

ORIGINAL ARTICLE

Assessment of substance use among injured persons seeking emergency care in Nairobi, Kenya



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ABSTRACT

Introduction: Trauma is a leading cause of morbidity and mortality in Kenya. In many countries, substance use is common among patients presenting with injuries to an emergency center (EC).

Objective: To describe the epidemiology of self-reported substance use among adult injured patients seeking ED care in Nairobi, Kenya.

Methods: This prospective cross-sectional study, assessed patients presenting with injuries to the Kenyatta National Hospital ED in Nairobi, Kenya from March through June of 2021. Data on substance use, injury characteristics and ED disposition were collected. Substances of interest were alcohol, stimulants, marijuana, and opiates. The Alcohol Use Disorders Identification Test-Concise (AUDIT-C) tool was used to characterize hazardous alcohol use.

Results: A total of 1,282 patients were screened for participation, of which 646 were enrolled. Among participants, 322 (49.8%) reported substance use in the past month (AUDIT-C positive, stimulants, opiates, and/or marijuana). Hazardous alcohol use was reported by 271 (42.0%) patients who screened positive with AUDIT-C. Polysubstance use, (≥ 2 substances) was reported by 87 participants in the past month. Median time from injury to ED arrival was 13.1 h for all enrollees, and this number was significantly higher among substance users (median 15.4 h, IQR 5.5 - 25.5; $p = 0.029$).

Conclusions: In the population studied, reported substance use was common with a substantial proportion of injured persons screening positive for hazardous alcohol use. Those with substance use had later presentations for injury care. These data suggest that ED programming for substance use disorder screening and care linkage could be impactful in the study setting.

African relevance

- Alcohol use, as well as other substance use, is associated with injury, and subsequently seeking acute care. There is currently limited data from injured acute care patients in Africa and Kenya on hazardous alcohol use or polysubstance use.
- There is an urgent need for research into how to best develop and implement substance use assistance interventions in the emergency care setting in sub-Saharan Africa.
- Current data demonstrate that a history of alcohol use was common among injured patients in Nairobi, Kenya. These data, along with

the burdens of use for other dangerous substances, suggest that the ED venue may be an impactful environment to access and provide care for persons with substance use disorders.

Introduction

Trauma is a leading cause of morbidity and mortality around the world, with particularly high impacts across Africa [1]. In Kenya, which has a developing emergency care system, one in eight adults are injured on an annual basis and injuries are among the most common causes for seeking acute medical attention [2–6]. At Kenya's largest hospital

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emergency center (Kenyatta National Hospital, KNH), prior work has shown that 25% of encounters are related to injuries [7].

Alcohol use is a known associated risk factor for injury, and use or abuse has been identified among Kenyan patients who suffer injuries [8–11]. More broadly, substance use beyond alcohol, such as stimulants (including khat, cocaine, and methamphetamines), marijuana, and/or opiates, have been seen to be common among injured emergency center (EC) patients in multiple settings [12–17]. There is limited data from injured EC patients in Kenya on hazardous alcohol use, or the use of two or more substances, polysubstance use. Prior work has not evaluated the role of self-reported substance use (as opposed to acute intoxication) and its potential role in screening for substance use and implementing interventions for change in EC settings in Kenya. This analysis evaluates self-reported substance use among traumatically injured patients in a national referral hospital emergency center in Nairobi, Kenya.

Methods

This study is a cross-sectional analysis of patients presenting with injuries to the KNH EC. This is an *a priori* secondary analysis of prospective data collected from March to June 2021 from persons with injuries seeking EC care [18]. KNH is the largest hospital in Kenya, the main public hospital serving the nation's capital, and it is also an important receiving center for referrals from across the country. The EC functions 24-hours a day and has continually available diagnostic and treatment resources including surgical specialists for injured patients. All participants enrolled in the study received standard care for injuries at the discretion of their treating providers in the EC, who were not members of the research team. The study was approved by the KNH Ethics and Research Committee and the Institutional Review Board of Rhode Island Hospital.

Patients with injuries at the KNH EC were screened 24-hours a day by research staff as close to time of arrival as possible during the enrolment period. Designation of a patient as a trauma case occurred at time of triage by the non-study affiliated clinical personnel at the EC who use the South African Triage Scale, which includes a variable indicating if the patient is seeking care for trauma [19]. All participants provided informed consent in either Kiswahili or English. Patients were eligible for inclusion if ≥ 18 years of age, seeking EC care for a physical injury, and both able and willing to provide informed consent. Exclusion criteria included: age < 18 years, seeking care for non-injury reasons, known to be pregnant, a legal prisoner of the state, and unable or unwilling to provide informed consent. Patients with altered mental status or clinical instability on arrival who did not have sufficient awareness to make decisions were excluded given their inability to provide informed consent, however these patients were reassessed throughout their EC course for screening and enrolment if their clinical state allowed. Participants were compensated for study participation.

Data on demographics, medical history, and substance use were collected at enrollment. Patients were then followed throughout the EC course by study staff. Data were again collected at the time of completion of EC care, regarding disposition and identified injuries. Data were collected using password protected electronic tablets and study data were collected and managed using REDCap electronic data capture tools hosted at Brown University [20,21]. Data sources in EC included direct participant questioning and EC medical record review to identify details of identified injuries.

Substance use was based on self-report of any predefined substance of interest used at least one time within 30-days of presentation for injury care. The preceding thirty day timeframe is frequently used in research evaluating individual substance use, including in the U.S.A., Africa, and in Kenya in validated tools such as the Global School-Based Student Health Survey [22–27]. Substance of interest were alcohol, stimulants (khat, cocaine, or methamphetamines), marijuana, and opiates. To characterize alcohol use, the 3-question Alcohol Use Disorders Identification Test-Concise (AUDIT-C) tool was used; AUDIT-C has been val-

idated as an appropriate screening tool for hazardous drinking in a variety of settings, including in the emergency center among trauma patients, as well as in Kenya [15,28–31]. An AUDIT-C score is considered positive for hazardous alcohol use in males with a score ≥ 4 , a score ≥ 3 in females [32].

Data analysis was completed using STATA Statistical Software Release 16.0 (College Station, Texas, USA). Descriptive analysis was performed for the population stratified based on substance use categories. Comparisons were made between patients reporting no substance use and independently compared to those reporting one or more substance(s) and those reporting two or more substances (polysubstance use) using chi-squared, Fisher's exact nonparametric testing or Wilcoxon rank sum as appropriate based on observation frequency and conformity with normality of distribution. Patient's alcohol use was assessed; only those patients with identified hazardous drinking using the AUDIT-C tool were considered as alcohol substance users.

Results

During the study enrolment period, 1282 patients presented for injury care to the KNH EC who were screened for participation. Among those, 563 (43.9%) did not meet inclusion criteria and 73 (5.7%) declined participation. A total 646 participants were enrolled (Fig. 1).

Of the 646 enrolled patients, 567 were male (87.8%) and the median age was 29 years (IQR: 25 - 37 years). Characteristics of patients reporting no substance use in the past month against those with reported ≥ 1 substance use (Table 1), and those with no substance use and those with reported ≥ 2 substances (Table 2) are outlined below. Substance users were statistically more likely to be male (≥ 1 substance $p \leq 0.001$, ≥ 2 substance $p = 0.047$). Age was similar across all groups. Both categories of substance users were less likely to have professional jobs and were also less likely to have full time employment. There was a statistical difference in the vocation and education levels between those with no and ≥ 1 substance use (vocation $p = 0.041$, education $p = 0.002$) and those with no and ≥ 2 substance use (vocation $p = 0.005$, education $p \leq 0.001$). Less than a quarter of all enrolled patients had attained post-secondary education.

History of arriving directly to the KNH EC versus being transferred from an outside facility was not significant between substance users and non-users ($p = 0.111$). The time from injury occurrence to KNH EC arrival was 13.1 h for all enrollees, and significantly longer for ≥ 1 substance users (median 15.4 h, IQR 5.5 - 25.5) than non-substance users (median 10.2 h, IQR 4.5 - 24.0; $p = 0.029$). The disposition destination from the EC was not significantly different between non-substance users, ≥ 1 substance users, and polysubstance users (Tables 1 and 2; $p = 0.250$ and $p = 0.51$, respectively).

Among enrollees, 322 patients (49.8%) reported some type of substance use in the past month. Patients also reported using stimulants ($n = 79$), marijuana ($n = 71$), and opiates ($n = 6$). Among those reporting substance use, 87 participants reported polysubstance use. The most common reported polysubstance combination was stimulant use reported by individuals who were AUDIT-C positive for hazardous alcohol use ($n = 57$).

Among all enrolled patients, 271 patients (42.0% of enrollees, 248 males and 23 females) reported alcohol use characteristics that yielded AUDIT-C positive outcomes for hazardous alcohol use (Table 3). There was not a significant difference between AUDIT-C positive males and females ($p = 0.055$). Of note, 10.5% of all enrollees reported having ≥ 6 alcohol drinks on one occasion daily, while a larger proportion (34.4%) reported ≥ 6 alcoholic drinks on one occasion at least weekly.

Discussion

Among the studied injured persons in the emergency care setting in Kenya, nearly half reported substance use in the past month, with over

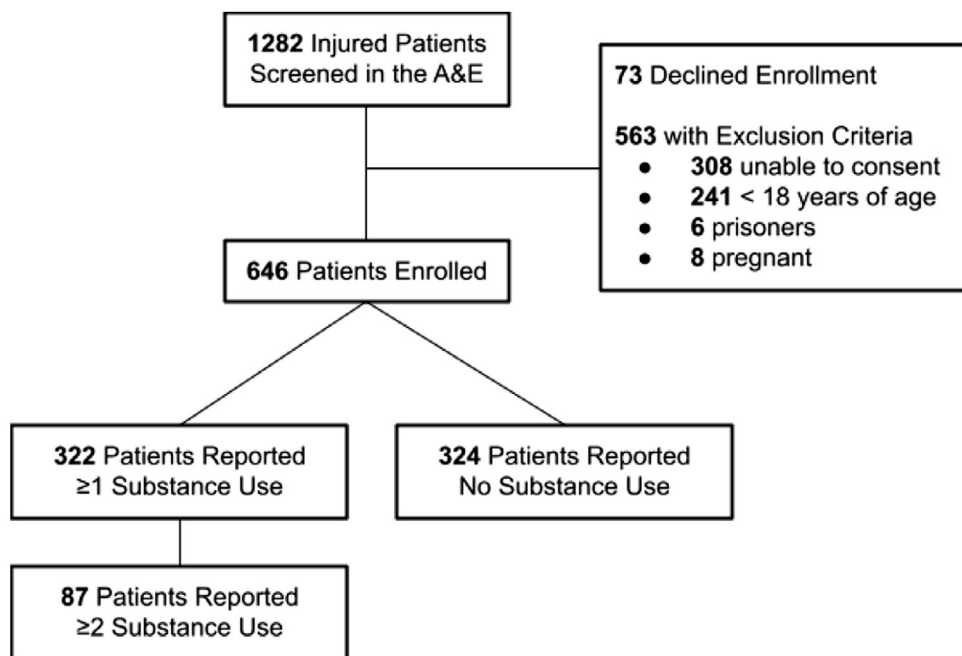


Fig. 1. Patient enrolment.

Table 1
Characteristics, no substance use vs ≥1 substance use.

	Non-Substance	≥1 Substance	p =
Number	324	322	
Demographics			
Age, years (Median, IQR)	28, 24–37	30, 25–37	0.121
Male (No,%)	268 (82.7%)	299 (92.9%)	<0.001
Vocation (No,%)			
Full Time Professional	37 (11.4)	24 (7.6)	
Full Time Laborer	103 (31.8)	99 (31.1)	
Part Time Professional	12 (3.7)	5 (1.6)	
Part Time Laborer	46 (14.2)	75 (23.6)	
Self Employed	68 (21.0)	61 (19.2)	
Unemployed	57 (17.6)	53 (16.7)	
Missing	1	5	
Highest Education Level (No,%)			
Post Secondary	70 (21.6%)	61 (18.9%)	0.002
Secondary	149 (46%)	114 (35.4%)	
Primary	105 (32.4%)	147 (45.7%)	
Injury and Referral			
Transferred from Outside Facility (No,%)	146 (45.3%)	126 (39.1%)	0.111
Hours, Injury to Arrival (Median, IQR)	10.2 (4.5, 24.0)	15.4 (5.5, 25.5)	0.029
Disposition from KNH ED (No,%)			
Discharged	177 (54.6%)	184 (57.3%)	0.250
Admitted	139 (42.9%)	131 (40.8%)	
Transferred from KNH	5 (1.5)	1 (0.3)	
Eloped	2 (0.6)	5 (1.6)	
Deceased in ED	1 (0.3)	0 (0)	
Missing	0	1	

one in eight reporting polysubstance use during that time frame. This observed burden in the injured population suggests that the EC venue may be an impactful environment to access and provide care for substance use disorders in Kenya and other similar settings. Furthermore as the EC treatment period has been documented as a setting in which health promotion and readiness to change is present, interventions for substance use may be both feasible and efficacious [33–35]. However, there is an urgent need for research into how to best develop and implement substance use assistance interventions in the EC setting in sub-Saharan Africa.

Alcohol use was the most common substance reported by the enrolled injured persons seeking care. There is limited prior research eval-

uating alcohol or drug use among injured patients in Kenya. Work by Odero et al. in 1995 found that 16.5% of their patients reported alcohol use within 12 h of injury and he found in 2007 that 32.8% of EC injury patients were suspected of being under the influence of alcohol preceding the injury based on the detection of “the smell of alcohol on the subjects’ breath” [9,36]. A survey among KNH road traffic injured patients in 2005 found an alcohol use prevalence 26.3% [37]. The current data found 42.0% of all enrollees were AUDIT-C positive, indicating a high percent of all trauma patients at the KNH EC have behavior consistent with hazardous drinking and/or active alcohol use disorder. Further, there were very high levels of reported binge drinking, with 44.9% of those with alcohol use in the past month reporting ≥6 alcoholic drinks

Table 2
Characteristics, no substance use vs ≥2 substance (polysubstance) use.

	Non-Substance	≥2 Substance	p =
Number	324	87	
Demographics			
Age, years (Median, IQR)]	28, 24–37	28, 24–35	0.048
Male (No,%)	268 (82.7%)	82 (94.3)	0.047
Vocation (No,%)			
Full Time Professional	37 (11.4)	5 (5.9%)	0.005
Full Time Laborer	103 (31.8)	21 (24.7%)	
Part Time Professional	12 (3.7)	0 (0)	
Part Time Laborer	46 (14.2)	23 (27.1%)	
Self Employed	68 (21.0)	12 (14.1%)	
Unemployed	57 (17.6)	23 (27.1%)	
Missing	1	3	
Highest Education Level (No,%)			
Post Secondary	70 (21.6%)	13 (14.9%)	<0.001
Secondary	149 (46%)	23 (26.4%)	
Primary	105 (32.4%)	51 (58.6%)	
Injury and Referral			
Transferred from Outside Facility (No,%)	146 (45.3%)	31 (35.6%)	0.18
Hours, Injury to Arrival (Median, IQR)	10.2 (4.5, 24.0)	16.7 (6.0, 27.0)	0.293
Disposition from KNH ED (No,%)			
Discharged	177 (54.6%)	51 (59.3%)	0.51
Admitted	139 (42.9%)	33 (38.4%)	
Transferred from KNH	5 (1.5)	0 (0)	
Eloped	2 (0.6)	2 (2.3)	
Deceased in ED	1 (0.3)	0 (0)	
Missing	0	1	

Table 3
Alcohol use disorders identification test-concise parameters (n = 314).

	No. (%)
How often do you drink alcohol?	
Once a month	74 (23.6)
2–4 times a month	103 (32.8)
2–3 times a week	94 (29.9)
4 or more times a week	41 (13.1)
Missing	2 (0.6)
How much alcohol (# drinks) do you have on a day when you drink?	
1–2	178 (56.7)
3–4	96 (30.6)
5–6	26 (8.3)
7–9	8 (2.6)
≥10	4 (1.2)
Missing	2 (0.6)
How often do you drink ≥6 drinks on one occasion?	
Daily	33 (10.5)
Once per week	108 (34.4)
Once per month	71 (22.6)
Less than monthly	15 (4.8)
Never	86 (27.4)
Missing	1 (0.3)
AUDIT-C Positive	
Male (score ≥4)	248 (91.5)
Female (score ≥3)	23 (8.5)

either daily or weekly. There no universal definition of binge drinking, though most commonly it is defined by the number of alcoholic drinks consumed in one sitting: ≥5 for men and ≥4 for women [38,39]. Alternatively, the AUDIT screening tool uses a definition of ≥6 drinks in one sitting for men and women [39]. Our study’s high frequency of binge drinking suggests that the injured population is at high-risk and injured EC patients in Kenya may benefit from interventions to support reduction in alcohol misuse.

While the prior work by Odero and colleagues in Kenyan ECs was around alcohol intoxication at the time of injury, substance use immediately preceding injury only captures a portion of the risk of future injury associated with substance use. In the current data the frequency of substance use over the past month was used to better understand the

burden of substance use among EC patients. This wider scope of understanding of substance use, presenting in the EC at one point in time, provides the opportunity to intervene and aim to reduce harm and prevent future injury, even if and when substance use may not have contributed to the index care presentation. As a consequence, every emergency care encounter presents an opportunity for both brief interventions and linkages to care (including efforts towards harm reduction and cessation) [40–43]. Given the high substance use burdens observed among the population studied, there is a need to develop targeted interventions and referral pathways, both within the Kenyan EC context and in other low-and middle-income countries).

Previous work among trauma patients in Kenya has shown significant delays in presenting to the EC for care. Delays to definitive care can be exacerbated when patients initially present to lower-level health facilities without the capacity to manage significant injuries. Generally, wide ranges in prior studies indicate significant heterogeneity in EC arrival time from injury [3,44,45]. In this study the time of injury to EC arrival was 13.1 h for all patients, with significantly longer delays among those reporting substance use. It is unknown what specifically led to the longer delays in presenting to KNH EC for trauma care among those with substance use, however it is possible that the substance users were less readily identified as needing transfer, which could impact the time to care access of trauma care in an already high-risk sub-population. Additionally, it is possible that there was a delay in the time to initial presentation for injury care due to patient intoxication. Although KNH is a national referral hospital, delays so much longer than previously reported in this and other large hospitals in and around Nairobi are likely multifactorial, and possibly complicated by the SARS CoV-2 pandemic which was ongoing during the time of data collection, but not easily or clearly identified. Future research in which prior and current substance use data is obtained would be beneficial to better understand delays in care as it related to substance use in the injured population.

Study inclusion required individual participants to provide their own informed consent. As such, patients with persistent altered mental status were excluded from enrollment (with particular concern for patients who may have been acutely intoxicated and/or critically injured). Therefore this study was not able to capture the entire population of substance users in the KNH EC during the study period and may have

underestimated the burden of use. In several of the study questions, substance use was reported on the interval of “in the past month” and even self-reported substance use in the hours leading up to a patient’s injury was not evaluated. Our findings may suffer from an element of either recall and/or social desirability bias. Given the nature of the data of interest pertaining to substance use if this type of bias was present it would most likely bias toward the null and the estimates may be an underestimation of the true burden of substance use in the population. Lastly, this study was performed during the pandemic caused by SARS CoV-2, and the findings may be less generalizable to other non-pandemic conditions. However as there has been evidence of increased alcohol and substance use during the SARS CoV-2 pandemic (as well as in prior epidemics) the results demonstrating high use in the population studied are consistent with the existing literature [46–48].

Conclusion

There is a gap in substance use research from high-risk emergency care settings in Africa such as Kenya. The current data demonstrate that a history of alcohol use was common and that there was a high prevalence of hazardous alcohol use based on the validated AUDIT-C tool among the injured population seeking care. These data along with the burdens of use for other dangerous substances suggest that the EC venue may be an impactful environment to access and provide care for persons with substance use disorders. Further study on substance misuse in the EC setting among injured persons are needed to inform development and implementation of substance use assistance interventions in Kenya.

Declaration of Competing Interests

The authors declare no conflicts of interest.

CRediT authorship contribution statement

J. Austin Lee: Conceptualization, Formal analysis, Writing – original draft. **Eric O. Ochola:** Data curation, Software, Methodology. **Janet Sugut:** Investigation, Project administration, Writing – review & editing. **Beatrice Ngila:** Investigation, Project administration. **Daniel K. Ojuka:** Investigation, Writing – review & editing. **Michael J. Mello:** Supervision, Writing – review & editing. **Adam R. Aluisio:** Funding acquisition, Conceptualization, Supervision, Writing – review & editing.

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Dissemination of Results

This work will be shared with the Emergency Medicine Kenya Foundation and will be further disseminated with relevant stakeholders at the local and national level within Kenya.

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References

- [1] Sebastian Abdur-Rahman LO, van As AB, Rode H. Pediatric trauma care in Africa: the evolution and challenges. *Semin Pediatr Surg* 2012;21(2):111–15.
- [2] Lee JA, Wanjiku G, Nduku N, Aluisio AR, Kharel R, Simiyu JT, et al. The status and future of emergency care in the Republic of Kenya. *Afr J Emerg Med* 2022;12(1):48–52.
- [3] Janeway H, O’Reilly G, Schmachtenberg F, Kharva N, Wachira B. Characterizing injury at a tertiary referral hospital in Kenya. *PLoS ONE* 2019;14(7):e0220179.
- [4] Gathecha GK, Githinji WM, Maina AK. Demographic profile and pattern of fatal injuries in Nairobi, Kenya, January–June 2014. *BMC Public Health* 2017;17(1):34.
- [5] Patel H, Suarez S, Shaull L, Edwards J, Altawil Z, Owuor J, et al. Patient characteristics from an emergency care center in rural Western Kenya. *J Emerg Med* 2019;56(1):80–6.
- [6] Wachira BW, Wallis LA, Geduld H. An analysis of the clinical practice of emergency medicine in public emergency departments in Kenya. *Emerg Med J EMJ* 2012;29(6):473–6.
- [7] Myers JG, Hunold KM, Ekernas K, Wangara A, Maingi A, Mutiso V, et al. Patient characteristics of the Accident and Emergency Department of Kenyatta National Hospital, Nairobi, Kenya: a cross-sectional, prospective analysis. *BMJ Open* 2017;7(10):e014974.
- [8] Gathecha GK, Ngaruiya C, Mwai W, Kendagor A, Owondo S, Nyanjau L, et al. Prevalence and predictors of injuries in Kenya: findings from the national STEPs survey. *BMC Public Health* 2018;18(3):1222.
- [9] Odero WO, Kibosia JC. Incidence and characteristics of injuries in Eldoret, Kenya. *East Afr Med J* 1995;72(11):706–10.
- [10] Odero W, Zwi AB. Drinking and driving in an urban setting in Kenya. *East Afr Med J* 1997;74(11):675–9.
- [11] Ranney ML, Odero W, Mello MJ, Waxman M, Fife RS. Injuries from interpersonal violence presenting to a rural health center in Western Kenya: characteristics and correlates. *Inj Prev* 2009;15(1):36–40.
- [12] McDonald A, Duncan ND, Mitchell DI. Alcohol, cannabis and cocaine usage in patients with trauma injuries. *West Indian Med J* 1999;48(4):200–2.
- [13] Bowley DM, Rein P, Cherry R, Vellema J, Snyman T, Boffard KD. Substance abuse and major trauma in Johannesburg. *South Afr J Surg Suid-Afr Tydskr Vir Chir* 2004;42(1):7–10.
- [14] Staton CA, Vissoci JRN, Toomey N, Abdelgadir J, Chou P, Haglund M, et al. The impact of alcohol among injury patients in Moshi, Tanzania: a nested case-crossover study. *BMC Public Health* 2018;18(1):275.
- [15] Sundet M, Kajombo C, Mulima G, Bogstrand ST, Varela C, Young S, et al. Prevalence of alcohol use among road traffic crash victims presenting to a Malawian Central Hospital: a cross-sectional study. *Traffic Inj Prev* 2020;21(8):527–32.
- [16] Peden M, van der Spuy J, Smith P, Bautz P. Substance abuse and trauma in Cape Town. *South Afr Med J Suid-Afr Tydskr Vir Geneesk* 2000;90(3):251–5.
- [17] Forson PK, Oduro G, Bonney J, Cobbold S, Sarfo-Frimpong J, Boyd C, et al. Emergency department admissions Kumasi, Ghana: prevalence of alcohol and substance use, and associated trauma. *J Addict Dis* 2020;38(4):520–8.
- [18] Aluisio A, Sugut J, Kinuthia J, Farquhar C, Mello M. Assessment of HIV testing services for patients presenting for emergency injury care in Nairobi, Kenya demonstrates beneficial potential for enhanced HIV care engagement. *HIV Med* 2021;22(S3):246.
- [19] Wangara AA, Hunold KM, Leeper S, Ndiawo F, Mweu J, Hartly S, et al. Implementation and performance of the South African Triage Scale at Kenyatta National Hospital in Nairobi, Kenya. *Int J Emerg Med* 2019;12(1):5.
- [20] Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42(2):377–81.
- [21] Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O’Neal L, et al. The REDCap consortium: building an international community of software platform partners. *J Biomed Inform* 2019;95:103208.
- [22] Balogun O, Koyanagi A, Stickley A, Gilmour S, Shibuya K. Alcohol consumption and psychological distress in adolescents: a multi-country study. *J Adolesc Health* 2014;54(2):228–34.
- [23] Esser MB, Pickens CM, Guy GP, Evans ME. Binge drinking, other substance use, and concurrent use in the U.S., 2016–2018. *Am J Prev Med* 2021;60(2):169–78.
- [24] Sileo KM, Miller AP, Wagman JA, Kiene SM. Psychosocial interventions for reducing alcohol consumption in sub-Saharan African settings: a systematic review and meta-analysis. *Addiction* 2021;116(3):457–73.
- [25] Carvalho AF, Stubbs B, Vancampfort D, Kloiber S, Maes M, Firth J, et al. Cannabis use and suicide attempts among 86,254 adolescents aged 12–15 years from 21 low- and middle-income countries. *Eur Psychiatry J Assoc Eur Psychiatr* 2019;56:8–13.
- [26] Eegunranti BA, Fatoye FO, Morakinyo O. Stimulant use among secondary school students in Osogbo, Nigeria. *Niger Postgrad Med J* 2009;16(3):218–23.
- [27] Liu Y, Elliott AL, Serdarevic M, Leeman RF, Cottler LB. A latent class analysis of the past-30-day substance use patterns among lifetime cocaine users: findings from a community sample in North Central Florida. *Addict Behav Rep* 2019;9:100170.
- [28] Reinert DF, Allen JP. The Alcohol Use Disorders Identification Test: an Update of Research Findings. *Alcohol Clin Exp Res* 2007;31(2):185–99.
- [29] Vitesnikova J, Dinh M, Leonard E, Boufous S, Conigrave K. Use of AUDIT-C as a tool to identify hazardous alcohol consumption in admitted trauma patients. *Injury* 2014;45(9):1440–4.
- [30] Rodríguez-Martos A, Santamariña E. Does the short form of the Alcohol Use Disorders Identification Test (AUDIT-C) work at a trauma emergency department? *Subst Use Misuse* 2007;42(6):923–32.

- [31] Harder VS, Musau AM, Musyimi CW, Ndetei DM, Mutiso VN. A randomized clinical trial of mobile phone motivational interviewing for alcohol use problems in Kenya. *Addiction* 2020;115(6):1050–60.
- [32] Bradley KA, DeBenedetti AF, Volk RJ, Williams EC, Frank D, Kivlahan DR. AUDIT-C as a brief screen for alcohol misuse in primary care. *Alcohol Clin Exp Res* 2007;31(7):1208–17.
- [33] Nilsen P, Baird J, Mello MJ, Nirenberg T, Woolard R, Bendtsen P, et al. A systematic review of emergency care brief alcohol interventions for injury patients. *J Subst Abuse Treat* 2008;35(2):184–201.
- [34] Gaume J, Grazioli VS, Paroz S, Fortini C, Bertholet N, Daeppen J-B. Developing a brief motivational intervention for young adults admitted with alcohol intoxication in the emergency department - Results from an iterative qualitative design. *PLoS ONE* 2021;16(2):e0246652.
- [35] Dwommoh R, Sorsdahl K, Myers B, Asante KP, Naledi T, Stein DJ, et al. Brief interventions to address substance use among patients presenting to emergency departments in resource poor settings: a cost-effectiveness analysis. *Cost Eff Resour Alloc CE* 2018;16:24.
- [36] Odero W, Polsky S, Urbane D, Carel R, Tierney WM. Characteristics of injuries presenting to a rural health centre in western Kenya. *East Afr Med J* 2007;84(8):367–73.
- [37] Hassan S, Macharia WM, Atinga J. Self reported alcohol use in an urban traffic trauma population in Kenya. *East Afr Med J* 2005;82(3):144–7.
- [38] Valencia Martín JL, Galán I, Segura García L, Camarells Guillem F, Suárez Cardona M, Brime Beteta B. [Binge drinking: the challenges of definition and its impact on health.]. *Rev Esp Salud Publica* 2020;94:e202011170.
- [39] Olthuis JV, Zamboanga BL, Ham LS, Van Tyne K. The utility of a gender-specific definition of binge drinking on the AUDIT. *J Am Coll Health J ACH* 2011;59(4):239–45.
- [40] Johnston BD, Rivara FP, Droesch RM, Dunn C, Copass MK. Behavior change counseling in the emergency department to reduce injury risk: a randomized, controlled trial. *Pediatrics* 2002;110(2 Pt 1):267–74.
- [41] Bernstein E, Edwards E, Dorfman D, Heeren T, Bliss C, Bernstein J. Screening and brief intervention to reduce marijuana use among youth and young adults in a pediatric emergency department. *Acad Emerg Med Off J Soc Acad Emerg Med* 2009;16(11):1174–85.
- [42] D'Onofrio G, O'Connor PG, Pantalon MV, Chawarski MC, Busch SH, Owens PH, et al. Emergency department-initiated buprenorphine/naloxone treatment for opioid dependence: a randomized clinical trial. *JAMA* 2015;313(16):1636–44.
- [43] Academic ED SBIRT Research Collaborative. The impact of screening, brief intervention, and referral for treatment on emergency department patients' alcohol use. *Ann Emerg Med* 2007;50(6):699–710. e1-6.
- [44] Botchey IM, Hung YW, Bachani AM, Paruk F, Mehmood A, Saidi H, et al. Epidemiology and outcomes of injuries in Kenya: a multisite surveillance study. *Surgery* 2017;162(6S):S45–53.
- [45] Otieno T, Woodfield JC, Bird P, Hill AG. Trauma in rural Kenya. *Injury* 2004;35(12):1228–33.
- [46] Jacob L, Smith L, Armstrong NC, Yakkundi A, Barnett Y, Butler L, et al. Alcohol use and mental health during COVID-19 lockdown: a cross-sectional study in a sample of UK adults. *Drug Alcohol Depend* 2021;219:108488.
- [47] Dubey MJ, Ghosh R, Chatterjee S, Biswas P, Chatterjee S, Dubey S. COVID-19 and addiction. *Diabetes Metab Syndr* 2020;14(5):817–23.
- [48] Meherali S, Punjani N, Louie-Poon S, Abdul Rahim K, Das JK, Salam RA, et al. Mental health of children and adolescents amidst COVID-19 and past pandemics: a rapid systematic review. *Int J Environ Res Public Health* 2021;18(7):3432.