

Interpersonal violence in peacetime Malawi

Rebecca G Maine,¹ Brittney Williams,¹ Jennifer A Kincaid,² Gift Mulima,³ Carlos Varela,³ Jared R Gallaher,¹ Trista D Reid,¹ Anthony G Charles¹

¹Department of Surgery, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

²Department of Surgery, Thomas Jefferson University, Philadelphia, Pennsylvania, USA

³Department of Surgery, Kamuzu Central Hospital, Lilongwe, Malawi

Correspondence to

Dr Rebecca G Maine, Department of Surgery, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA; rebecca_maine@med.unc.edu

This article was presented as an oral presentation at the 2018 World Trauma Congress in San Diego, California.

Received 4 October 2018
Accepted 5 October 2018

© Author(s) (or their employer(s)) 2018. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

To cite: Maine RG, Williams B, Kincaid JA, et al. *Trauma Surg Acute Care Open* 2018;**3**:e000252.

ABSTRACT

Background The contribution of interpersonal violence (IPV) to trauma burden varies greatly by region. The high rates of IPV in sub-Saharan Africa are thought to relate in part to the high rates of collective violence. Malawi, a country with no history of internal collective violence, provides an excellent setting to evaluate whether collective violence drives the high rates of IPV in this region.

Methods This is a retrospective review of a prospective trauma registry from 2009 through 2016 at Kamuzu Central Hospital in Lilongwe, Malawi. Adult (>16 years) victims of IPV were compared with non-intentional trauma victims. Log binomial regression determined factors associated with increased risk of mortality for victims of IPV.

Results Of 72 488 trauma patients, 25 008 (34.5%) suffered IPV. Victims of IPV were more often male (80.2% vs. 74.8%; $p<0.001$), younger (median age: 28 years (IQR: 23–34) vs. 30 years (IQR: 24–39); $p<0.001$), and were more often admitted at night (47.4% vs. 31.9%; $p<0.001$). Of the IPV victims, 16.5% admitted alcohol use, compared with only 4.4% in other trauma victims ($p<0.001$). In regression modeling, compared with extremity injuries, head injuries (3.14, 2.24–4.39; $p<0.001$) and torso injuries (4.32, 2.98–6.27; $p<0.001$) had increased risk of mortality. Compared with other or unknown mechanisms, penetrating injuries also had increased risk of mortality (1.46, 95% CI 1.17 to 1.81, $p=0.001$). Alcohol use was associated with a lower risk of mortality (0.54, 95% CI 0.39 to 0.75; $p<0.001$).

Discussion Even in a sub-Saharan country that never experienced internal collective violence, IPV injury rates are high. Public health efforts to measure and address alcohol use, and studies to determine the role of “mob justice,” poverty, and intimate partner violence in IPV, in Malawi are needed.

Level of evidence Level III.

INTRODUCTION

Injuries are the leading cause of mortality and disability-adjusted life years lost globally, with 4.8 million deaths and 211 000 years of life lost annually. The majority of this burden is shouldered by low-income and middle-income countries (LMICs).¹ Although a substantial part of the global burden of trauma is attributable to road traffic injuries and falls, the 2013 global burden of disease study estimated that interpersonal violence accounted for 8.4% of all injury-related deaths.¹

Interpersonal violence is “the intentional use of physical force or power, threatened or actual, against a person or group that results in or has a high likelihood of resulting in injury, death, psychological

harm, maldevelopment, or deprivation.”² Interpersonal violence is divided into family and intimate partner violence and community violence. The former category includes child maltreatment, intimate partner violence, and elder abuse, whereas the latter is broken down into assault by strangers, violence related to property crimes, and violence in workplaces and other institutions.²

There is a geographic and regional variation in the incidence and prevalence of injuries from interpersonal violence. WHO data indicate that the rate of interpersonal violence is high in sub-Saharan Africa. This is due in part to the high prevalence of armed conflict in this region.³ People who live in regions with high rates of conflict face increased risk of injury from interpersonal violence, including non-conflict-related interpersonal violence.^{4–6}

Unlike other countries in sub-Saharan Africa, Malawi, since its independence from the British colonial rule in 1964, has not experienced internal armed conflict or civil war. Thus, it is an ideal country in sub-Saharan Africa to evaluate whether interpersonal violence is a large part of the overall trauma burden in the region due to a current or historical legacy of armed conflict or whether other factors are driving this interpersonal violence. The aim of this study was to determine the impact of interpersonal violence on the overall trauma burden at the tertiary referral hospital in the capital city, Lilongwe. We hypothesized that the rates of interpersonal violence in Malawi are similarly high when compared with other countries in the region and that victims of interpersonal violence differed from other trauma victims.

METHODS

We performed a retrospective review of the prospectively collected trauma registry at Kamuzu Central Hospital (KCH) in Lilongwe, Malawi, from January 2009 through December 2016. All patients who present to the emergency department with traumatic injuries are recorded. KCH is a 1000-bed hospital and a referral center for the central region of the country, with a population of approximately six million persons. Additionally, there is a 31-bed burn unit and a 4-bed 24-hour emergency department. There is no prehospital care system in Malawi and minimal basic life support measures are available prior to arrival at the hospital.

Injuries were classified as interpersonal violence if the mechanism of injury was assault and/or the injury was documented as intentional. Self-inflicted injuries were not considered interpersonal violence. All pediatric patients (<16 years of age) were excluded from this analysis.

The mean, SD, and the shape of the distribution were calculated for each continuous variable, and frequencies were tabulated for categorical variables. We compared demographic and clinical variables between patients presenting following interpersonal violence and non-intentional injury. For categorical variables, we performed a Pearson's χ^2 test, whereas for continuous variables a Student's two-sample t-test compared normally distributed variables, and Kruskal-Wallis tested differences in parametric variables. A p value of <0.05 was considered statistically significant.

The relative risk of mortality for victims of interpersonal violence compared with non-intentional trauma victims was evaluated with a Poisson regression. The risk of interpersonal violence on mortality was adjusted for injury severity using the Malawi Trauma Score (MTS),⁷ number of injuries, and night-time admission in the regression model. Factors potentially associated with mortality after interpersonal violence were evaluated with univariable log binomial regression of mortality, including sex, age, number of injuries, location of the most severe injury, mechanism of interpersonal violence (blunt vs. penetrating), and reported alcohol use. Factors with a p value ≤ 0.1 were included in the multivariable log

binomial to identify factors associated with increased risk of mortality for victims of interpersonal violence. Data analysis was performed using STATA V.15 (StataCorp, College Park, TX).

RESULTS

During the study period, 72 438 adult patients presented after a trauma and were included in the trauma registry at KCH. Of these, 25 008 (34.5%) were victims of interpersonal violence (table 1). The majority of intentional injuries were classified primarily as assaults (97.7%). A small number of interpersonal violence cases were from intentional motor vehicle collisions (126, 0.5%), falls (69, 0.3%), burns (42, 0.2%), and other mechanisms (14, 0.2%) (table 2). Of the 251 gunshot wounds in the registry, 174 (69.3%) were the result of interpersonal violence, and 124 of the bites (6%) were from interpersonal violence.

The characteristics of patients between the interpersonal violence and non-intentional injury cohort differed (table 1). Victims of interpersonal violence were younger, with a median age of 28 years (IQR: 23–34 vs. 30 years, IQR: 24–39;

Table 1 Characteristics of patients with intentional and unintentional injuries

	Patients	Unintentional injuries	Injuries from interpersonal violence	P value
Patients, n (%)	72 438	46 689 (64.5)	25 008 (34.5)	
Age in years, median (IQR)	29 (24–37)	30 (24–39)	28 (23–34)	0.0001
Female sex, n (%)	16 744 (23.4)	11 785 (25.3)	4959 (19.8)	<0.001
Transferred, n (%)	10 578 (14.8)	8050 (17.3)	2528 (10.1)	<0.001
Hours to presentation, n (%)*				<0.001
0–4	25 139 (59.5)	16 800 (61.4)	8339 (56.1)	
5–24	11 527 (27.3)	6433 (23.5)	5094 (34.3)	
25–48	2558 (6)	1756 (6.4)	802 (5.4)	
49–96	1318 (3.1)	1012 (3.7)	306 (2.1)	
>96	1715 (4.1)	1385 (5.1)	330 (2.2)	
Night-time admission (18:00–06:00), n (%)	26 721 (37.3)	14 883 (31.9)	11 838 (47.4)	<0.001
Alcohol use, n (%)†	6151 (8.6)	2039 (4.4)	4112 (16.5)	<0.001
Year of admission, n (%)				<0.001
2009	5807 (8.1)	3620 (7.8)	2187 (8.8)	
2010	7545 (10.5)	4845 (10.4)	2700 (10.8)	
2011	9398 (13.1)	6201 (13.3)	3197 (12.8)	
2012	9935 (13.9)	6530 (14)	3405 (13.6)	
2013	10 407 (14.5)	6715 (14.4)	3692 (14.8)	
2014	10 197 (14.2)	6668 (14.3)	3529 (14.1)	
2015	9511 (13.3)	6308 (13.5)	3203 (12.8)	
2016	8906 (12.4)	5811 (12.4)	3095 (12.4)	
Occupation, n (%)				<0.001
Farmer	5860 (8.4)	4411 (9.7)	1449 (5.9)	
Other employment	54 755 (78.4)	35 757 (78.8)	18 998 (77.6)	
Unemployed	9208 (13.2)	5184 (11.4)	4024 (16.4)	
Season of injury, n (%)				<0.001
Rainy (December–February)	17 339 (24.2)	10 978 (23.5)	6361 (25.4)	
Lush, green (March–May)	17 991 (25.1)	11 846 (25.4)	6145 (24.6)	
Cold, dry (June–August)	18 427 (25.7)	12 452 (26.7)	5975 (23.9)	
Hot, dry (September–November)	17 949 (25)	11 422 (24.5)	6527 (26.1)	
Injury severity—Malawi Trauma Score, median (IQR)	8 (6–11)	8 (6–10)	10 (8–12)	0.0001

*Available for 42 257 patients (59.1%).

†Not documented in 307 people (0.4%).

Table 2 Mechanism and injuries for victims of interpersonal violence

	Patients n (%)
Blunt injuries	8096 (32.4)
Body	
Hands	2722 (34.2)
Feet	171 (2.1)
Stone or brick	1455 (18)
Tool	404 (5)
Stick	907 (11.2)
Metal object	1735 (21.4)
Other	652 (8.1)
Penetrating	6131 (24.5)
Knife or sharp object	5812 (94.8)
Gun	195 (0.8)
Other	124 (2)
Other*	10 781 (43.1)
Motor vehicle collision	126 (1.2)
Bite	124 (1.2)
Fall	71 (0.7)
Occupational/machine injury	3 (<0.01)
Burn	41 (0.2)
Collapsed structure	21 (<0.01)
Unknown	10 395 (96.4)

*For patients without clear documentation of blunt or penetrating assault weapon. Percentage out of 10 781 patients.

$p<0.001$). There was a male preponderance in the entire trauma cohort (76.6%); however, women were less frequently victims of interpersonal violence (4959, 19.8%) ($p<0.001$). Victims of interpersonal violence were more frequently admitted directly from the scene (22 460, 89.9%) than the non-intentional injury cohort (38 603, 82.7%) ($p<0.001$). Time from injury to presentation was available for 42 257 (59%) patients. Fewer victims of interpersonal violence presented within 4 hours of injury (8339, 56.1% vs. 16 800, 61.4%; $p<0.001$). Victims of interpersonal violence were more likely to be unemployed (16.4%, $n=4027$ vs. 11.4%, $n=5189$; $p<0.001$). Alcohol use was also reported more often in victims of interpersonal violence (16.5%, 4114 vs. 4.4%, 2039). The MTS⁷ was used to estimate injury severity and could be calculated for 41 457 (57.6%) patients; interpersonal violence patients had higher injury severity, with a median MTS of 10 (IQR 8–12 vs. 8, IQR: 6–10; $p<0.001$), compared with the non-intentional injury cohort.

The timing of interpersonal violence differed from general traumas. More interpersonal violence victims were admitted at night (18:00–06:00) (47.4%, 11 838 vs. 31.9%, 14 889; $p<0.001$) and on weekends (38.7%, $n=9686$ vs. 30.1%, $n=14 068$; $p<0.001$). There were slightly more incidents of interpersonal violence in the hot, dry season (September–December), compared with other seasons, whereas the cold, dry season (June–August) was the most common season for non-intentional injuries (table 1).

For 10 395 (41.5%) patients the mechanism of assault (blunt vs. penetrating) and/or weapon used was not recorded (table 2). In 14 613 (58.4%) patients for whom assault weapon was documented, gun violence was uncommon in this population, comprising only 3.2% ($n=195$) of penetrating injuries and less than 1% of all interpersonal violence. Blunt assaults with hands/

feet caused 34.2% of injuries, whereas some type of object was used in the remaining documented cases.

Victims of interpersonal violence had a lower mortality rate (404, 1.62% vs. 1016, 2.39%; $p<0.001$) than non-intentional trauma victims, including lower prehospital mortality (1.02% vs. 1.21%; $p=0.02$). Compared with blunt interpersonal violence victims, the interpersonal violence patients with penetrating wounds had higher mortality (2.5% vs. 1%; $p<0.001$) and were more frequently brought in dead (1.6% vs. 0.5%; $p<0.001$) (table 3). Overall fewer interpersonal violence victims were admitted to the hospital than non-intentional injury patients (14%, $n=3487$ vs. 18.5%, $n=8621$; $p<0.001$). Of the victims of interpersonal violence, patients with penetrating wounds were more likely to be admitted (20% vs. 10.6%; $p<0.001$). Intensive care unit admission was similar between penetrating and blunt assaults (1.6% vs. 1.5%; $p=0.8$).

Log binomial regression analysis of factors associated with mortality demonstrated decreased risk of mortality for women (Relative Risk (RR) 0.25, 95% CI 0.17 to 0.38, $p<0.001$), those who admitted alcohol use (RR 0.54, 95% CI 0.39 to 0.75, $p<0.001$), and blunt mechanism of injury, compared with other/unknown mechanisms (RR 0.57, 95% CI 0.44 to 0.74, $p<0.001$). Increased risk of mortality was seen with older age (RR 1.03, 95% CI 1.02 to 1.03, $p<0.001$), primary head injuries (RR 3.14, 95% CI 2.25 to 4.39, $p<0.001$) or torso injuries (RR 4.33, 95% CI 2.99 to 6.28, $p<0.001$), compared with the extremity, and the number of injuries (2 injuries: 1.27, 95% CI 1.02 to 1.58, $p=0.031$; 3 or more injuries: 2.01, 95% CI 1.54 to 2.62, $p<0.001$). Compared with unknown mechanisms, penetrating traumas had increased risk of mortality (RR 1.46, 95% CI 1.17 to 1.81, $p=0.001$) (table 4).

The risk of mortality from interpersonal violence compared with non-intentional traumas was lower (0.48, 95% CI 0.35 to 0.66, $p<0.001$) when adjusted for night admission, injury severity using MTS, number of injuries, and alcohol use (table 5).

DISCUSSION

Interpersonal violence is a significant cause of morbidity and mortality for many populations globally.² We evaluated the role of interpersonal violence on overall trauma burden and trauma mortality in a sub-Saharan African country in peacetime. Using a large hospital-based trauma surveillance database, interpersonal violence accounted for 35% of the traumas evaluated in the cohort. There was a strong association between interpersonal violence and alcohol use. Mechanism and anatomic location of injury in interpersonal violence were associated with mortality. Patients with penetrating injuries and those with head injury following interpersonal violence had an increased risk of mortality.

Interpersonal violence rates are high in sub-Saharan Africa.³ Violent conflict is the third leading cause of mortality worldwide.⁸ Sub-Saharan Africa has the highest number of active armed conflicts, more than any other region globally.⁶ There is a strong association between active and historical armed conflict and an increased incidence of interpersonal violence in a society. El Salvador, Guatemala, Liberia, and South Africa are just a few examples of countries where homicide rates remained high or increased in the postwar period.⁹ Many assume it is this armed conflict, or the aggressive cultures that conflict creates, that drives the high rates of interpersonal violence.^{4–6} Malawi, however, is a country that has never seen internal armed conflict since its independence. Despite this, over one-third of all traumas with severe

Table 3 Clinical and management characteristics by assault mechanism for victims of interpersonal violence*

	All patients	Blunt (n=8068)	Penetrating (n=6095)	P value
Body region of worst injury, n (%)				<0.001
Head	7996 (56.5)	4631 (57.4)	3365 (55.2)	
Torso	2286 (16.1)	1384 (17.1)	902 (14.8)	
Extremities	3881 (27.4)	2053 (25.5)	1828 (30)	
Number of body injuries, n (%)				<0.001
1 injury	7827 (55.2)	4257 (52.7)	3570 (58.4)	
2 injuries	4765 (33.6)	2916 (36.1)	1849 (30.3)	
3 or more injuries	1595 (11.2)	904 (11.2)	691 (11.3)	
Shock*, n (%)	5628 (51)	3370 (51.5)	2258 (50.3)	0.218
Initial AVPU score†				
4—alert	13 038 (91.9)	7706 (95.3)	5332 (87.4)	<0.001
3—responds to voice	959 (6.8)	310 (3.8)	649 (10.6)	
2—responds to pain	32 (0.2)	18 (0.2)	14 (0.2)	
1—unresponsive	163 (1.1)	57 (0.7)	106 (1.8)	
Admitted, n (%)	2084 (14.7)	858 (10.6)	1226 (20.1)	<0.001
Highest ward of care, n (%)				
Ward	1000 (95.9)	396 (96.4)	604 (95.6)	0.796
High dependency unit (HDU)	27 (2.6)	9 (2.2)	18 (2.8)	
Intensive care unit	16 (1.5)	6 (1.4)	10 (1.6)	
Any procedure, n (%)	1874 (13.2)	802 (9.9)	1072 (17.5)	<0.001
Outcome				
Brought in dead	138 (1.0)	40 (0.5)	98 (1.6)	<0.001
Died in hospital	91 (0.6)	40 (0.5)	51 (0.9)	
Survived	13 854 (98.4)	7976 (99)	5878 (98.3)	

**Shock index (initial heart rate/initial systolic blood pressure) >0.7.

†AVPU score classifies mental status as Alert, responsive to Voice, responsive to Pain, or Unresponsive

enough injuries to present to a tertiary hospital are the result of interpersonal violence. Studies in other African countries, most with some ongoing interethnic conflict, similarly demonstrate

elevated rates of interpersonal violence. The rates in countries like Ethiopia, Tanzania, and Uganda, while high at 22.2% to 28%,^{10–12} were lower than the rate in this study. Furthermore,

Table 4 Univariable and multivariable log binomial regression of factors associated with mortality in victims of interpersonal violence

	Patients, n (%)	Univariable analysis			Multivariable analysis		
		Relative Risk	95% CI	P value	Relative Risk	95% CI	P value
Sex							
Male	20 036 (80.2)	Reference					
Female	4959 (19.8)	0.25	0.17 to 0.38	<0.001	0.29	0.19 to 0.43	<0.001
Age (years)		1.03	1.02 to 1.04	<0.001	1.03	1.02 to 1.03	<0.001
Injury location							
Extremities	34 909 (48.7)	Reference			Reference		
Head	25 181 (35.1)	3.07	2.20 to 4.27	<0.001	3.14	2.25 to 4.39	<0.001
Torso	11 587 (16.2)	3.91	2.71 to 5.66	<0.001	4.33	2.99 to 6.28	<0.001
Number of injuries							
1	13 682 (55)	Reference			Reference		
2	8478 (34.1)	1.29	1.04 to 1.61	0.02	1.27	1.02 to 1.58	0.032
3 or more	2726 (11)	2.14	1.64 to 2.79	<0.001	2.01	1.54 to 2.62	<0.001
Mechanism of injury							
Other/unknown	10 781 (43.1)	Reference			Reference		
Blunt	8 096 (32.4)	0.58	0.45 to 0.76	<0.001	0.57	0.44 to 0.74	<0.001
Penetrating	6131 (24.5)	1.46	1.17 to 1.81	0.001	1.46	1.17 to 1.81	0.001
Alcohol used	4112 (16.5)	0.59	0.43 to 0.82	0.001	0.54	0.39 to 0.75	<0.001

Table 5 Association of interpersonal violence with mortality, adjusted log binomial regression modeling

	Patients, n (%)	Univariable analysis			Multivariable analysis		
		Relative Risk	95% CI	P value	Relative Risk	95% CI	P value
Interpersonal violence	25 008 (34.5)	0.54	0.43 to 0.69	<0.001	0.48	0.35 to 0.67	<0.001
Night admission		1.07	0.89 to 1.28	0.477	0.96	0.75 to 1.24	0.773
Number of injuries							
1	44 603 (61.9)	Reference			Reference		
2	29 484 (28.5)	1.31	1.05 to 1.63	0.017	1.03	0.77 to 1.38	0.84
3 or more	6881 (9.6)	2.34	1.87 to 2.93	<0.001	1.32	0.95 to 1.83	0.1
Malawi Trauma Score*		1.17	1.14 to 1.19	<0.001	1.17	1.15 to 1.2	<0.001
Alcohol used	6188 (8.5)	0.9	0.65 to 1.26	0.542	0.68	0.42 to 1.1	0.114

*Available for 41 457 patients (57.6%).

the rate of trauma-related mortality attributable to interpersonal violence is much higher in many sub-Saharan African countries, reported at 13% to 70%,^{12–14} in contrast to high-income countries like Norway and the UK, where rates range from 1.7% to 3.6%.^{15 16}

Men are more commonly the victims of violence worldwide, with the average rate of fatal violence against men compared with women of 3.2:1, but as high as 5.7:1 in some sub-Saharan African countries.^{10 11 17} This was true in our population in Malawi. However, as interpersonal violence was self-reported or caregiver-reported, we suspect that the rate of interpersonal violence including domestic violence and sexual assault may have been higher for women and under-reported. Sexual assault or rape was reported as the mechanism in less than 1% of all episodes of interpersonal violence, which suggests significant under-reporting as rates of intimate partner violence in Malawi have been estimated at 11% to 13%¹⁸ and up to 70% in some LMICs.^{18 19} Future efforts to understand the specific role of gender in interpersonal violence in Malawi must seek additional forums to identify victims and specific risk factors, as many people may be reluctant to admit to interpersonal violence on arrival in the emergency department, especially when the potential perpetrator of the violence is present. Specific screening programs to identify victims of sexual assault and intimate partner violence are needed both to accurately characterize the impact of these on the trauma burden and to develop programs to support victims and prevent this type of violence.

Alcohol use was significantly higher in victims of interpersonal violence than non-intentional traumas. As this was also self-reported, alcohol use is likely even higher. Alcohol use is a known risk factor for interpersonal violence.^{10 20} Alcohol impacts cognitive and motor function, increasing the risk that people who are intoxicated may become victims of violence.¹⁷ In some studies the use of alcohol by either the victim or the perpetrator of violence was as high as 67%.¹¹ Whereas the rate of alcohol use was significantly higher in the interpersonal violence victims in our study, at 16.5%, it is much lower overall than the 27% to 47% found in other published reports about the association between alcohol use and injury.¹⁷ Our lower rate likely represents under-reporting, as routine blood alcohol levels are not currently checked. To improve the understanding of how alcohol impacts injuries in Malawi, all trauma victims should have their alcohol levels routinely measured. This is especially true as survivors of violence who develop post-traumatic stress disorder are even more likely to abuse alcohol, putting them again in harm's way.¹⁷

Poverty has been linked to increased rates of interpersonal violence.^{11 19 21} Poverty and the accompanying stress can make

people living in a poor household feel frustrated, angry, and inadequate. Unfortunately, it is often the other family members who are the outlet for this anger, through violence.¹⁹ Although we did not collect specific information on individual patient poverty level as part of the trauma registry, victims of interpersonal violence were more frequently unemployed than the rest of the trauma cohort, as has been found in other sub-Saharan countries.¹¹ This suggests that the underlying drivers of interpersonal violence—in the absence of formal ethnic strife or war—may be socioeconomic factors like poverty.

A unique aspect of interpersonal violence, particularly in LMICs, is the role of “mob justice.” This is a form of public extrajudicial punishment where an alleged criminal is humiliated, beaten, or summarily executed by a crowd or vigilantes. This form of street justice occurs where dysfunctional and/or corrupt judiciary systems and law enforcement exist and the people choose to take the law into their own hands. In many countries in sub-Saharan Africa, within a milieu of poverty and weak governance, corruption is pervasive, particularly in law enforcement.^{22 23} There is little published research on the impact on this type of social policing and its impact on trauma rates in Malawi and similar countries. The role of mob justice in the high rate of interpersonal violence was not captured in our study but warrants further specific investigations. Improved policing and formal consequences for crimes could potentially decrease this source of traumatic injury.

Limitations

There are several limitations to our study. This is a retrospective review of prospectively collected data and is subject to the limitations of the study design. Both the intent of the injury and the use of alcohol were self-reported and thus likely under-reported. The lower rate of women reporting interpersonal violence may reflect an unwillingness to report intimate partner violence.¹⁸ Furthermore, the assault weapon was missing from a large number of patients. Despite these limitations, this study is important because KCH is one of the only hospitals that have maintained a trauma registry in a low-income sub-Saharan African country for nearly a decade. With its large sample size, which captures admitted, discharged, and dead-on-arrival victims of interpersonal violence, this study is unique in its ability to characterize the large role interpersonal violence contributes to the trauma burden in sub-Saharan Africa, even in a country at peace and without a history of internal conflict.

CONCLUSION

The proportion of the trauma burden attributable to interpersonal violence in Malawi is very high, despite the fact that the country has never experienced internal conflict. Alcohol, male sex, and unemployment were associated with interpersonal violence. Routine screening for alcohol use should be adopted for trauma victims and resources developed to treat alcohol dependence. The high rate of interpersonal violence makes further study of it in Malawi essential for designing public health interventions to decrease its contribution to the trauma burden, including identifying at-risk populations and determining whether mob justice plays an important role in interpersonal violence.

Contributors RGM: study design, data analysis, data interpretation, article draft and revision. BW: study design, data interpretation, article revision. JAK: data interpretation, article draft and revision. GM: study design, data interpretation, article revision. CV: study design, data interpretation, article revision. JG: data interpretation, article revision. TR: study design, data interpretation, article revision. AGC: study design, data interpretation, article revision.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Not required.

Ethics approval The Institutional Review Board of the University of North Carolina at Chapel Hill and the National Health Science and Research Council of Malawi approved this study.

Provenance and peer review Not commissioned; internally peer reviewed.

Data sharing statement Study data were collected from the Kamuzu Central Hospital trauma registry. These data are maintained at the hospital and available with permission from the Malawi Ministry of Health.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0>

REFERENCES

- Haagsma JA, Graetz N, Bolliger I, Naghavi M, Higashi H, Mullany EC, Abera SF, Abraham JP, Adofo K, Alsharif U, et al. The global burden of injury: incidence, mortality, disability-adjusted life years and time trends from the Global Burden of Disease study 2013. *Inj Prev* 2016;22:3–18.
- Krug EG, Mercy JA, Dahlberg LL, Zwi AB. The world report on violence and health. *Lancet* 2002;360:1083–8.
- Institute for Economics and Peace. 2018. Global Peace Index - Snap Shot 2018 <http://visionofhumanity.org/app/uploads/2018/06/Global-Peace-Index-2018-Snapshot.pdf> (12 Jul 2018).
- Ember C, War EM. Socialization, and interpersonal violence: a cross-cultural study. *The Journal of Conflict Resolution* 1994;38:26.
- Hecker T, Fetz S, Ainamani H, Elbert T. The cycle of violence: associations between exposure to violence, trauma-related symptoms and aggression—findings from congolesse refugees in Uganda. *J Trauma Stress* 2015;28:448–55.
- Wagner Z, Heft-Neal S, Bhutta ZA, Black RE, Burke M, Bendavid E. Armed conflict and child mortality in Africa: a geospatial analysis. *Lancet* 2018;392:857–65.
- Gallaher J, Jefferson M, Varela C. 2018. The malawi trauma score: a model for predicting trauma-associated mortality in a resource-poor setting <http://www.asc-abstracts.org/abs2018/75-04-the-malawi-trauma-score-a-model-for-predicting-trauma-associated-mortality-in-a-resource-poor-setting/> (25 Jul 2018).
- Pike IL, Straight B, Oesterle M, Hilton C, Lanyasunya A. Documenting the health consequences of endemic warfare in three pastoralist communities of northern Kenya: a conceptual framework. *Soc Sci Med* 2010;70:45–52.
- Willman A, Makisaka M. 2010. Interpersonal violence prevention: a review of the evidence and emerging lessons [background paper] http://web.worldbank.org/archive/website01306/web/pdf/wdr%20background%20paper_willman.pdf (25 Jul 2018).
- Tadesse BT, Dachew BA, Biftu BB, Kelkay MM, Adane KC, Gorgas DL. High incidence of interpersonal violence in Northwest Ethiopia: A cross-sectional study. *Int Emerg Nurs* 2015;23:213–7.
- Chalya PL, Gilyoma JM. The burden of intentional injuries in Mwanza City, north-western Tanzania: a tertiary hospital survey. *Tanzan J Health Res* 2012;14:204–11.
- Mutto M, Lett R, Lawoko S, Nansamba C, Svanstrom L. Intentional injuries among Ugandan youth: a trauma registry analysis. *Inj Prev* 2010;16:333–6.
- Ziraba AK, Kyobutungi C, Zulu EM. Fatal injuries in the slums of Nairobi and their risk factors: results from a matched case-control study. *J Urban Health* 2011;88(Suppl 2):256–65.
- Lewis C, Wood D. Interpersonal violence as a major contributor towards the skewed burden of trauma in KwaZulu-Natal, South Africa. *S Afr Med J* 2015;105:827–30.
- Howe A, Crilly M. Violence in the community: a health service view from a UK Accident and Emergency Department. *Public Health* 2002;116:15–21.
- Kristiansen T, Lossius HM, Rehn M, Kristensen P, Gravseth HM, Røislien J, Søreide K. Epidemiology of trauma: a population-based study of geographical risk factors for injury deaths in the working-age population of Norway. *Injury* 2014;45:23–30.
- Matzopoulos R, Bowman B, Mathews S, Myers J. Applying upstream interventions for interpersonal violence prevention: an uphill struggle in low- to middle-income contexts. *Health Policy* 2010;97:62–70.
- Bazargan-Hejazi S, Medeiros S, Mohammadi R, Lin J, Dalal K. Patterns of intimate partner violence: a study of female victims in Malawi. *J Inj Violence Res* 2013;5:38–50.
- Tran TD, Nguyen H, Fisher J. Attitudes towards Intimate Partner Violence against Women among Women and Men in 39 Low- and Middle-Income Countries. *PLoS One* 2016;11:e0167438.
- Greene MC, Kane JC, Tol WA. Alcohol use and intimate partner violence among women and their partners in sub-Saharan Africa. *Glob Ment Health* 2017;4:e13.
- Seedat M, Van Niekerk A, Jewkes R, Suffla S, Ratele K. Violence and injuries in South Africa: prioritising an agenda for prevention. *Lancet* 2009;374:1011–22.
- Ng'walali PM, Kitinya JN. Mob justice in Tanzania: a medico-social problem. *Afr Health Sci* 2006;6:36–8.
- Forgus S, Delva W, Hauptfleisch C, Govender S, Blitz J. Community v. non-community assault among adults in Khayelitsha, Western Cape, South Africa: a case count and comparison of injury severity. *S Afr Med J* 2014;104:299–301.