcohol related harms interventions at public health and social service facilities in the WC province[4] which were detailed in the Alcohol Harms Reduction Policy White Paper published in 2017.[5] To assess efficacy of proposed interventions, it was critical for health and government agencies to have access to updated and relevant data on the impact of alcohol on health outcomes to guide their policies and implementation strategies.

In March 2020, the WHO declared COVID-19 a global pandemic which prompted lockdowns restricting movement in many countries.[6] In SA, the National Government authorised five different lockdown alert levels (AL) with various restrictions on movement, economic activity and alcohol and tobacco sales.[7] During AL 5 and 4, only essential travel was permitted under very specific circumstances and all sales of alcohol and tobacco were banned. During AL 3, restricted trade of alcohol and on-site consumption was permitted with less stringent movement restrictions and a curfew required people to be confined to their place of residence between 22h00 and 04h00 daily. A complete ban of alcohol sales and on-site consumption was re-introduced halfway during AL 3 in July 2020, splitting AL 3 into levels 3a and 3b, and again from 29 December 2020 to 2 February 2021. AL 2 and 1 allowed normal trade of alcohol with a curfew of 23h00 to 04h00 in AL 2 and 00h00 and 04h00 in AL 1. This provided a unique opportunity to examine the effect of alcohol restrictions on injury-related mortality.

Investigation of the effect of alcohol restrictions and lockdown on trauma in SA hospitals showed a 53% reduction in hospital presentations in a major academic hospital and 59-69% reduction in a regional hospital.[8,9] Similarly, a decrease of 23.3% in alcohol-related cases presenting to trauma units was reported in the Netherlands during lockdown and alcohol restrictions.[10] Deaths due to unnatural causes in SA decreased by at least 120 cases per week during the alcohol sales ban.[11] This study therefore aimed to investigate the role of the

COVID-19 lockdown periods on blood alcohol concentrations (BAC) to determine whether the alcohol restrictions were associated with reduced injury-related mortality and changes in BAC in these fatalities in the WC province between 2019 and 2020. The rationale for this research was to provide updated mortality data involving alcohol and violence to guide policy and interventions, and to further contribute to the evidence available on reducing alcohol availability as a mechanism to reduce trauma cases.

Methods

Study setting

The WC is one of nine provinces in SA, with a population of just over 7 million people, approximately 11.8% of the total population of the country.[12] The female to male ratio in the country is 51% female and 49% male.[13] In SA, provincially based Forensic Pathology Services (FPS) are mandated to support the South African Police Service (SAPS) in investigating deaths that are classified as unnatural or sudden and unexpected, according to the National Health Act of 2003 (NHA),[14] and as mandated by the Inquests Act (Act 58 of 1959).[15] This support includes obtaining any relevant history pertaining to the death, the performance of an autopsy by an authorised medical practitioner, and the collection of relevant forensic evidence and specimens.[14]

In the WC, FPS performs this function through 16 mortuary facilities, of which the two in the Cape Town metropole receive approximately 80% of the annual caseload (>8 000 deaths). Altogether, the 16 mortuaries typically receive an annual caseload of approximately 11 000 unnatural death cases.[16] These include homicides, suicides, accidents (including road traffic collisions (RTCs)), sudden and unexpected and procedure-related deaths.[14] At post-mortem,

specimens are collected at the discretion of the authorised medical practitioner for ancillary investigations such as the analysis of alcohol (ethanol) in blood.

During the routine performance of post-mortems, blood specimens were drawn from decedents, placed into a glass vial containing sodium fluoride and potassium oxalate, and submitted to the National Health Forensic Chemistry Laboratory (FCL) for ethanol concentration determination. The site of blood collection (central versus peripheral) was not recorded; however, peripheral blood specimens are recommended for collection. At the FCL, BAC testing is performed using headspace sampling and gas chromatography with flame ionisation detection according to national standards. Note that no BAC analyses were performed by the authors themselves.

Study design

This study was a descriptive, cross-sectional and retrospective study of post-mortem BACs obtained from deceased persons who died from injury-related deaths across the WC province between 1 January 2019 and 31 December 2020 (inclusive).

Sample population

All deaths that were due to traumatic injuries in the WC province between 2019 and 2020 were included. This included all suspected homicide, suicide, and accident cases, including road traffic deaths. All injury-related death cases in which specimens were collected for alcohol analysis were then further investigated. All deaths that were deemed to be of natural causes were excluded from this study. The cases not classified or unconfirmed to be injury-related were also excluded, amongst which were fragmented human remains, as well as non-viable

and abandoned foetuses. Cases where specimens for BAC were withdrawn, not submitted, discarded, or not processed due to drying, were excluded.

Data collection and analysis

Mortality data were collected from the FPS Business Information Management system (BIMS). This system contains routinely recorded data that is uploaded by Forensic Pathology Officers (FPOs) at all the WC mortuary facilities. Only key variables are recorded in this database, and thus the study was limited to the variables that were routinely collected. Cases were identified according to the external mechanism of injury and/or cause of death. Variables were collected for all injury-related deaths and included demographics (age, sex, and mortuary of autopsy); death information (date, time, manner, external mechanism of injury, and cause of death); and toxicological data (BAC and other drug analyses and results). BAC data was obtained from the National FCL laboratory information management system (LIMS). Where variables were not clearly stated in the BIMS/LIMS databases, these were stated as 'unspecified'.

All data was analysed using the statistical package STATA 13 (StataCorp, TX, USA) with regards to demographics, circumstances of death, and BAC results. Frequency distributions were developed for all categorical data. Frequency distributions between years were analysed for significant differences using the Pearson's Goodness of Fit test. Pairwise differences were assessed using Bonferonni correction. Numerical data was analysed with the Shapiro Wilk test to determine if the distribution was normal. No data showed a normal distribution, therefore differences between groups were analysed using the Wilcoxon sum rank test for two group comparison and the Kruskal Wallis test for multiple group comparison. The level of significance was set at 0.05 for all statistical tests.

COVID-19 lockdown levels and alcohol restriction

Data was assessed according to lockdown levels and periods of alcohol restrictions (Table 2).

Table 2. COVID-19 lockdown levels and periods of alcohol restriction in South Africa (Mar 2020 – Feb 2021) (adapted from SA National Government)

Lockdown level and alcohol ban	Dates
Lockdown level 5	27 March 2020 – 30 Apr 2020, 28 Dec 2020 – 2 Feb 2021
First complete alcohol sales ban	27 March 2020 -24 May 2020
Lockdown level 4	1 May 2020 – 30 May 2020
First partial alcohol ban	25 May 2020 – 11 July 2020
Lockdown level 3a	1 June 2020 – 11 Jul 2020
Second complete alcohol sales ban	13 July 2020 – 14 Aug 2020
Lockdown level 3b	13 July 2020 – 14 Aug 2020
Lockdown level 2	15 Aug 2020 – 19 Sep 2020
Second partial alcohol ban	15 Aug 2020 – 27 Sep 2020
Lockdown level 1	20 Sep 2020 – 17 Dec 2020
Third complete alcohol sales ban	29 Dec 2020 – 2 Feb 2021

Ethics

The study commenced after obtaining ethical approval from the University of Cape Town (UCT), Health Research Ethics Committee (HREC 751-2020), as well as the WC Health Ethics Committee. In addition to this, approval was obtained from the Director of FPS in the WC and the Head of the Division of Forensic Medicine and Toxicology at UCT.

Results

Prevalence of injury-related cases in the Western Cape

A total of 21 796 autopsies were conducted in WC between 1 January 2019 and 31 December 2020. Of these 16 027 (73.5%) were injury-related deaths [70.7% of 11 832 cases in 2019, and

75.5% of 10 147 cases in 2020] (Table A1). A significantly greater proportion of injury-related deaths was observed overall in 2020 (p<0.001). The distribution of cases between the two years in relation to lockdown levels and alcohol restrictions is presented in Fig. 1. In total, significantly fewer cases were admitted at each mortuary in 2020 than in 2019 (p<0.001), with most of the deaths over the two years occurring within the Cape Town metropole (73.3%). There was a 15.7% decrease in total unnatural death admissions, and on average a 47.7% decrease in injury-related cases during lockdown AL 5 and 4 (April -May 2020) (Fig. 1).

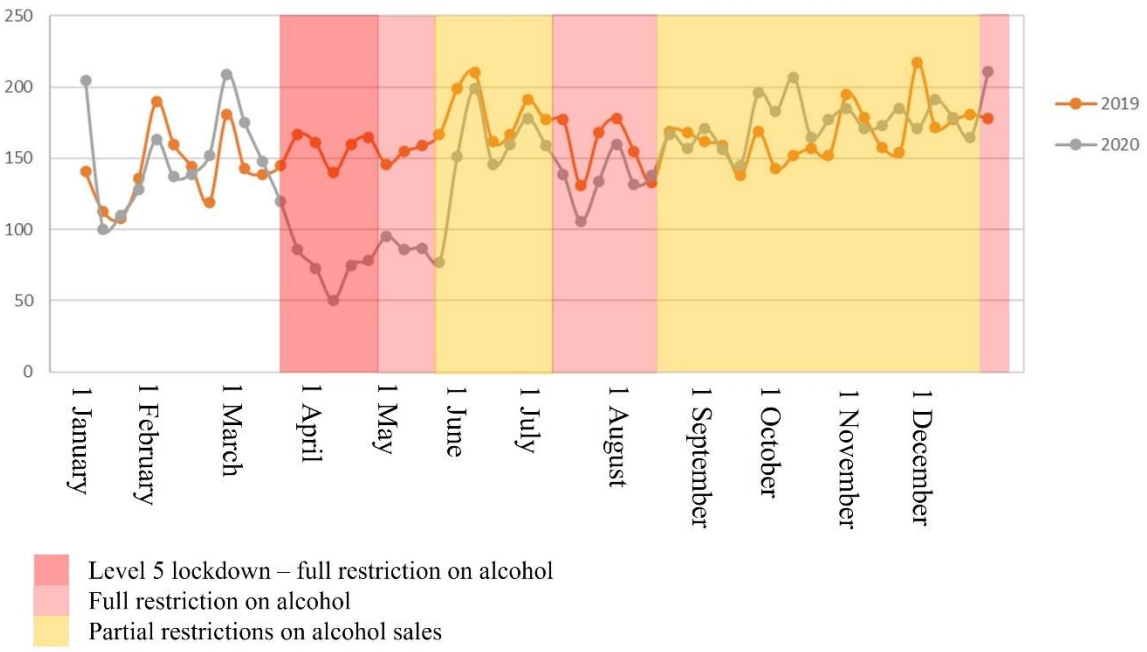
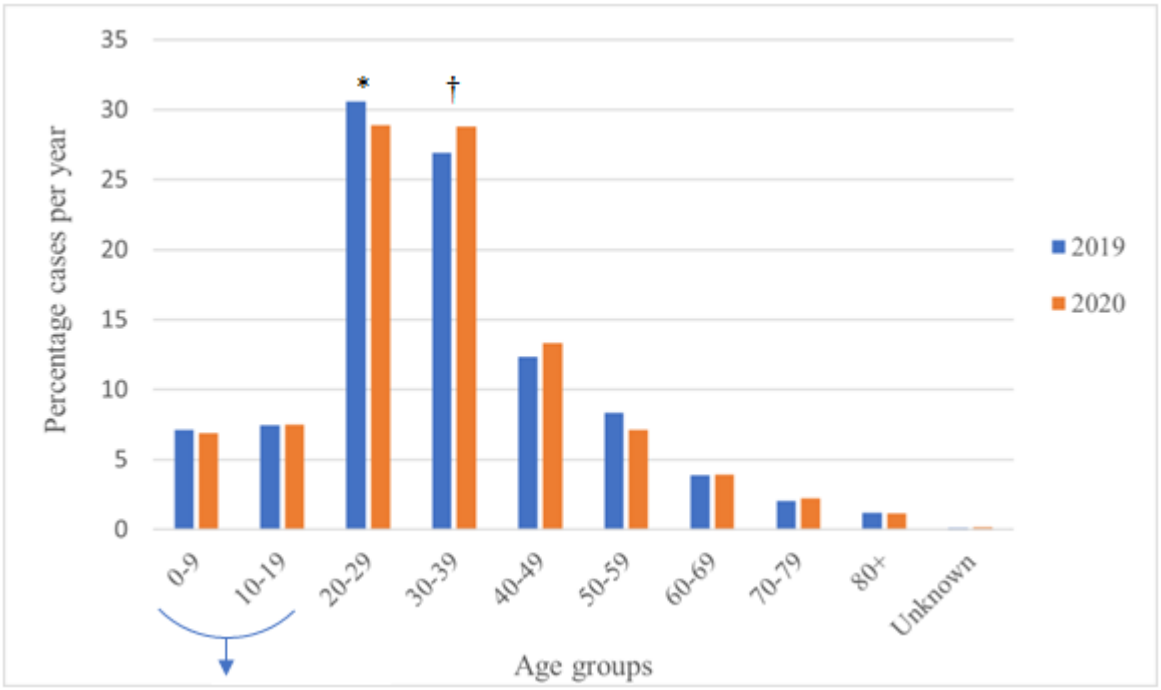


Fig. 1. Weekly injury-related deaths in the Western Cape between 1 January 2019 and 31 December 2020 showing levels of alcohol restriction and lockdown in 2020.

Demographic and case data of injury-related deaths

Where age was reported in injury-related deaths during the two years (99.9%), the mean age was 33 years (SD = 16.3 years; range = 1 day to 97 years). Most individuals were young adults aged between 20-29 years (n = 4 771, 29.8%) and 30-39 years (n = 4 460, 27.8%) (Fig. 2). The distribution of paediatric deaths (<18 years) differed between 2019 and 2020 (p=0.0337), primarily due to an observed increase in deaths involving 6–12-year-olds in 2020 (p=0.038)

(Fig. 2). In 2020, there was a significant decrease for those in the 20–29-year age group and a significant increase in the 30-39-year age group.



*Significant decrease (p<0.007)
†Significant increase(p=0.038)

Age distribution of children per year. N (% year)

Age	**2019**	**2020**
<1	344 (36.5)	280 (33.0)
1-5	174 (18.4)	156 (18.4)
6-12	139 (14.7)	152 (17.9)
13-17	284 (30.1)	260 (30.6)
Total:	**1072**	**952**

Fig. 2. Percentage distribution of injury-related cases per year by age group

Most injury-related deaths were males (n = 13 144, 82.1%) with no significant difference in the distribution of sex between the years (p=0.162). Cases of unknown sex accounted for less than 1% of the total case load. The manners of death were recorded as suicide (n=1 374, 8.6%), homicide (n=8 190, 51.1%), accident (transport-related) (n=2 673, 16.9%) and accident (other) (n=1 096, 6.8%) (Table A2). The manner of death was unknown or still under investigation in 2 694 (16.8%) cases. A significant difference in the distribution of manner of death existed between 2019 and 2020 (p<0.001). Pairwise analysis revealed this was due to an increased

proportion of homicide cases (p<0.001) and a decreased proportion of transport-related accident cases (p<0.001) in 2020 compared to 2019.

There were significantly fewer cases in 2020 compared to 2019 with a 47.7% decrease in injury-related cases in April and May (Fig. 3A, Table A3). This coincides with AL 4 and 5 of lockdown comprising the first complete ban on the sale and on-site consumption of alcohol, as well as the associated curfew-related restricted movement (Fig. 1).

During the study period, most injury-related death cases occurred over the weekend, with 18.7% of cases occurring on a Saturday and 22.7% on a Sunday (Fig. 3B). Overall, a significant difference was observed in the distribution of cases between days of the week between 2019 and 2020 (p<0.001). While in both years most cases occurred on the weekend, there was a significantly smaller proportion of cases on a Sunday (p<0.001) and significantly larger proportions on Wednesdays (p<0.001) and Thursdays (p<0.001) during 2020.

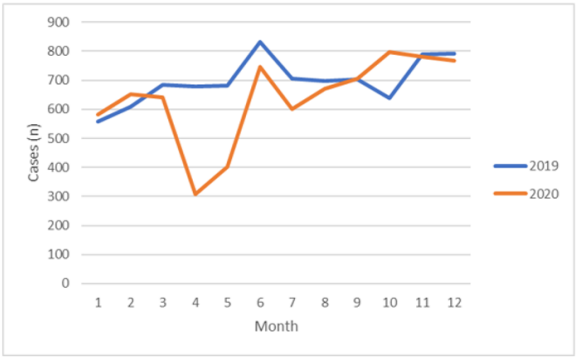
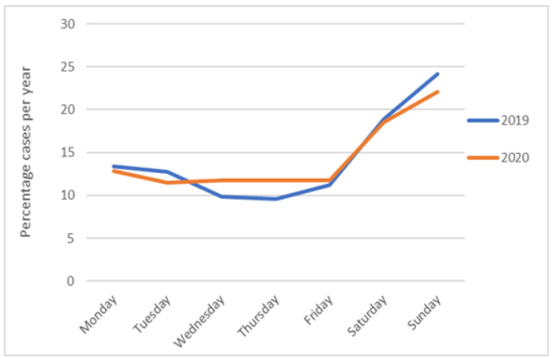


Fig. 3. A. Monthly distribution of injury-related cases per year.



B. Percentage distribution of injury-related cases per year by day of the week.

Alcohol and injury-related deaths

Blood was collected for the analysis of ethanol in 12 077 cases (75.4%), for which results were available in 11 502 cases (95.3%). In six of these cases there was no result due to insufficient quantity or poor quality of blood for analysis. The remainder of the results presented relates to

the sample of 11 496 results available. There was no significant difference in the proportion of cases where alcohol was requested between the two years. Where results were received, most BAC results were negative for both years (<0.01 g/100mL) (n=6 999 of 11 496; 60.9%) (Fig. 4).

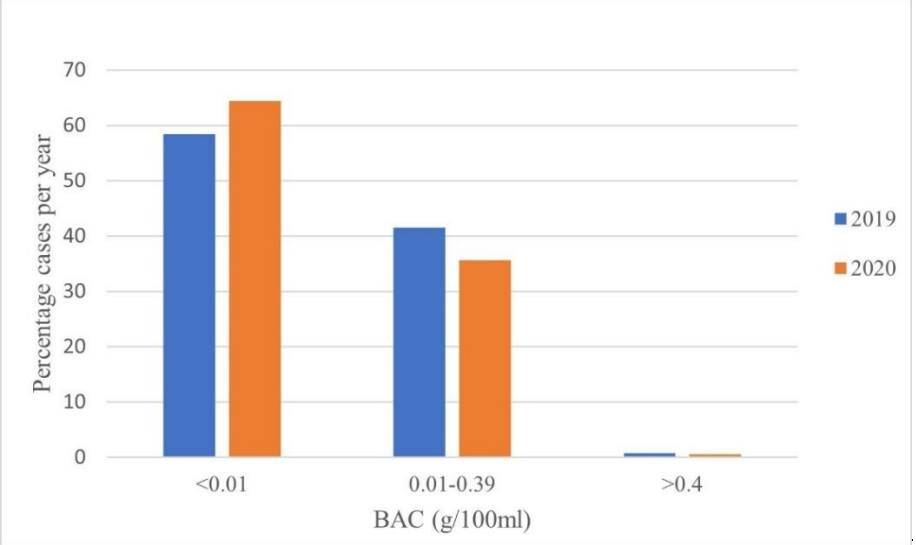


Fig. 4. Percentage distribution of cases by BAC level between 2019 and 2020.

During the study period, the distribution of BACs reported followed a similar pattern to the weekly distribution of injury-related deaths (Fig. 5). There were more injury-related deaths occurring on the weekend where ethanol was detected (>0.01 g/100mL), and in significantly more cases with BAC >0.05% in 2019 than 2020 (p<0.001).

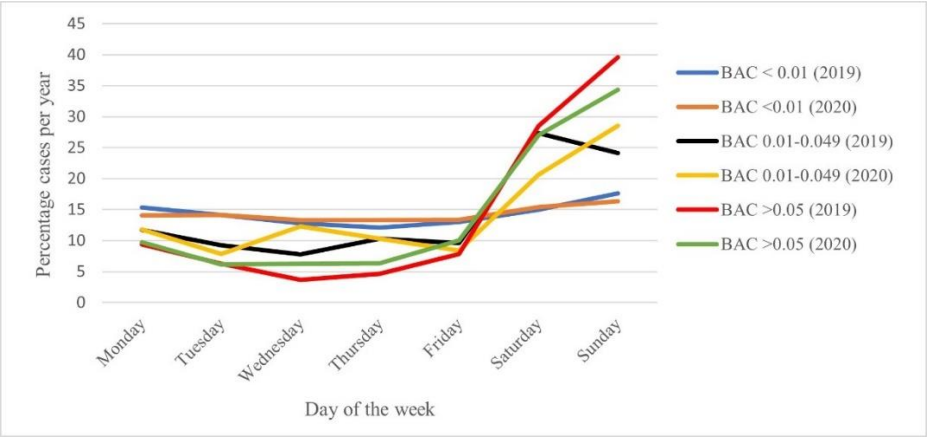


Fig. 5. Percentage distribution of cases per year by days of the week and BAC level.

During periods of complete ban of alcohol sales and on-site consumption in 2020 the distribution of cases during the week was significantly different from the same period in 2019 (p<0.001) (Fig. 6A).

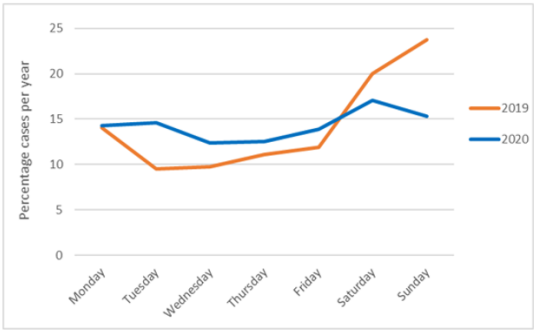


Fig. 6. A. Percentage distribution of cases by day of the week during periods of complete alcohol ban in 2020 compared to the same period in 2019.

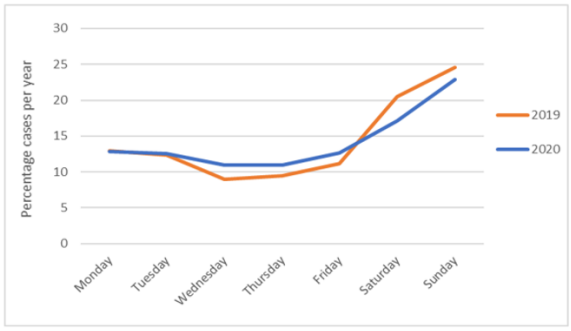


Fig. 6. B. Percentage distribution of cases by day of the week during periods of reduced alcohol sales in 2020 compared to the same period in 2019.

A similar decrease in the distribution of cases during the week was seen during periods of reduced alcohol sales in 2020 compared to the same period in 2019 (p<0.001) (Fig. 6B).

Blood alcohol concentration data

The distribution of positive alcohol concentration levels (>0.01 g/100 mL) according to demographics, manner of death, and lockdown restrictions can be seen in Table 3.

Table 3. Distribution of alcohol positive cases (mean BAC, BAC >0.01 g/100mL and >0.05g/100mL) in 2019 (n = 6003) and 2020 (n= 5493). (* $p<0.001$)

	Mean (sd) g/100mL BAC positive cases		BAC >0.01g/100mL [n (% available BAC results)]		BAC >0.05g/100mL [n (% available BAC results)]	
	2019	**2020**	**2019**	**2020**	**2019**	**2020**
Total	0.18 (0.1)	0.17 (0.09)	**2523 (42.0)**	**1974 (35.9) ***	**2241 (37.3)**	**1771 (32.2) ***
Sex						
Female	0.20 (0.11)	0.19 (0.11)	338 (41.4)	257 (37.1)	305 (37.4)	230 (33.2)
Male	0.17 (0.1)	0.17 (0.09)	**2183 (42.1)**	**1717 (35.8) ***	**1935 (37.3)**	**1541 (32.1) ***
Age						
0-11	-	0.030 (-)	-	1 (1.0)	-	-
12-17	0.10 (0.07)	0.11 (0.07)	54 (26.2)	40 (20.5)	41 (19.9)	34 (17.4)
18-29	0.16 (0.09)	0.16 (0.09)	**1017 (43.4)**	**729 (35.4) ***	**892 (38.1)**	**644 (31.3) ***
30-39	0.19 (0.1)	0.18 (0.1)	**771 (42.3)**	**649 (37.0) ***	688 (37.8)	599 (34.1)
40-49	0.20 (0.11)	0.19 (0.1)	358 (45.3)	315 (41.1)	327 (41.4)	289 (37.7)
50-59	0.20 (0.1)	0.18 (0.1)	224 (44.4)	179 (44.5)	206 (40.9)	158 (39.3)
60-69	0.19 (0.11)	0.14 (0.09)	**73 (36.3)**	**42 (22.5) ***	**65 (32.3)**	**36 (19.3) ***
70-79	0.17 (0.09)	0.10 (0.08)	22 (3)	18 (21.7)	19 (21.6)	11 (13.3)
80+	0.07 (0.04)	0.01 (-)	4 (14.3)	1 (2.9)	3 (10.7)	-
Manner of death						
Homicide	0.17 (0.09)	0.16 (0.09)	**1465 (41.4)**	**1160 (34.3) ***	**1291 (36.5)**	**1035 (30.6) ***
Suicide	0.14 (0.09)	0.14 (0.09)	199 (35.1)	156 (29.2)	171 (30.1)	130 (24.3)
Accident – transport	0.20 (0.1)	0.20 (0.09)	499 (49.7)	379 (49.7)	465 (46.3)	354 (46.4)
Accident - other	0.18 (0.1)	0.19 (0.11)	**90 (32.5)**	**58 (21.7) ***	75 (27.1)	52 (19.5)
Lockdown levels in 2020 (Corresponding periods in 2019)						
No lockdown	0.18 (0.1)	0.18 (0.1)	469 (39.3)	548 (41.2)	423 (35.5)	493 (37.1)
Level 1	0.16 (0.09)	0.17 (0.09)	773 (43.3)	698 (41.0)	678 (38.0)	639 (37.5)
Level 2	0.19 (0.1)	0.17 (0.09)	250 (42.1)	269 (41.5)	231 (38.9)	240 (37.0)
Level 3a	0.19 (0.11)	0.18 (0.1)	349 (42.9)	275 (36.5)	312 (38.4)	248 (33.0)
Level 3b	0.18 (0.1)	0.17 (0.09)	**239 (43.5)**	**98 (19.6) ***	**211 (38.4)**	**87 (17.4) ***
Level 4	0.18 (0.1)	0.16 (0.08)	**189 (40.7)**	**48 (15.7) ***	**170 (36.6)**	**41 (13.4) ***
Level 5	0.18 (0.11)	0.10 (0.09)	**254 (42.1)**	**38 (14.9) ***	**216 (35.8)**	**23 (9.0) ***
Alcohol bans in 2020 (Corresponding periods in 2019)						
Complete ban	0.18 (0.11)	0.17 (0.09)	**434 (43.1)**	**147 (19.4) ***	**384 (38.1)**	**127 (16.8) ***
Partial ban	0.18 (0.1)	0.17 (0.09)	685 (42.0)	641 (39.0)	617 (37.8)	577 (35.1)
No restrictions	0.17 (0.1)	0.17 (0.1)	1404 (41.8)	1186 (38.4)	1240 (36.9)	1067 (34.5)

There was no significant difference in the mean BAC over the two years. Significant differences in the numbers of positive BAC within and above the legal limit were observed in males and in the age groups 18-39 and 60-69 years. Regarding the manner of death in cases with positive BAC, significant differences were observed in homicide cases ($p<0.01$) and in non-transport related accident cases.

There were no significant differences in number of cases with positive BACs between the two years in AL 1 to 3a, however significant differences were observed within AL 3b, 4 and 5 lockdown periods. Analysis of the restriction of alcohol showed significant differences only during the complete ban on sales and on-site consumption, which coincided with restriction on movement.

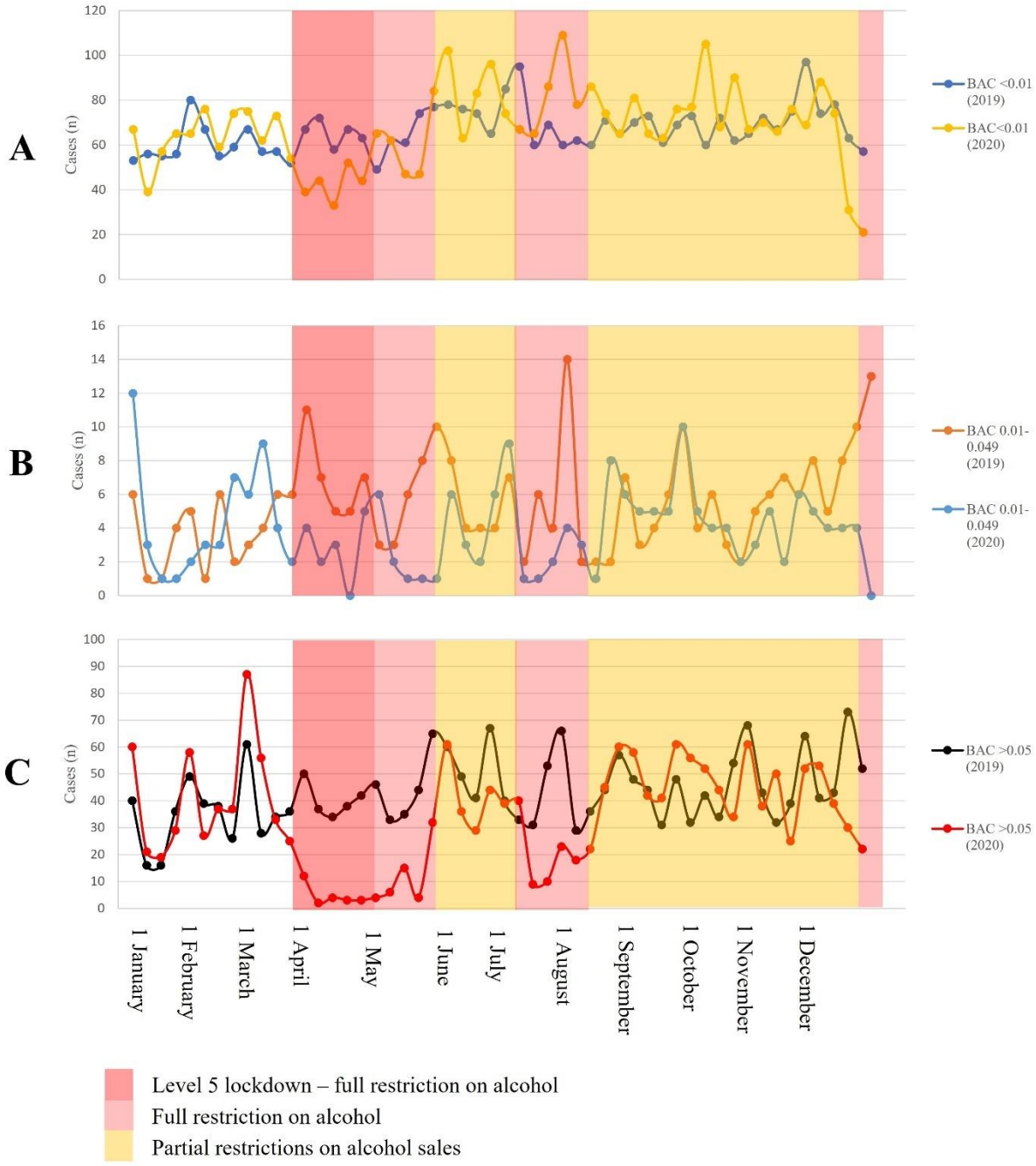


Fig.7. Weekly injury-related death cases by BAC level in the Western Cape between 1 January 2019 and 31 December 2020, showing levels of alcohol restriction.

During the periods of complete restriction on alcohol sales, there were decreases in the number of cases with negative BACs as well as within the *per se* legal limit in SA under 0.05 g/100 mL (Fig. 7A and 7B). The number of cases with BAC >0.05 g/100 mL appears to decrease

dramatically in 2020 during the hard lockdown (Fig. 7C) and at the end of the year during full alcohol ban. This coincides with an overall decrease in injury-related cases during that period.

BAC in homicide and transport-related deaths

Analysis of homicides and transport-related deaths according to BAC in the different levels of lockdown and alcohol restrictions illustrated dramatic decreases in the numbers of cases with BAC>0.05 g/100 mL for homicides and transport-related accidents (Fig. 8C) compared to those cases with a negative BAC and with BAC <0.05 g/100mL (Fig. 8A and 8B). Again, this coincides with a decline in overall cases received by the mortuary in 2020 lockdown AL5. Most transport related cases involved pedestrians in both years. The relative proportion of cases for each road user remained similar except for a significant decrease in the proportion of railway pedestrians in 2020 (p<0.001). This was mostly observed during AL 5 and 4 lockdown periods. Overall, there were fewer transport-related accidents in 2020 compared to 2019 (Fig. A1). Further analysis revealed this was primarily due to a decrease in pedestrian related cases during AL 5 and 4. With regards to homicides, most were due to firearm violence, however in 2020 there was a significant increase in the proportion of cases due to firearm violence (p<0.001) and a decrease in the proportion of sharp force trauma cases (p<0.001). Overall, there were significantly fewer (4.2%) homicide cases in 2020 than in 2019, and this was mostly seen during AL 5 and 4.

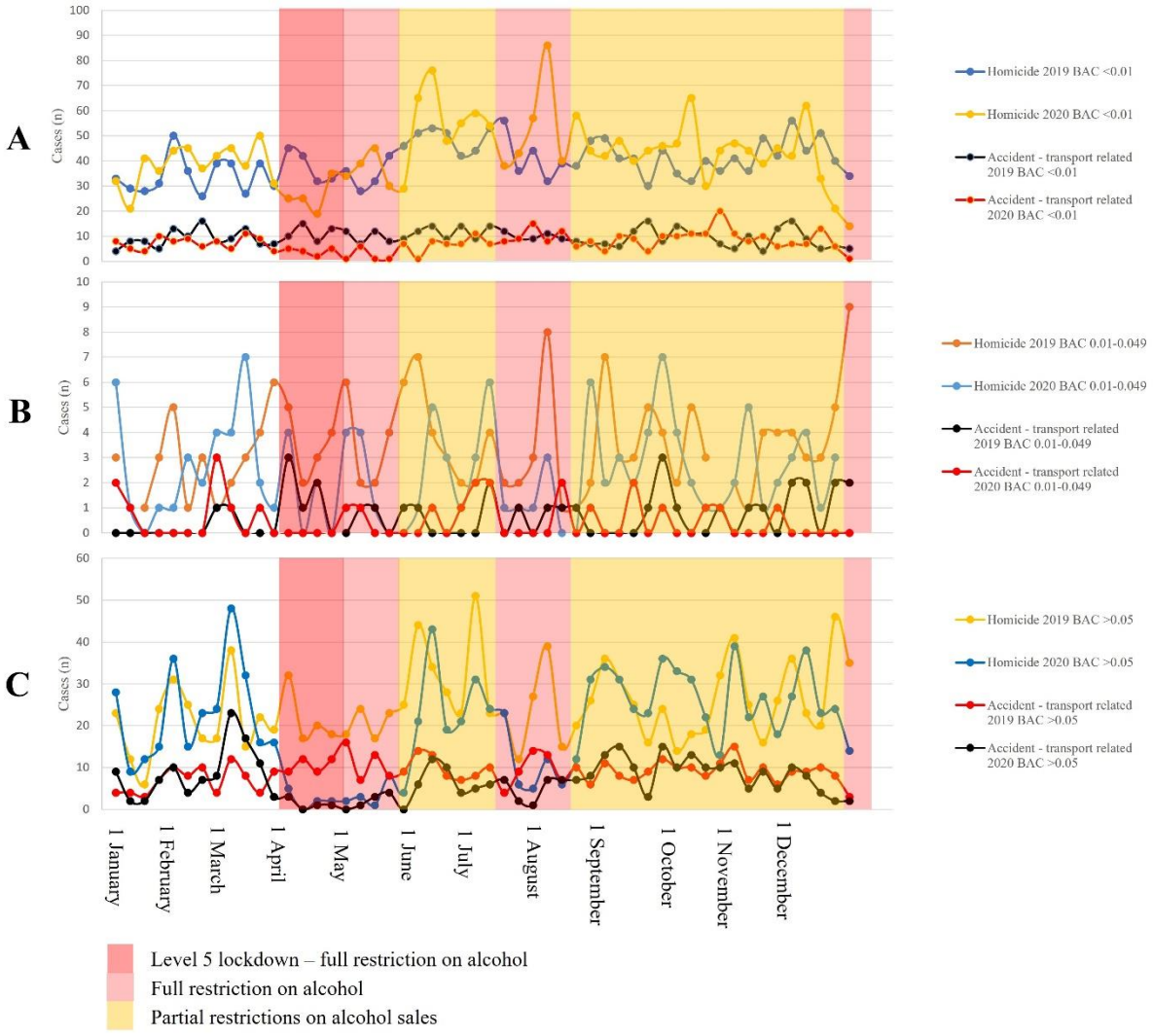


Fig. 8. Weekly homicide and transport related deaths by BAC showing levels of lockdown

Discussion

This study examined injury-related deaths in the WC province over two years, and further reviewed the effect of the COVID-19 lockdown and restrictions on alcohol sale and on-site consumption, together with movement restrictions, on BAC results in injury-related deaths in 2020.

Most forensic mortuary facilities saw a decrease in case load in 2020, with a 15.7% decrease in total suspected unnatural death admissions in 2020 compared to 2019 and a 47.7% decrease

in injury-related cases during lockdown AL 5 and 4 (April -May 2020) in SA compared to the same period in 2019. This aligned with the 53% decrease in trauma patients observed at Groote Schuur Hospital (a large academic hospital in Cape Town, SA) during the same period,[8] with similar declines in unnatural deaths reported in a study relating to the curfew and restricted sale of alcohol during COVID-19.[17] Similarly, decreases in general and orthopaedic trauma presentations during the COVID-19 restrictions were reported in multiple other SA studies.[18–20]

The female to male ratio of injury-related cases in the WC of 1:4 was not significantly different between the two years and was consistent with previous findings.[21,22] The mean age of 33 years with young adults between 20 and 40 comprising the majority of decedents in both years was consistent with the findings of the injury mortality survey in 2017,[22] which suggests young people in this economically-active age group are at a higher risk of injury-related deaths than older adults. Surprisingly, examination of injury-related deaths in children revealed an increase in the 6-12-year age group in 2020. This was an unexpected finding and deserves further analysis. A previous study reported a significant negative impact to the physical and psychological well-being of children during lockdown,[23] which may explain the increase in the 6-12 year age group in this study as children were not attending school and recreational activities were severely curtailed due to lockdown.[7] Children of caregivers who showed hazardous drinking habits have been shown to be negatively impacted by poor parental supervision and neglect[24] which could also be a contributing factor.

This study's finding of most injury-related deaths occurring over weekends is similar to previous studies that found both alcohol related deaths and homicides to be significantly higher over weekends.[25–28] People generally have more time for leisure activities over weekends and consume more alcohol over Thursdays, Fridays and Saturdays than in the rest of the week,[29] which is in keeping with the finding of an increase in the number of cases with positive BAC

and the number of cases with BACs > 0.05 g/100 mL over weekends, both in 2019 and 2020 in this study. The finding of a greater number of injury-related deaths in October 2020 compared with October 2019 could be due to the relaxation in restrictions in October 2020, both on alcohol and curfew with people having the opportunity once again to go out and drink in the evenings resulting in a possible rebound effect.[30,31] A similar increase in alcohol-related emergencies post lockdown was reported by Murthy and Narasimha (2021).[30] The increase in injury-related deaths over weekends could also contribute to the higher case numbers with positive BACs on weekends. The significant difference in the weekly distribution of injury-related cases during the complete and partial ban periods on the sale and on-site consumption of alcohol could be related to the alcohol restrictions and the limitation on movement. The differential effect of the alcohol restrictions from the limitations on movement were not able to be separated in this study, however Moultrie et al. (2021) found that the restrictions on movement were far less important than the alcohol ban.[17] They did however acknowledge the lack of data on potential confounding factors as a limitation in their study.

There was no significant difference in the mean positive BAC between 2019 and 2020, except in April and May when there was a complete alcohol ban and lockdown on movement. This finding is similar to Chu et al.'s (2022) finding of a statistically significant reduction in trauma only during periods of complete alcohol bans.[9]

While there was indeed a decrease in homicide cases during AL 5 and 4 of lockdown, the relaxation of restrictions in AL 3 resulted in a rebound effect with a spike in homicide cases, resulting in an increased proportion of homicide cases in 2020. The same effect was reported in trauma units which showed a 107% increase in violent assaults and firearm injuries in AL 3 of lockdown during which alcohol sales and on-site consumption were re-introduced with nightly curfews restricting after-hours movement.[8] The incidence rate of homicides per 100 000 population in the WC was 61.1 in 2019 and 57.2 in 2020,[32,33] which is slightly higher than

the 55/100 000 reported for the WC in the injury mortality survey,[22] and much higher than the national per capita ratio reported by SAPS of 9.3 in 2019 and 5.8 in 2020.[34]

Most WC homicide cases were due to firearm injuries in both years (47% in 2019 and 53% in 2020) with an incidence rate of 28.9/100 000 in 2019 and 30.4/100 000 in 2020. While FPS does not record details regarding firearms, this finding is consistent with the increase of illegal firearms and ammunition reported by the SAPS[34]. Notably, eleven out of the top thirty police stations reporting illegal firearms and ammunition are located in the WC.[34] While the South African Medical Research Council (SAMRC) reported a general decrease in firearm fatalities from 2000 to 2012, which coincided with the implementation of the new Firearms Control Act 60 of 2000,[35] firearm deaths remained a significant contributor to homicides from 2012[22,36] Firearm injuries have also been associated with alcohol, as indicated by a large group of studies in a recent meta-analysis, showing a third of firearm associated decedents having consumed alcohol prior to death with heavy consumption (>0.8 mg/100 mL) in over a quarter of cases.[37]

The incidence rate of suicides was 10.0/100 000 in both years. Suicide rates during lockdown were examined in Spain and were also unchanged compared to the same period in the previous year.[38] The incidence rates of RTC's were 22.1 and 16.5/100 000 for 2019 and 2020 respectively. The decrease in the incidence of RTC fatalities in 2020 could be due to fewer RTC's occurring due to lockdown measures in general, as has been reported in other countries.[39] RTC presentations to trauma units which decreased substantially during lockdown levels 5 and 4, returned to normal rates in level 3,[8] in keeping with findings in transport-related fatalities in this study. Additionally, there was a significant decrease in railway pedestrian deaths during level 5 and 4 of lockdown, which is most likely due to the prohibition of public transport during these periods.[40]

In the study population, a positive BAC was detected in 5 078 (42.2%) of cases. This is similar to a previous study finding 41% (42 of 104) of cases examined having a positive BAC[21]. Of the cases with positive BAC in this study, 79% had BAC greater than the legal driving limit of 0.05 g/100 mL. This is in keeping with the heavy episodic drinking (HED) culture that is reported to be prevalent in SA.[41] A recent online survey of drinking patterns during the COVID-19 restrictions found nearly half (48.5%) of the participants (346 out of 798 respondents) to be classified as HEDs.[42] They defined HED as consuming more than 6 drinks per occasion monthly or more frequently.

The finding of a relatively high number of positive BACs in the 12-17-year age group (on average 23.4% positive cases where BAC results were available) is unexpected and deserves further analysis. It is possible that adolescents could be accessing alcohol from their parents as was suggested by Rossow et al.(2021) in their study on parental influence of their children's drinking behaviour.[43] BAC is not routinely analysed in children; thus, this finding may be an underrepresentation of the true role of alcohol in this age group and merits further investigation.

Homicide and transport-related collisions accounted for the greatest proportion of cases with positive BAC in comparison to suicides, non-transport related accidents and those that were unknown or under investigation, with the majority of transport-related collisions involving pedestrians in both years. This is in line with a previous SA study that found the involvement of pedestrians to be a great risk factor for alcohol-attributed fatal road traffic crashes.[44]

The decreases in the number of cases with negative BACs and those within the legal limit of 0.05 g/100 mL during the periods of complete restriction on alcohol sales, and the apparent dramatic decrease in the number of cases with BAC >0.05 g/100 mL could be attributed to overall case numbers decreasing during these periods (47.7% decrease in total injury-related cases during ALs 5 and 4) but may also have been impacted by the restrictions on alcohol and

movement. Given that the mean BACs in 2019 and 2020 were similar in the periods of the alcohol bans, it is likely that the greatest impact observed in 2020 was a decline in overall injury fatalities, particularly during hard lockdown (AL 5 and 4), which in turn caused significant declines in number of cases with positive BACs. This hard lockdown included restriction of movement, which prevented people from being on the streets or in vehicles.

Limitations

Data collection was limited to the variables that were routinely input into the BIMS system by FPOs, and data capturing errors may occur. In addition, any cases that were under investigation or undetermined may not be updated on that system if a pathologist updates their cause of death after receiving the results of ancillary investigations. Individuals who demised sometime after an initial injury may have been intoxicated at the time, but BAC may not have been performed due to the prolonged survival time. There is no standard practice regarding testing of BAC in those persons < 18 years of age and it is left to the pathologist's discretion. This may result in an underestimation of the prevalence of alcohol-related injury deaths in paediatric cases.

Blood sampling occurred routinely during post-mortem examinations and any errors made during sampling and handling were not accounted for. Analysis was performed at FCL, and the authors cannot account for any errors performed by the laboratory. The BAC method adopted by the FCL is however accredited by the SA National Accreditation System (SANAS). Very few toxicology results were available at the time of data collection due to extensive backlogs at the laboratory and consequently toxicology results were not analysed further in this study. The role of drugs in these cases could not be assessed and does warrant further investigation given the reported prevalence of drugs in injury-related deaths.[21]

The findings in this study relate to the WC province and may not be generally applicable to other provinces in the country.

Conclusion

A retrospective analysis of BAC in injury-related deaths in the WC during 2019 and 2020 was performed to determine whether the COVID-19 lockdown and restricted access to alcohol impacted injury-related deaths and BACs in these cases. The data presented in this study confirms the great burden of injury-related mortality in the WC province and illustrated a decrease in injury-related deaths during the lockdown periods that coincided with the alcohol ban and restriction of movement, and an increase following relaxation of restrictions on movement and alcohol sales. There was no difference in the mean BACs between 2019 and 2020 during the same periods of the alcohol restrictions. The only differences were that there were fewer cases with positive BAC, however, this could be attributed to an overall decrease in cases during the hard lockdowns (AL 4 and 5).

This study highlighted the routine consolidation of mortality, alcohol and toxicology data allows for robust research and should be promoted in all forensic pathology facilities. The impact of other drugs aside from alcohol should not be ignored in our assessment of injury-related deaths. Standardised practice in the testing of alcohol and toxicology in children is recommended and should be considered in all children.

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Author contributions. VRB and BD conceptualised the study, VRB, IM and BD collected the data. VRB wrote the manuscript. IM and BD revised the manuscript. All authors approved the manuscript for publication.

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Conflicts of Interest. None.

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Appendices

Appendix A: Extended results

TableA1. Distribution of total and traumatic cases at each mortuary between 2019 and 2020. N (% mortuary)

	2019		2020	
Mortuary	**Total mortuary intake**	**Traumatic deaths. N(% intake)**	**Total mortuary intake**	**Traumatic deaths. N(% intake)**
Beaufort West	67	58 (86.57)	60	56 (93.33)
Ceres	197	118 (59.9)	184	123 (66.85)
George	255	214 (83.92)	222	192 (86.49)
Hermanus	430	291 (67.67)	313	260 (83.07)
Knysna	150	109 (72.67)	105	78 (74.29)
Laingsburg	36	34 (94.44)	29	26 (89.66)
Malmesbury	184	125 (67.93)	130	91 (70)
Mossel Bay	146	123 (84.25)	108	92 (85.19)
Oudtshoorn	115	76 (66.09)	126	101 (80.16)
Paarl	625	437 (69.92)	513	428 (83.43)
Riversdale	46	36 (78.26)	42	37 (88.1)
Salt River	4196	2880 (68.64)	3492	2568 (73.54)
Tygerberg	4486	3291 (73.36)	3829	3000 (78.35)
Vredenburg	158	105 (66.46)	122	87 (71.31)
Vredendal	171	120 (70.18)	182	136 (74.73)
Worcester	570	354 (62.11)	507	381 (75.15)
Total	11832	8371 (70.75)	9964	7656 (76.84)

Table A2. Distribution of manner of death per year. N (% year)

Manner of death	**2019**	**2020**
Accident (Other)	551 (6.58)	545 (7.12)
Homicide	4182 (49.96)	4008 (52.35)*
Suicide	688 (8.22)	686 (8.96)
Accident – transport related	1516 (18.11)	1157 (15.11) *
Under investigation	897 (10.72)	862 (11.26)
Unspecified	395 (4.72)	348 (4.55)
Unknown	142 (1.7)	50 (0.65)
Total:	**8371**	**7656**

*Significant pairwise differences between years following Bonferroni correction

Table A3. Monthly distribution of cases per year. N (% year)

Month	**2019**	**2020**
January	558 (6.67)	581 (7.59)
February	609 (7.28)	651 (8.5)
March	685 (8.18)	641 (8.37)
April	679 (8.11)	307 (4.01)*

May	681 (8.14)	403 (5.26)*
June	831 (9.93)	745 (9.73)
July	706 (8.43)	602 (7.86)
August	699 (8.35)	671 (8.76)
September	704 (8.41)	707 (9.23)
October	638 (7.62)	798 (10.42)*
November	788 (9.41)	781 (10.2)
December	793 (9.47)	769 (10.04)
Total	**8371**	**7656**

Table A4. Distribution of BAC levels between 2019 and 2020. N (%year)

BAC level	2019	2020
0.00	3480 (57.97)*	3519 (64.06)*
0.01-0.04	282 (4.7)*	203 (3.7)*
0.05-0.09	295 (4.91)	250 (4.55)
0.1-0.14	384 (6.4)	336 (6.12)
0.15-0.19	462 (7.7)	398 (7.25)
0.2-0.24	470 (7.83)*	342 (6.23)*
0.25-0.29	353 (5.88)*	254 (4.62)*
>0.3	277 (4.61)*	191 (3.48)*
Total:	**6003**	**5493**

Table A5. Distribution of cases within each BAC level by days of the week. N (% year)

BAC	<0.01 g/100ml		0.01-0.049 g/100ml		>0.0.05 g/100ml	
Day of the week	2019	2020	2019	2020	2019	2020
1	614 (17.64)	575 (16.34)	68 (24.11)	58 (28.57)	888 (39.63)*	609 (34.39)*
2	534 (15.34)	496 (14.09)	33 (11.7)	24 (11.82)	210 (9.37)	173 (9.77)
3	492 (14.14)	497 (14.12)	26 (9.22)	16 (7.88)	141 (6.29)	109 (6.15)
4	445 (12.79)	469 (13.33)	22 (7.8)	25 (12.32)	83 (3.7)*	111 (6.27)*
5	420 (12.07)	469 (13.33)	29 (10.28)	21 (10.34)	104 (4.64)*	112 (6.32)*
6	452 (12.99)	470 (13.36)	27 (9.57)	17 (8.37)	175 (7.81)*	178 (10.05)*
7	523 (15.03)	543 (15.43)	77 (27.3)	42 (20.69)	640 (28.56)	479 (27.05)

Table A6. Type of homicide in 2019 and 2020. N (% year).

Type of homicide	2019	2020	p-value
Assault/Blunt Trauma	579 (13.85)	543 (13.55)	1
Ballistic Trauma	1980 (47.35)	2133 (53.22)	<0.0001
Sharp Force Trauma	1540 (36.82)	1245 (31.06)	<0.0001
Other	83 (1.98)	87 (2.17)	1
Total:	4182	4008	

Table A7. Transport related accidents in 2019 and 2020. N (% year).

Individual	2019	2020	p-value
Driver	251 (16.55)	220 (19.01)	0.173
Passenger	347 (22.87)	257 (22.21)	1
Pedestrian	718 (47.33)	564 (48.75)	1
Cyclist	26 (1.71)	24 (2.07)	1
Motor-Cyclist	73 (4.81)	55 (4.75)	1
Railway Pedestrian	86 (5.67)	18 (1.55)	<0.0001
Other	16 (1.05)	19 (1.64)	1

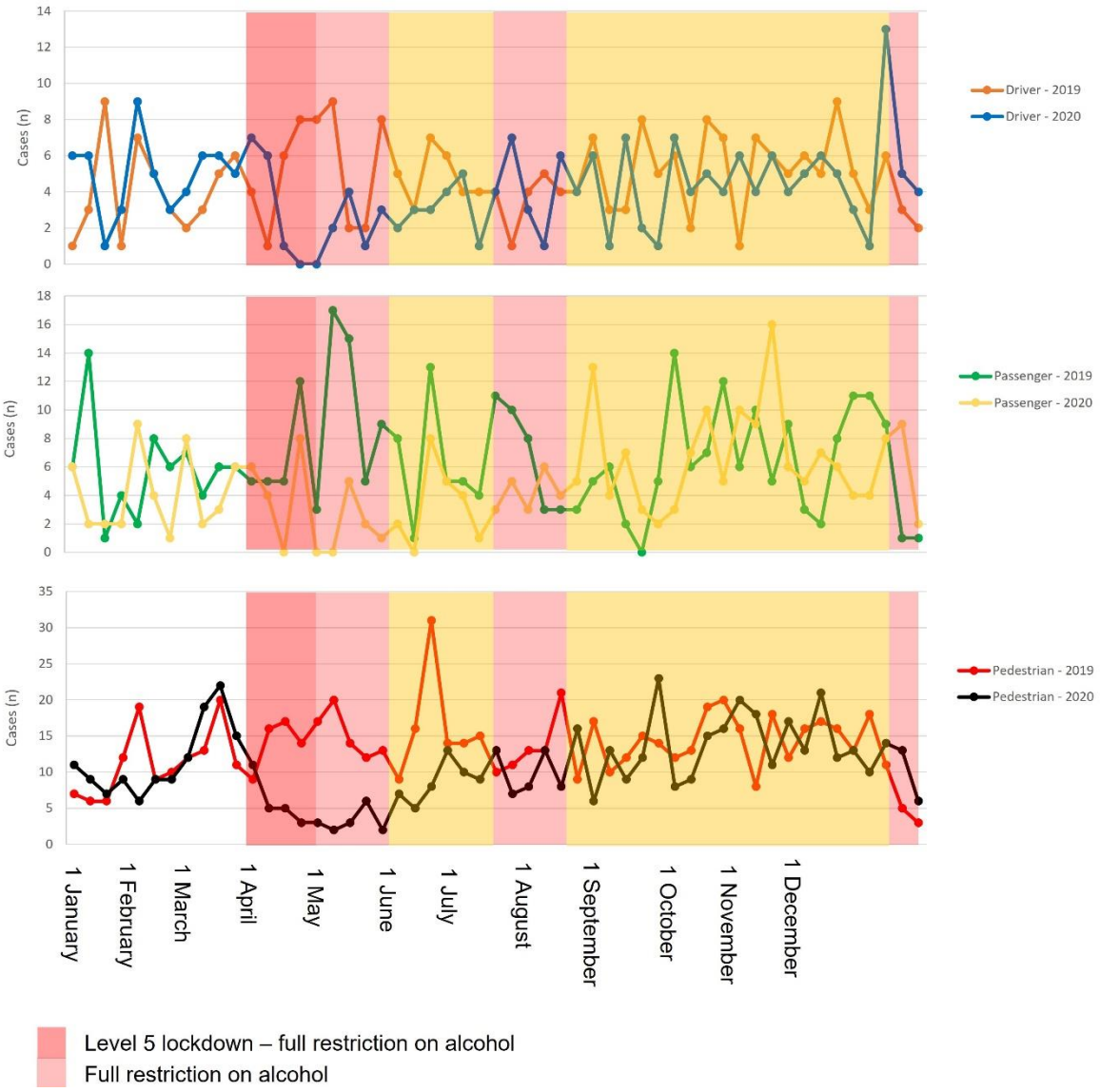

Fig. A1. Weekly transport deaths by user in the Western Cape between 1 January 2019 and 31 December 2020, showing levels of alcohol restriction

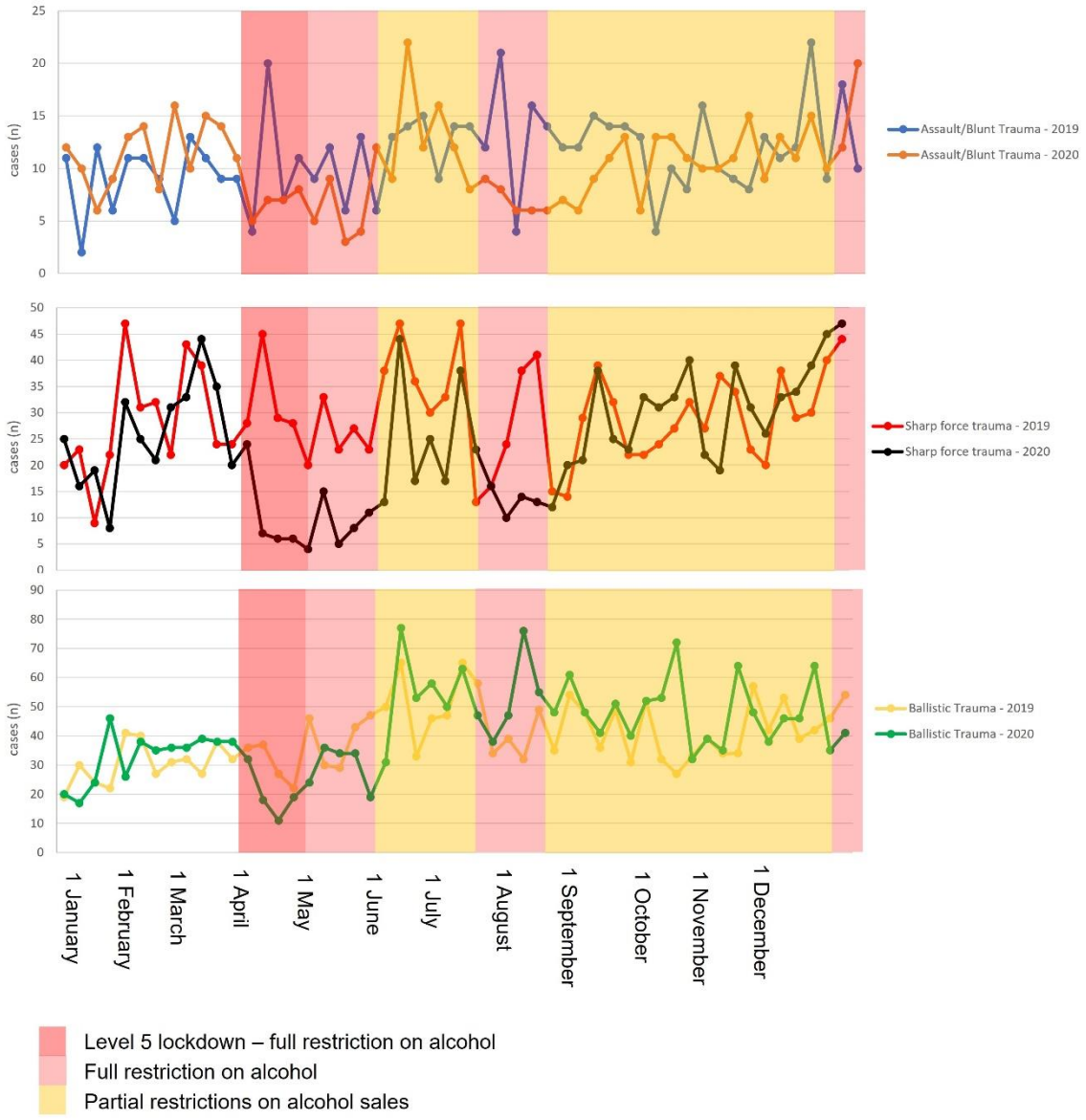

Fig. A2. Weekly homicide deaths by type of homicide in the Western Cape between 1 January 2019 and 31 December 2020, showing levels of alcohol restriction

Appendix B: Ethics letters

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room G50- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

20 November 2020

HREC REF: 751/2020

Dr I Molefe
Division of Forensic Medicine & Toxicology
Entrance 3, Level 1, Falmouth Building-FHS
Email: itumeleng.molefe@uct.ac.za
Student: varushka.bachan@uct.ac.za

Dear Dr Molefe

PROJECT TITLE: INVESTIGATING BLOOD ALCOHOL CONCENTRATIONS IN VIOLENT DEATH AND ITS RELATIONSHIP TO THE COVID-19 NATIONAL LOCKDOWN IN WESTERN CAPE, SOUTH AFRICA- A CROSS-SECTIONAL RETROSPECTIVE REVIEW-MMED CANDIDATE-DR VARUSHKA BACHAN

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020 & 06 July 2020.

Approval is granted for one year until the 30 November 2021.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Dr Varushka Bachan will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

HREC/REF-751/2020sa

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

HREC/REF-751/2020sa

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

HUMAN RESEARCH ETHICS COMMITTEE
26 OCT 2021
HEALTH SCIENCES FACULTY
UNIVERSITY OF CAPE TOWN

FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

FHS017: Annual Progress Report / Renewal

Record Reviews/Audits/Collection of Biological Specimens/Repositories/Databases/Registries

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval, including any documentation described below.			
☑ Approved	Annual progress report	Approved until/next renewal date	30.10.22
☐ Not approved	See attached comments		
Signature Chairperson of the HREC/ Designee		Date Signed	27/10/21

Note: Please note that incomplete submissions will not be reviewed.
Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.

Please clarify your plan for research-related activities during COVID-19 lockdown

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	25 October 2021		
HREC REF Number	751/2020	Current Ethics Approval was granted until	30 Nov 2021
Protocol title	Investigating blood alcohol concentrations in violent death and its relationship to the Covid-19 National lockdown in Western Cape, South Africa: A cross-sectional retrospective review		
Principal Investigator	Dr Itumeleng Molefe		
Department / Office Internal Mail Address	Division of Forensic Medicine and Toxicology Falmouth Building, Falmouth Road, Faculty of Health Sciences, UCT		
1.1 Does this protocol receive US Federal funding?		☐ Yes	☑ No

2. Protocol status (tick ✓)

☐	Research-related activities are ongoing
☑	Data collection is complete, data analysis only

Please indicate (in the block below) the titles and HREC reference numbers of any projects currently making use of the Database/registry/repository.

Investigating blood alcohol concentrations in violent death and its relationship to the Covid-19 National lockdown in Western Cape, South Africa: A cross-sectional retrospective review (HREC 751/2020)

3. Protocol summary

Total number of records or specimens collected, reviewed or stored since the original approval		21798
Total number of records or specimens collected, reviewed or stored since last progress report		21798
Have any research-related outputs (e.g. publications, abstracts, conference presentations) resulted from this research? If yes, please list and attach with this report.	☐ Yes	☑ No

4. Signature

Signature of PI		Date	25/10/2021

Appendix C: Author guidelines for SAMJ

Author Guidelines

The *SAMJ* has launched a new submission and tracking system. Authors will be required to register a profile on the Editorial Manager platform in order to submit a manuscript.

To submit a manuscript, please proceed to the *SAMJ* Editorial Manager website:

www.editorialmanager.com/samj

To access and submit an article already in production, please see the guidelines here.

Author Guidelines

General article format/layout

Accepted manuscripts that are not in the correct format specified in these guidelines will be returned to the author(s) for correction, which will delay publication.

General:

- Manuscripts must be written in UK English.
- The manuscript must be in Microsoft Word format. Text must be single-spaced, in 12-point Times New Roman font, and contain no unnecessary formatting (such as text in boxes).
- Please make your article concise, even if it is below the word limit.
- Qualifications, ***full*** affiliation (department, school/faculty, institution, city, country) and contact details of ALL authors must be provided in the manuscript and in the online submission process.
- Abbreviations should be spelt out when first used and thereafter used consistently, e.g. 'intravenous (IV)' or 'Department of Health (DoH)'.
- Include sections on Acknowledgements, Conflict of Interest, Author Contributions and Funding sources. If none is applicable, please state 'none'.
- Scientific measurements must be expressed in SI units except: blood pressure (mmHg) and haemoglobin (g/dL).
- Litres is denoted with an uppercase L e.g. 'mL' for millilitres).
- Units should be preceded by a space (except for % and ºC), e.g. '40 kg' and '20 cm' but '50%' and '19ºC'.
- Please be sure to insert proper symbols e.g. µ not u for micro, a not a for alpha, b not B for beta, etc.
- Numbers should be written as grouped per thousand-units, i.e. 4 000, 22 160.
- Quotes should be placed in single quotation marks: i.e. The respondent stated: '...'
- Round brackets (parentheses) should be used, as opposed to square brackets, which are reserved for denoting concentrations or insertions in direct quotes.
- If you wish material to be in a box, simply indicate this in the text. You may use the table format –this is the *only* exception. Please DO NOT use fill, format lines and so on.

Research

Guideline word limit: 4 000 words

Research articles describe the background, methods, results and conclusions of an original research study. The article should contain the following sections: introduction, methods, results, discussion and conclusion, and should include a structured abstract (see below). The

introduction should be concise – no more than three paragraphs – on the background to the research question, and must include references to other relevant published studies that clearly lay out the rationale for conducting the study. Some common reasons for conducting a study are: to fill a gap in the literature, a logical extension of previous work, or to answer an important clinical question. If other papers related to the same study have been published previously, please make sure to refer to them specifically. Describe the study methods in as much detail as possible so that others would be able to replicate the study should they need to. Results should describe the study sample as well as the findings from the study itself, but all interpretation of findings must be kept in the discussion section, which should consider primary outcomes first before any secondary or tertiary findings or post-hoc analyses. The conclusion should briefly summarise the main message of the paper and provide recommendations for further study.

Select figures and tables for your paper carefully and sparingly. Use only those figures that provided added value to the paper, over and above what is written in the text.

Do not replicate data in tables and in text .

Structured abstract

- This should be 250-400 words, with the following recommended headings:
    - **Background:** why the study is being done and how it relates to other published work.
    - **Objectives:** what the study intends to find out
    - **Methods:** must include study design, number of participants, description of the intervention, primary and secondary outcomes, any specific analyses that were done on the data.
    - **Results:** first sentence must be brief population and sample description; outline the results according to the methods described. Primary outcomes must be described first, even if they are not the most significant findings of the study.
    - **Conclusion:** must be supported by the data, include recommendations for further study/actions.
- Please ensure that the structured abstract is complete, accurate and clear and has been approved by all authors.
- Do not include any references in the abstracts.

Main article

All articles are to include the following main sections: Introduction/Background, Methods, Results, Discussion, Conclusions.

The following are additional heading or section options that may appear within these:

- Objectives (within Introduction/Background): a clear statement of the main aim of the study and the major hypothesis tested or research question posed
- Design (within Methods): including factors such as prospective, randomisation, blinding, placebo control, case control, crossover, criterion standards for diagnostic tests, etc.
- Setting (within Methods): level of care, e.g. primary, secondary, number of participating centres.
- Participants (instead of patients or subjects; within Methods): numbers entering and completing the study, sex, age and any other biological, behavioural, social or cultural factors (e.g. smoking status, socioeconomic group, educational attainment, co-existing disease indicators, etc)that may have an impact on the study results. Clearly define how participants were enrolled, and describe selection and exclusion criteria.
- Interventions (within Methods): what, how, when and for how long. Typically for randomised controlled trials, crossover trials, and before and after studies.

- Main outcome measures (within Methods): those as planned in the protocol, and those ultimately measured. Explain differences, if any.

Results

- Start with description of the population and sample. Include key characteristics of comparison groups.
- Main results with (for quantitative studies) 95% confidence intervals and, where appropriate, the exact level of statistical significance and the number need to treat/harm. Whenever possible, state absolute rather than relative risks.
- Do not replicate data in tables and in text.
- If presenting mean and standard deviations, specify this clearly. Our house style is to present this as follows:
- E.g.: The mean (SD) birth weight was 2 500 (1 210) g. Do not use the ± symbol for mean (SD).
- Leave interpretation to the Discussion section. The Results section should just report the findings as per the Methods section.

Discussion

Please ensure that the discussion is concise and follows this overall structure – sub-headings are not needed:

- Statement of principal findings
- Strengths and weaknesses of the study
- Contribution to the body of knowledge
- Strengths and weaknesses in relation to other studies
- The meaning of the study – e.g. what this study means to clinicians and policymakers
- Unanswered questions and recommendations for future research

Conclusions

This may be the only section readers look at, therefore write it carefully. Include primary conclusions and their implications, suggesting areas for further research if appropriate. Do not go beyond the data in the article.

Tables

- Tables should be constructed carefully and simply for intelligible data representation. Unnecessarily complicated tables are strongly discouraged.
- Large tables will generally not be accepted for publication in their entirety. Please consider shortening and using the text to highlight specific important sections, or offer a large table as an addendum to the publication, but available in full on request from the author
- Embed/include each table in the manuscript Word file - do not provide separately as supplementary files.
- Number each table in Arabic numerals (Table 1, Table 2, etc.) and refer to consecutively in the text.
- Tables must be cell-based (i.e. not constructed with text boxes or tabs) and editable.

- Ensure each table has a concise title and column headings, and include units where necessary.
- Footnotes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || then ** †† ‡‡ etc.

References

NB: *Only complete, correctly formatted reference lists in Vancouver style will be accepted. Reference lists must be generated manually and not with the use of reference manager software. Endnotes must* ***not*** *be used.*

- Authors must verify references from original sources.
- Citations should be inserted in the text as superscript numbers between square brackets, e.g. These regulations are endorsed by the World Health Organization,[2] and others.[3,4-6]
- All references should be listed at the end of the article in numerical order of appearance in the Vancouver style (not alphabetical order).
- Approved abbreviations of journal titles must be used; see the List of Journals in Index Medicus.
- Names and initials of all authors should be given; if there are more than six authors, the first three names should be given followed by et al.
- Volume and issue numbers should be given.
- First and last page, in full, should be given e.g.: 1215-1217 **not** 1215-17.
- Wherever possible, references must be accompanied by a digital object identifier (DOI) link). Authors are encouraged to use the DOI lookup service offered by CrossRef:
    - On the Crossref homepage, paste the article title into the 'Metadata search' box.
    - Look for the correct, matching article in the list of results.
    - Click Actions > Cite
    - Alongside 'url =' copy the URL between { }.
    - Provide as follows, e.g.: https://doi.org/10.7196/07294.937.98x

Some examples:

- *Journal references:* Price NC, Jacobs NN, Roberts DA, et al. Importance of asking about glaucoma. Stat Med 1998;289(1):350-355. http://dx.doi.org/10.1000/hgjr.182
- *Book references:* Jeffcoate N. Principles of Gynaecology. 4th ed. London: Butterworth, 1975:96-101.
- *Chapter/section in a book:* Weinstein L, Swartz MN. Pathogenic Properties of Invading Microorganisms. In: Sodeman WA, Sodeman WA, eds. Pathologic Physiology: Mechanisms of Disease. Philadelphia: WB Saunders, 1974:457-472.
- *Internet references:* World Health Organization. The World Health Report 2002 - Reducing Risks, Promoting Healthy Life. Geneva: WHO, 2002. http://www.who.int/whr/2002 (accessed 16 January 2010).
- Legal references

- Government Gazettes:

National Department of Health, South Africa. National Policy for Health Act, 1990 (Act No. 116 of 1990). Free primary health care services. Government Gazette No. 17507:1514. 1996.

In this example, 17507 is the Gazette Number. This is followed by :1514 - this is the notice number in this Gazette.

- Provincial Gazettes:

Gauteng Province, South Africa; Department of Agriculture, Conservation, Environment and Land Affairs. Publication of the Gauteng health care waste management draft regulations. Gauteng Provincial Gazette No. 373:3003, 2003.

- Acts:

South Africa. National Health Act No. 61 of 2003.

- Regulations to an Act:

South Africa. National Health Act of 2003. Regulations: Rendering of clinical forensic medicine services. Government Gazette No. 35099, 2012. (Published under Government Notice R176).

- Bills:

South Africa. Traditional Health Practitioners Bill, No. B66B-2003, 2006.

- Green/white papers:

South Africa. Department of Health Green Paper: National Health Insurance in South Africa. 2011.

- Case law:

Rex v Jopp and Another 1949 (4) SA 11 (N)

Rex v Jopp and Another: Name of the parties concerned

1949: Date of decision (or when the case was heard)

(4): Volume number

SA: SA Law Reports

11: Page or section number

(N): In this case Natal - where the case was heard. Similarly, (C) woud indicate Cape, (G) Gauteng, and so on.

NOTE: no . after the v

- *Other references (e.g. reports) should follow the same format:* Author(s). Title. Publisher place: Publisher name, year; pages.
- Cited manuscripts that have been accepted but not yet published can be included as references followed by '(in press)'.
- Unpublished observations and personal communications in the text must **not** appear in the reference list. The full name of the source person must be provided for personal communications e.g. '...(Prof. Michael Jones, personal communication)'.

From submission to acceptance

Submission and peer-review

To submit an article:

- Please ensure that you have prepared your manuscript in line with the SAMJ requirements.
- All submissions should be submitted via Editorial Manager
- The following are required for your submission to be complete:
  - Anonymous manuscript (unless otherwise stated)
  - Manuscript
  - Any supplementary files: figures, datasets, patient consent form, permissions for published images, etc.
- Once the submission has been successfully processed on Editorial Manager, it will undergo a technical check by the Editorial Office before it will be assigned to an editor who will handle the review process. If the author guidelines have not been appropriately followed, the manuscript may be sent back to the author for correcting.