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ORIGINAL RESEARCH

Prevalence of Head Injury Among Trauma Patients at Debre Tabor Comprehensive Specialized Hospital, North Central Ethiopia

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Background: Head injury is one of the most common reasons for patient admission and death in surgical units of Ethiopian hospitals, but little is known about the problem in North-central Ethiopia. Therefore, this study aimed to assess the magnitude and associated factors of head injury at Debre Tabor Teaching and Referral Hospital in south Gondar zone, North-central Ethiopia.

Methods: A cross-sectional study was conducted on 370 trauma patients at Debre Tabor Teaching and Referral Hospital from November 1 to December 30, 2019, using a systematic random sampling technique. The data were collected through a face-to-face interview. The data were analyzed using SPSS version 23. Bivariate and multivariable logistic regression analyses were performed to identify factors associated with head injury. P-value <0.05 was used to declare statistical significance.

Results: The mean (±SD) age of patients was 41.4 (± 11.6) years. The prevalence of head injury was 39.7%, 95% CI (34.9–44.9%). Two hundred sixty-five (72%) were male and 259 (70%) of all trauma patients were from rural residents. The study also found that younger age (20–24 years) [AOR=1.2; 95% CI (1.29–8.86)], being male [(AOR=2.02; 95% CI (1.31–6.24)], alcohol use [(AOR=6.31; 95% CI (2.03–16.08)], and rural residence [(AOR= 1.40; 95% CI (1.13–6.94)] were the factors associated with head injury.

Conclusion: Like other studies done in Ethiopia, head injury is a major problem in the study area. The study also revealed that socio-demographic and behavioral factors are mainly associated with head injury. Therefore, appropriate prevention strategies should be devised and implemented against the contributing factors both at the individual and community level to minimize the risk of head injury.

Keywords: head injury, prevalence, trauma, Ethiopia

Introduction

The World Health Organization (WHO) global burden of injury estimate ranked injury among the top ten leading causes of death, and men in Africa have the highest injury-related mortality rates in the world.[1] Among African nations, the rate of injury mortality in the year 2004 was the highest in Nigeria and the lowest in Egypt. Ethiopia was ranked as the third leading country.[2]

Head Injury is one of the major public health problems and the leading cause of mortality and morbidity across all age groups, particularly the young and productive part of the world's population.[2,3] It is classified as mild, moderate, and severe using the Glasgow Coma Scale (GCS). The problem happens with a greater burden

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in low- and middle-income countries and it is magnified by the high prevalence of risk factors and poor health care delivery systems.[2–4]

Worldwide, the incidence of traumatic brain injury (TBI) is rising.[5,6] It is estimated that 1–2% of people living in high-income countries live with a TBI disability and the incidence is high in some countries in Africa.[7] The mortality rate of TBI in Africa was reported to be 81/100,000 per year, with greater than 10% of all case fatality rates in South Africa.[6]

In Ethiopia, like other developing countries, head injury is a common public health problem.[8] According to previous studies done in Ethiopia, the prevalence of head injury in patients presenting to the surgical emergency department ranged from 24.9% to 49.4%.[9–11] The main causes and risk factors for head injury are diverse and may include road traffic accidents (RTA), falls, and interpersonal violence/assault.[6,8,10–13]

According to several studies, the higher prevalence of head injury was seen in adolescents, young adults, and the elderly,[6,10,12] males,[6,9–11,14] daily laborer, unemployed and illiterate.[11] Studies also mentioned behavioral factors as contributors to head injury. A study conducted in southern Ethiopia revealed that 31% of the head injury patients had a history of alcohol consumption before 6 hours of the trauma.[10]

Head injury is a devastating trauma that results in loss of life or affects patients' quality of life even after treatment.[15] Managing the problem requires resource preparedness and professional skills. Therefore, understanding the magnitude and associated factors of head injury will reduce occurrences and improve patient outcomes through effective interventions.

Even though the hospital reports in the country indicate a high burden of the problem, evidence-based information about head injuries remains scant. Hence, we aimed to determine the magnitude and associated factors of head injury among trauma patients at Debre Tabor Teaching and Referral Hospital, which serves the majority of the rural and urban population in the south Gondar zone, North-central Ethiopia.

Methods

Study Design and Setting

A hospital-based cross-sectional study was conducted from November 1–December 30, 2019, at Debre Tabor Teaching and Referral Hospital (DTTRH), which is found 665 km from Addis Ababa (the capital city of Ethiopia). The hospital is the largest in the South Gondar zone, which was established in 1953 and serves more than 2.5 million population in its catchment area. It has more than 33 specialists in various areas of medical specialization and 230 other health professionals constituting the health care team with a total capacity of 160 inpatient beds in five major departments. The surgical department is one of the main departments, which provides major and minor operations, outpatient and inpatient services, a surgical referral clinic, and surgical emergency service. In general, the hospital provides diagnostic and treatment services for trauma patients.

Source and Study Population

All trauma patients presented to the emergency department of DTTRH were the source population, while all trauma patients presented to a surgical emergency department in the study period from November–December 2019 were the study population. All trauma patients who visited the emergency department in the study period with an age greater than 18 years were included in the study.

Sample Size Determination and Sampling Techniques

The required sample size was determined using the single population proportion formula by taking the prevalence of head injury (40.5%) among trauma patients from a study done at the surgical department of Gondar University Referral Hospital, Northwest Ethiopia,[11] with a 95% level of confidence and 5% margin of error, non-response rate of 10% and calculated using Epi info 7.2. The final sample size was 406. A reference population of 7200 patients presented to the surgical emergency department of DTTRH in the last six months of the year 2019 (May–October/2019) was used and then by taking the proportion in the two-month period, which becomes 2400. A systematic random sampling technique was used to get the participants (2400 were divided by 406 to obtain the constant for the sampling interval, which was 6). Then, taking every six patients from a random start was studied until the total sample size (406 trauma patients) was obtained.

Study Variables

The dependent variable was a head injury. The independent variables were sociodemographic characteristics (age,

sex, marital status, religion, educational status, and place of residence), behavioral characteristics (smoking, alcohol, psychoactive substances/khat, and traditional medicine), and clinical characteristics (mechanisms of injury and history of comorbidities).

Operational Definitions

Head injury is any physical damage/structural change to the scalp or skull due to any type of external force to the head.[16,17]

Traumatic brain injury (TBI) is an alteration in brain function, which is manifested as confusion, altered levels of consciousness, coma, seizures, etc.[18]

Trauma is any serious injury to the body resulting from violence or an accident.[19]

GCS: Glasgow coma scale was used to assess the neurological status of the patient.[18]

Mild head injury is an injury to the head when GCS is between 13 and 15.[18]

Moderate head injury is an injury to the head when GCS between 9 and 12.[18]

Severe head injury is an injury to the head when GCS ≤ 8.[18]

Psychoactive substances: ingredients that alter mood, cognition, and behavior.[20]

Data Collection Tools and Procedures

The data were collected using a structured questionnaire, which was developed after a review of similar kinds of literature. The data was collected using a face-to-face interview with each trauma patient. The interview included information on socio-demographic characteristics, clinical characteristics, and behavioral factors. Two intern medical doctor students (who were working in the emergency department) were trained and collected the data. To ensure the reliability of the information, the respondents were interviewed using their local (Amharic) language. To ensure the quality of the data, every questionnaire was reviewed for completeness, accuracy, and clarity daily during the data collection period by trained data collectors.

Data Processing and Analysis

The data were checked for completeness, coded and entered into Epi-info version 7.2, and analyzed using SPSS version 23. Bivariate and multivariable logistic regression analyses were performed to identify factors associated with head injury. First, a bivariate logistic regression analysis was done to determine the association between the dependent and each independent variable. Independent variables in the bivariate logistic regression model with a p-value of less than 0.25 were included in the multivariable logistic regression analysis. Finally, variables in multivariable logistic regression with a p-value <0.05 were considered as significantly associated with the outcome variable. An adjusted odds ratio (AOR) with a 95% confidence interval was used to measure the strength of association. Multi-collinearity between independent variables in the model was checked, and the variance inflation factor was found acceptable. The Hosmer-Lemeshow goodness-of-fit test indicated (P = 0.267) that the model was good enough to fit the data well.

Results

Socio-Demographic Characteristics

Out of 406 selected trauma patients, 370 patients have participated in this study with a response rate of 91.1%. Two hundred sixty-five (72%) were male patients. The mean (±SD) age of patients was 41.4 (± 11.6) years. About (207, 55.9%) of the trauma patients were married and only (50, 13.5%) completed college and above. Most of the patients (329, 88.9%) were orthodox religious followers, and more than two-thirds (259, 70%) were from rural residences (Table 1).

Behavioral Characteristics

For the behavioral characteristics of the respondents (9, 2.4%) individuals have been found to have a history of cigarette smoking. There were (192, 51.9%), trauma victims with a history of alcohol consumption 30 minutes before the incident, (113, 58.9%) of them were within the age range of 25–44 years. Beer was the most consumed beverage (107, 55.7%) followed by tela (local beverage) (39, 20.3%). There were (112, 30.3%) respondents who have been found to have consumption of psychoactive substances (khat) (Table 2).

Clinical Characteristics

Nearly two-thirds (64.9%) of trauma patients stayed for the one hour until they arrived at their first health care contact and only (3, 0.8%) patients were delayed for more than 24 hours without seeking health care. Based on the patient's level of consciousness, the study has found that most of all trauma patients (274, 74.1%) have been found to have a normal level of consciousness and (56, 15.1%) have minimal injury. One hundred forty-four (38.9%) of the patients who arrived at SED have been managed as an outpatient (Table 3).

Table 1 Socio-Demographic Characteristics of Trauma Patients at DTTRH in North-Central Ethiopia

Variables	Categories	Frequency	Percent
Age group (years)	15–19	56	15.1
	20–24	54	14.6
	25–44	206	55.7
	45–64	47	12.7
	>65	7	1.9
Sex	Male	265	71.6
	Female	105	28.4
Place of residence	Rural	259	70
	Urban	111	30
Marital status	Married	207	55.9
	Single	139	37.6
	Divorced	4	1.1
	Widowed	20	5.4
Level of education	Unable to read and write	44	11.9
	Primary school completed	101	27.3
	Secondary school completed	175	47.3
	College and above	50	13.5
Religion	Orthodox	329	88.9
	Muslim	36	9.7
	Protestant	5	1.4

Mechanism of Injury

Regarding the mechanism of injury in all trauma patients, the majority of injury cases (152, 41.1%) were due to assault (interpersonal conflict), followed by (145, 39.2%) and (73, 19.7%) of injury cases were due to road traffic accident (RTA) and fall-down accident, respectively. The prevalence of head injury in trauma patients visiting the emergency department of DTTRH was 39.7%, 95% CI (34.9–44.9%). The study also showed that out of all patients with a head injury (124, 33.5%) sustained a blunt head injury.

Table 2 Behavioral Characteristics of Trauma Patients at DTTRH in North-Central Ethiopia

Variables	Categories	Frequency	Percent
Smoking	Yes	9	2.4
	No	361	97.6
Alcohol	Yes	192	51.9
	No	178	48.1
Type of alcohol beverage (n=192)	Beer	107	55.7
	Areki	28	14.6
	Tela	39	20.3
	Others*	18	9.4
Consumed any psychoactive substance/ khat	Yes	112	30.3
	No	258	69.7
Use of traditional medicine	Yes	12	3.2
	No	358	96.8

Note: Other*= Tej, Weyne, Wuski, and Bukri (local drink).

Table 3 Clinical Characteristics of Trauma Patients at DTTRH in North-Central Ethiopia

Variables	Categories	Frequency	Percent
Duration of presentation after injury	< 1 hour	240	64.9
	1–6hours	110	29.7
	7–12hours	10	2.7
	13–24hours	7	1.9
	> 24 hours	3	0.8
Referral history from other health facilities to the current hospital	Yes	80	21.6
	No	290	78.4
GCS at time of presentation	≤ 8	16	4.3
	9–12	24	6.5
	13–15	56	15.1
	15	274	74.1
Diagnostic procedure	None	165	44.6%
	X-ray	138	37.3
	Laboratory tests	63	17.0
	More than one	2	0.5%
Trauma patient managed as	Outpatient	144	38.9
	Inpatient	226	61.1
The types of intervention given	Non-operative approach	271	73.2
	Operative approach (surgery)	99	26.8
Patient outcomes	Improved	367	99.2
	Died	3	0.8

Factors Associated with Head Injury

In the bivariate analysis, the age of respondents, residence, sex, alcohol consumption, history of any comorbidities, mechanism of injury, and type of alcohol consumed were identified to be significantly associated with head injury. However, age, alcohol consumption, sex, and residence were remained significantly associated with head injury in the multiple logistic regression analysis. Patients whose age group was 20–24 years were 1.2 times more likely to be diagnosed with head injury [AOR=1.2; 95% CI (1.29–8.86)] than patients above 65 years. Male trauma patients [AOR=2.02; 95% CI (1.31–6.24)] were approximately two times more likely to have a head injury than females. Trauma patients who were from a rural residence

[AOR=1.40; 95% CI (1.13–6.94)] were 1.4 times more likely to have a head injury than those from urban residences. Patients who drank alcohol before the injury were approximately six times more likely to develop head injury than those who did not have alcoholic exposure before the incident [AOR=6.31; 95% CI (2.03–16.08)] (Table 4).

Discussion

This study aimed to assess the magnitude and factors associated with head injury among trauma patients in north-central Ethiopia. The magnitude of head injury in trauma patients visiting the surgical emergency department of DTTRH was 39.7%, 95% CI (34.9–44.9%). This finding was in line with 40.5% at Gondar University Referral Hospital, Ethiopia[11] and 42.3% in Singapore.[21] It was lower than 49.4% in Gedeo Zone, Southern Ethiopia.[10] However, it was higher than 5.4% in Nigeria[22] and 12.4% on the island of Viti Levu, Fiji (Island).[23] The observed variation compared to previous studies might be due to the difference in socio-economic status, social relationship, and lifestyle factors. Besides, the variation may be explained by the difference in sample size, the operational definitions used across studies, and the methodology of the research as a whole.

Concerning the cause of injury, this study revealed that the majority of injuries were mostly related to interpersonal violence (152, 41.1%), followed by RTA (145, 39.2%), and falling accidents (73, 19.7%). This finding was also mentioned in the study conducted at Jimma University Hospital, Southwest Ethiopia, which revealed that interpersonal fights accounted for 38.5% and road traffic accidents for 36.5% of head injury cases[3] and a study from Gondar university Referral Hospital (Northwest Ethiopia) also revealed similar findings.[11] However, this finding was not supported by a study done in Australia, which revealed that the majority of the injuries occurred due to sport and recreational activities.[24] The possible reason for this variation may be due to the difference in socio-cultural and behavioral characteristics of the study participants.

The odds of sustaining head injury among those who are aged 20–24 were 1.2 times more likely when compared with those aged above 65 years. This is consistent with previous reports from WHO,[25] Qatar,[26] Addis Ababa,[9] Jimma,[12] and Tikur Anbessa[27] in Ethiopian studies. Might be because of their high level of involvement in interpersonal violence and their working-age exposure to different factors related to their activities because of their age as interpersonal violence is also the most common

Table 4 Determinant Factors of Head Injury Among Trauma Patients of DTTRH in North-Central Ethiopia

Variables	Categories	Head Injury		COR with 95% CI	AOR with 95% CI	P-value
		Yes	No			
Age group (years)	15–19 20–24 25–44 45–64 >65	14 (9.5%) 23 (15.6%) 89 (60.5%) 19 (12.9%) 2 (1.4%)	42(18.8%) 31(13.9%) 117(52.5% 28(12.6%) 5(2.2%)	0.45 (0.20–1.01) 0.42 (0.24–0.85) 0.49 (0.21–1.14) 2.83(0.12–4.85) 1	0.99 (0.25–3.91) 1.20 (1.29–8.86) 1.92 (0.53–6.94) 2.09 (0.22–19.8) 1	0.050 **0.015** 0.097 0.838
Sex	Male Female	117 (79.6%) 30 (20.4%)	148(66.4%) 75(33.6%)	1.98 (1.21–3.22) 1	2.02 (1.31–6.24) 1	**0.006**
Residence	Rural Urban	114(77.6%) 33 (22.4%)	145 (50.3%) 78 (48.9%)	1.85 (1.20–2.85) 1	1.40 (1.13–6.94) 1	**0.007**
Alcohol consumption	Yes No	133(90.5%) 14(9.5%)	59(26.5%) 164(73.5%)	26.4(14.1–49.4) 1	6.31 (2.03–16.1) 1	**0.040**
History of comorbidities	Yes No	5(3.4%) 142(96.6%)	15(6.7%) 208(93.3%)	7.4 (1.04–24.4) 1	1.7 (0.15–6.69) 1	0.356
Mechanism of injury	RTA Assault Fall down	107(49.3%) 85(39.2%) 25(11.5%)	38(24.8%) 67(43.8%) 48(31.4%)	0.77 (0.44,1.33) 2.12(1.08,4.18) 1	1.4 (0.50–3.70) 2.4 (0.76–7.56) 1	0.539 0.138

Note: Bold indicates statistical significant.
Abbreviations: COR, crude odds ratio; AOR, adjusted odds ratio.

mechanism of injury. Young people are usually sustaining more RTA than other age groups as they travel more for work. This magnifies the possible economic impact of head injury as the productive age group of the society is primarily affected. In contrast, those individuals above the age of 65 spend their time in a more stable environment and are relatively protected from violence and injury when compared with other age groups.

This study also found that the sex of respondents was significantly associated with head injury. Being male was approximately 2 times more likely to sustain head injury than females. This finding was supported by previous studies conducted among head injury patients in an Ethiopia emergency center and reported that the majority of the trauma patients were male[27] and in Nigeria.[22] The finding may be explained by the higher rates of traveling, emotional, and risk-taking behavior among males.

Alcohol consumption was also shown to be another important variable significantly associated with head injury. Those patients who consumed alcohol were approximately 6 times more likely to be present with a head injury. This finding was supported by a report from WHO that showed up to 45% of injured patients reported consumption of alcohol before their injury[28] and another study reported that drunkenness behavior (social risk-taking) was positively associated with the occurrence of injuries.[29]

This study found that residency was a factor associated with head injury. Patients from rural residences were 1.4 times more likely to have a head injury than patients from urban residences. This finding was supported by studies conducted elsewhere.[30,31] This might be explained as people from rural areas have low awareness about road traffic accidents and most of them consume local alcohol drink (Areki) and are usually exposed to assault and/or interpersonal violence.

Limitations

This study had some limitations. First, the study was done in a single institution (DTTRH), which makes it difficult to generalize to the greater population in Ethiopia. This study did not collect data related to the mental health history of the patient like epilepsy and other antisocial disorders. Besides, the cross-sectional nature of the study may not show a cause-and-effect relationship.

Conclusion

Like other studies done in Ethiopia, head injury is a major problem in the study area. The study also revealed that socio-demographic and behavioral factors are mainly associated with head injury. Therefore, appropriate prevention strategies should be devised and implemented against the contributing factors both at the individual and community level to minimize the risk of head injury.

Abbreviations

DTTRH, Debre Tabor Teaching and Referral Hospital; ED, Emergency Department; GCS, Glasgow Coma Scale; RTA, Road Traffic Accident; TBI, Traumatic Brain Injury; WHO, World Health Organization.

Data Sharing Statement

The data sets used in this study are available from the corresponding authors on reasonable request.

Ethical Approval and Consent to Participate

An ethical approval letter was obtained from Debre Tabor University ethical review Committee. An official letter of co-operation was written to Debre Tabor Teaching and Referral Hospital to obtain their co-operation in facilitating the study. Written consent was obtained from each participant for a patient with good GCS scores and family for a patient with low GCS scores before data collection. Confidentiality of information was assured by excluding names and identification in the questionnaire. All participants were informed about the purpose of the study, and that it was conducted in accordance with the Declaration of Helsinki.

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Author Contributions

All authors made a significant contribution to the work reported, in the conception, study design, execution, acquisition of data, analysis and interpretation, drafting, revising or critically reviewing the article; and they gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare no conflicts of interest for this work.

References

1. Haagsma JA, Graetz N, Bolliger I, 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.
2. Maas AI, Stocchetti N, Bullock R. Moderate and severe traumatic brain injury in adults. *Lancet Neurol*. 2008;7(8):728–741. doi:10.1016/S1474-4422(08)70164-9
3. Aenderl I, Gashaw T, Siebeck M, Mutschler W. Head injury–a neglected public health problem: a four-month prospective study at Jimma University Specialized Hospital, Ethiopia. *Ethiop J Health Sci*. 2014;24(1):27–34. doi:10.4314/ejhs.v24i1.4
4. Bergersen K, Halvorsen JØ, Tryti EA, Taylor SI, Olsen A. A systematic literature review of psychotherapeutic treatment of prolonged symptoms after mild traumatic brain injury. *Brain Inj*. 2017;31:279–289. doi:10.1080/02699052.2016.1255779
5. Summers CR, Ivins B, Schwab KA. Traumatic brain injuries in the United States: an epidemiologic overview. *Mt Sinal J Med*. 2009;76:105–110. doi:10.1002/msj.20100
6. Qureshi JS, Ohm R, Rajala H, et al. Head injury triage in a sub Saharan African urban population. *Int J Surg*. 2013;11(3):265–269. doi:10.1016/j.ijsu.2013.01.011
7. De SMJ, Roberts I, Perel P, Edwards P, Kenward MG. Patient outcome after traumatic brain injury in high-, middle- and low-income countries: analysis of data on 8927 patients in 46 countries. *Int J Epidemiol*. 2009;38(September2008):452–458. doi:10.1093/ije/dyn189
8. Laeke T, Tirsit A, Kassahun A, et al. Prospective Study of surgery for traumatic brain injury in Addis Ababa, Ethiopia: trauma causes, injury types, and clinical presentation. *World Neurosurg*. 2021. doi:10.1016/j.wneu.2021.04.016
9. Tsegaye F, Abdella K, Ahmed E, Tadesse TBK. Pattern of fatal injuries in Addis Ababa, Ethiopia: a one-year audit. *East Cent African J Surg*. 2010;15(2):10–17.
10. Eshete A, Taye F. Magnitude of severe head injury and its associated factors among head injury patients in Gedeo Zone, Southern Ethiopia: a Two-Year Retrospective Study. *Ethiop J Health Sci*. 2018;28(3):323–330. doi:10.4314/ejhs.v28i3.10
11. Ayele TA, Zeleke BM, Tessema GA, Fentie Melak M. Magnitude and patterns of injuries among patients in Gondar University Hospital, northwest Ethiopia: an institutional-based study. *Open Access Surg*. 2017;10:25–31. doi:10.2147/OAS.S126043
12. Woldemichael K, Berhanu N. Magnitude and pattern of injury in Jimma University specialized hospital, South West Ethiopia. *Ethiop J Health Sci*. 2011;21(3):155–165.
13. Endalamaw A, Birhanu Y, Alebel A, Amare Demsie A, Habtewold TD. The burden of road traffic injury among trauma patients in Ethiopia: a systematic review and meta-analysis. *Afr J Emerg Med*. 2019;9(suppl):S3–S8. doi:10.1016/j.afjem.2019.01.013
14. Laeke T, Tirsit A, Debebe F, Girma B, Gere D, Park KBAA. Profile of head injuries: prehospital care, diagnosis, and severity in an Ethiopian tertiary hospital. *World Neurosurg*. 2019;127:e186–e192. doi:10.1016/j.wneu.2019.03.044
15. Bramlett HM, Dietrich WD. Long-term consequences of traumatic brain injury: current status of potential mechanisms of injury and neurological outcomes. *J Neurotrauma*. 2015;32(23):1834–1848. doi:10.1089/neu.2014.3352
16. No authors. *Traumatic Brain Injury*. Wikipedia; 2021.
17. Asmamaw Y, Yitayal M, Debie A, Handebo S. The costs of traumatic head injury and associated factors at University of Gondar specialized referral hospital, Northwest Ethiopia. *BMC Public Health*. 2019;19(1):1399. doi:10.1186/s12889-019-7800-3
18. Blyth BJ, Bazarian JJ. Traumatic alterations in consciousness: traumatic brain injury. *Emerg Med Clin North Am*. 2010;28(3):571–594. doi:10.1016/j.emc.2010.03.003
19. Center for Substance Abuse Treatment (US). *Trauma-Informed Care in Behavioral Health Services*. Rockville (MD): Substance Abuse and Mental Health Services Administration (US); 2014. (Treatment Improvement Protocol (TIP) Series, No. 57.) Section 1, A Review.
20. World Health Organization. *Neuroscience of Psychoactive Substance Use and Dependence*. Geneva: World Health Organization; 2004.
21. Wui LW, Shaun GE, Ramalingam G, Wai KMS. Epidemiology of trauma in an acute care hospital in Singapore. *J Emerg Trauma Shock*. 2014;7(3):174. doi:10.4103/0974-2700.136860
22. Emejulu KC, Isiguzo CM, Agbasoga CE, Ogbuagu C. Traumatic brain injury in the accident and emergency department of a tertiary hospital in Nigeria. *East Cent African J Surg*. 2010;15(2):28–38.
23. Kool B, Raj N, Wainiqolo I, Kafoa B, McCaig E, Ameratunga S. Hospitalized and fatal head injuries in viti levu, fiji: findings from an Island- wide trauma registry (TRIP 4). *Neuroepidemiology*. 2012;38(3):179–185. doi:10.1159/000337261
24. Amaranath JE, Ramanan M, Reagh J, et al. Epidemiology of traumatic head injury from a major paediatric trauma centre in New South Wales, Australia. *ANZ J Surg*. 2014;84(6):424–428. doi:10.1111/ans.12445
25. World health organization. *Burden: Mortality, Morbidity and Risk Factors*; 2008.
26. Bener A, Abdulrahman YS, Abdelaleem EY, Khalid MK. Trends and characteristics of injuries in the state of Qatar: hospital-based study. *Int J Inj Contr Saf Promot*. 2012;19(4):368–372. doi:10.1080/17457300.2012.656314
27. Landes M, Venugopal R, Berman S, Heffernan S, Maskalyk J, Azazh A. Epidemiology, clinical characteristics and outcomes of head injured patients in an Ethiopian emergency centre. *Afr J Emerg Med*. 2017;7(3):130–134. doi:10.1016/j.afjem.2017.04.001
28. World Health Organization. *Road Traffic Injuries: Fact Sheet*; 2015.
29. Pickett W, Molcho M, Simpson K, et al. Cross national study of injury and social determinants in adolescents. *Inj Prev J Int Soc Child Adolesc Inj Prev*. 2005;11(4):213–218. doi:10.1136/ip.2004.007021
30. Yue JK, Upadhyayula PS, Avalos LN, Phelps RR, Suen CG, Cage TA. Concussion and mild-traumatic brain injury in rural settings: epidemiology and specific health care considerations. *J Neurosci Rural Pract*. 2020;11(1):23–33. doi:10.1055/s-0039-3402581
31. Moshiro C, Heuch I, Åstrøm AN, Setel P, Hemed Y, Kvåle G. Injury morbidity in an urban and a rural area in Tanzania: an epidemiological survey. *BMC Public Health*. 2005;10:11. doi:10.1186/1471-2458-5-11