

Causes of injuries resulting in a visit to the emergency department of a Provincial General Hospital, Nyanza, western Kenya

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Abstract

Background: There is increasing importance of trauma not only as a major cause of surgical admissions, but also a significant cause of morbidity, mortality and disability.

Objective: To document injury-related visits and hospitalization in a provincial hospital, western Kenya.

Methods: On-site review of records of all patients who visited emergency department (ED) from January 2002 through December 2003, and admissions of year 2003.

Results: A total of 15365 patients visited the ED, of which 41% (6319/15395) were injury cases. The leading causes of injury were assault (42%), road traffic crashes (RTC) (28%), unspecified soft tissue injury (STI) (11%). Cut-wounds, dog-bites, falls, burns and poisoning were infrequently reported (each <10%). The age group 15-44 years formed the largest proportion (75%). A total of 3253 patients were admitted in 2003, of which 1010 (31%) were due to injuries. RTC were leading cause of hospitalization (49%) followed by assault (16%). Men were more likely to be hospitalized due to assault (OR=2.22; CI = 1.45 - 3.41) and not burns or poisoning ($p < 0.01$). There were 64 (6.3%) injury-related deaths, mainly resulting from RTC (41.9%), burns (19.4%) and assault (16.1%).

Conclusions: This study provides considerable information on major causes of injuries, useful for epidemiological surveillance and injury prevention campaigns.

Keywords: Emergency, visit, hospitalization, Kenya, Africa

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Introduction

In sub-Saharan Africa, even though injury ranks third as a major cause of death and permanent disability among the adult population after tuberculosis and HIV/AIDS¹, it remains largely a neglected health problem^{2,3}. Kenya, like other developing countries, lacks organized efforts to reduce the burden of injuries. A number of studies in different regions of Kenya have documented the increasing importance of trauma not only as a major cause of surgical admissions, but also a significant cause of morbidity, mortality and serious permanent

disability⁴⁻⁸. Important measures of morbidity include rates of hospitalization and duration of stay. The use of emergency department (ED) data provides a cost-effective opportunity but largely an unused source of information for determining injury causes, identifying subgroups of the population at highest risk, associated risk factors and planning for interventions within a health facility catchment area^{4,9}, since up to 50% of patients visiting hospitals are due to injuries^{10,11}.

The direct medical costs to hospitals that are already resource constrained and indirect costs of lost productivity on the national economy due to prolonged hospitalization explains need for injury prevention and control. This study sought to provide information on the external causes of injuries requiring ED visit and/or hospitalization and describe the burden due to injuries in a large publicly

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funded provincial general and referral hospital in Nyanza region, western Kenya.

Methods

Setting/study facility

Nyanza Provincial General Hospital, a large publicly funded hospital with 400 beds, in western Kenya, serves a catchment population of more than 4.4 million people, including the neighbouring areas of Western and Rift Valley provinces. The ED personnel register and document the cause of injury in the medical records for all cases that are admitted and treated for injury routinely on a 24-hour basis, based on the ninth Revision of WHO *International Classification of Diseases, Clinical Modification (ICD-9-CM)*¹².

Selection of cases

A retrospective on-site medical record review of injury-related ED visit and/or hospital admissions from 1st January 2002 through 31st December 2003 were reviewed. However due to limited resources, time constraints and its completeness, only data for 2003 were used for in-patient information to compute the length of stay (LOS) and in-hospital deaths, both of which were used as proxies for injury severity.

Training of data extractors

A data collection manual was prepared by the authors, who specified the aims of the study and items to be collected to three research assistants that were trained on-site, and supervised by them. At the commencement of the study, the authors and field assistants dual-filled 20 records and compared their results to ensure they were collecting information consistently in accordance with data collection manual instructions.

Data collection

Data for cases that accrued in the study period above were extracted from medical records of both ED and inpatient onto a designed data collection form, and variables included:

- 1) demographics (age and gender); and
 - 2) cause of injury (both external and nature of injury or clinical manifestation);
 - 3) specialized facility utilization; and
 - 4) if admitted, length of stay and outcome.
- Supervision of information extraction from ED notes, clinical notes and discharge summaries by the lead, who by then was a master of public health

student, at the School of Public Health & Community Development, Maseno University, Kisumu, Kenya.

Data Analysis

We performed separate analyses for patients treated solely at the ED and those admitted. We used proportions to describe the frequencies by gender and age was grouped as 0-4, 5-14, 15-29, 30-44, 45-59 and 60 and above. Chi-square test and Odds Ratios (ORs) and their 95% confidence intervals were computed to compare proportions. Statistical Package for Social Sciences (SPSS) software for windows version 10.0 was used for data analysis. $P < 0.05$ was considered statistically significant. This study received ethical approval of the Nyanza Province Hospitals Ethical Review Board, and the hospital administration allowed access to the medical records.

Results

Causes of Injury

Of 15,365 patients who visited the study hospital's ED during the two-year period, 6319 (41%) were injury patients, with a mean age was 25.5 (range 1-95) years. Majority were male 4198/6319 (66%) [95% CI: 65% to 67] and 2121/6319 (34%) (95% CI: 32% to 35%) were female, with a male to female ratio of nearly 2:1.

The top three leading causes of injuries visiting ED, and which accounted for 80.6% of hospital visits were: assault (41.6%), road traffic crashes (27.7%) and unspecified soft tissue injuries (11.3%). The other causes included cut-wounds (7.2%), dog bites and falls each contributed just above 3%, while burns and poisoning constituted 1.2 % and 0.8% respectively.

Injury-related admissions were analysed only for the year 2003 data. Of the 3253 admitted cases, 1010 (31%) were hospitalized. RTCs were by far the leading cause of hospitalization accounting for nearly 50% of the admissions, and also accounted for 42.2% of all injury deaths, followed by assault (Table1). In contrast, burns though relatively infrequent among injury patients treated at ED and discharged, were most life threatening and accounted for almost a fifth (18.8%) of all recorded injury-related deaths (Table 1).

Table 1: Causes of injury by patient disposition, Kisumu, western Kenya

External cause	Treated and released in the ED N=6319 (100%)			Admitted in the hospital N=1010 (100%)			Died in the hospital N=64 (100%)		
	No	(%)	Rank	No	%	Rank	No	%	Rank
Assault	2629	41.6	1	153	15.1	2	11	17.2	3
RTC	1749	27.7	2	500	49.5	1	27	42.2	1
STI	714	11.3	3	2	0.2	-			
Cut wound	452	7.2	4	2	0.2	-			
Fall	212	3.4	5	103	10.2	3	6	9.4	4
Dog bite	207	3.3	6	4	0.4	-			
Burn	78	1.2	7	71	7.0	5	12	18.8	2
Poisoning	49	0.8		67	6.6	6	3	4.7	6
SII	2	0.0		101	10.0	4	5	7.8	5
Others	227	3.6		7	0.7	-			

RTC: Road traffic crashes STI: Soft tissue injury (unspecified) SII: Self inflicted injury

Table 2 illustrates variations of injury by external cause across the six age groups. Most injuries occurred in the most economically productive age group 15-44 years, who represented 75% (4336/5803) of all injury cases, of whom young adults aged 15-29 years

comprised 50% (2921/5803), while those aged 30-44 years comprised 25% (1415/5803). The lowest frequency of injuries was found in older people aged 60 and above (1.9%).

Table 2: ED injury visit by cause and age group of patients, Kisumu, western Kenya, January 2002-December, 2003

External cause**	% of total visits (n) per age* group						
	0-4(278)	5-14(698)	15-29(2921)	30-44(1415)	45-59(382)	60+(109)	All ages(5803)
Assault	16.9	23.2	51.9	40.7	34.0	25.7	42.4
RTC	24.1	20.9	23.4	33.8	38.2	42.2	27.0
STI	17.3	17.3	9.3	11.2	12.0	11.9	11.1
Cut wound	15.8	13.2	6.4	4.8	4.5	7.3	7.2
Poisoning	0.7	0.3	1.0	0.6	0.5	0.0	0.8
Fall	7.9	7.9	2.2	2.3	4.5	2.8	3.4
Dog bite	2.9	10.2	2.3	2.3	3.1	4.6	3.4
Burn	9.4	3.0	0.6	0.4	0.3	0.9	1.2
SII	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Others	5.0	6.2	2.8	3.9	2.9	4.6	3.6

*516 patients missed information on age RTC: Road traffic crashes STI: Soft tissue injury (unspecified)

**The figures in bold refer to percent distribution of the two leading causes of injury in each age group.

SII/: Self inflicted

The two most frequent causes of injury in each age group are shown in bold. Overall, assault was the most leading cause of injury in our study hospital accounting for slightly over 50% of the visits in teenagers and young adults aged 15-29 years, and together with RTC were either the first or second leading cause of injury in nearly across all age groups. Soft tissue injury (unspecified), cut wound and fall mostly affected children less than 15 years old. Burns occurred most among the under fives and dog bites was mostly in children 5-14 years.

Analysis of causes of injury by gender among visits to ED showed no gender differences, except

for cuts which occurred more significantly among males than females, 8.1% *versus* 5.3% (OR=1.56; 95%CI: 1.25 to 1.96; p<0.001) (Table 3).

Table 3: Injury distribution by cause and gender attending the emergency department (ED), Kisumu, western Kenya, January 2002-December, 2003

Cause of Injury	TotalN=6319	Gender		OR (95% CI)	P-Value
		Malen=4198 (66)	Femalen=2121 (34)		
Assault	2629 (41.6)	1750 (41.7)	879 (41.4)	1.01 (0.91 to 1.12)	0.853
RTC	1749 (27.7)	1134 (27.0)	615 (29.0)	0.91 (0.81 to 1.02)	0.096
STI	714 (11.3)	497 (11.8)	217 (10.2)	1.18 (0.99 to 1.40)	0.057
Cuts	452 (7.2)	339(8.1)	113 (5.3)	1.56 (1.25 to 1.96)	<0.001
Falls	212 (3.4)	128 (3.0)	84 (4.0)	0.76 (0.57 to 1.02)	0.586
Dog bites	207 (3.3)	132 (3.1)	75 (3.5)	0.89 (0.66 to 1.19)	0.409
Burns	78 (1.2)	48 (1.1)	30 (1.4)	0.81 (0.51 to 1.31)	0.409
Poisoning	49 (0.8)	21 (0.5)	28 (1.3)	0.38 (0.21 to 0.69)	0.357
SII	2 (0.0)	2 (0.0)	0 (0.0)	—	—
Others	227 (3.6)	147 (3.5)	80 (3.8)	0.93 (0.70 to 1.23)	0.585

RTC= Road Traffic Crashes STI, Soft Tissue Injuries (unspecified) SII, Self-Inflicted Injuries
 OR=odds ratio CI=confidence interval Figures in parenthesis are percents

Observations of injury admissions by gender showed that more males than females were admitted due assault, but the converse was true for burns and poisoning (Table 4)

Table 4: Distribution of injuries causing admission by cause and gender, Kisumu, western Kenya, January-December, 2003

Cause of Injury	TotalN=1010	Gender		OR (95% CI)	P-Value
		Malen=659 (65.2)	Femalen=351 (34.8)		
RTC	500 (49.5)	330 (50.3)	167 (47.7)	1.11 (0.85 to 1.45)	0.434
Assault	153 (15.1)	120 (18.2)	33 (9.4)	2.22 (1.45 to 3.41)	<0.001
Falls	103 (10.2)	71 (10.8)	32 (9.1)	1.21 (0.76 to 1.92)	0.402
SII	101 (10.0)	63 (9.6)	38(10.9)	0.87 (0.56 to 1.36)	0.529
Burns	71 (7.0)	30 (4.6)	41 (11.4)	0.32 (0.19 to 0.55)	<0.001
Poisoning	67 (6.6)	34 (5.2)	33 (9.4)	0.51 (0.30 to 0.86)	0.007
Dog bite	4 (0.4)	2(0.2)	2 (0.6)	0.53 (0.05 to 5.29)	0.995
Cuts	2 (0.2)	1 (0.2)	1 (0.3)	0.53 (0.01 to 19.51)	0.651
STI	2 (0.2)	2 (0.2)	0 (0.0)	—	—
Others	7 (0.7)	4 (0.6)	3 (0.9)	0.71 (0.13 to 4.00)	0.653

RTC= Road Traffic Crashes SII, Self-Inflicted Injuries OR=odds ratio CI=confidence interval
 STI, Soft Tissue Injuries Figures in parenthesis are percents

Injury severity

Using length of stay (LOS) and inpatient fatality as a proxies for injury severity, we found that there were 1010 hospitalizations with a mean LOS of 8.4 (SD18.9) days, with a median value of 4.0 days (range1-315 days) (Table 5). Of major causes of injuries resulting in hospitalization, falls on average resulted in greater mean LOS (15.6) days in comparison to all other injury causes. For total inpatient days, which take into account both the mean LOS and the frequency of hospitalization, RTC accounted for the largest proportion (46.9%) and contributed to 42.2% of all injury related deaths, with an in-hospital case fatality rate (CFR) of (5.4%). Injury due to burns accounted for 18.8% of all injury

related deaths, and had the highest CFR (16.9%), followed by that due to assault (7.2%) (Table 5). Overall, 946 of the 1010 (93.7) admitted patients were discharged home, with only 64 dying, giving an in-patient injury-related fatality rate of 6.3%, two thirds of which were men 42/64, (67.7%).

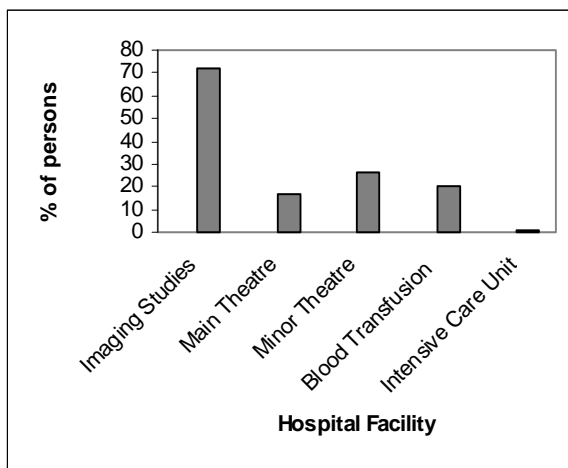
Table 5: Mean LOS (in days), bed-days and mortality of hospitalized patients by cause, Kisumu, western Kenya

Cause of injury	Number of patients hospitalized (%)	Mean LOS	Total inpatient-days No. (%)	Number of deaths N=64(%)	Mortality among hospitalized
RTC	500 (49.5)	7.9	3363 (46.9)	27 (42.2)	5.4
Fall	103 (10.2)	15.6	1609 (19.1)	6 (9.4)	5.8
Assault	153 (15.1)	8.1	1235(14.6)	11 (17.2)	7.2
Burn	71 (7.0)	13.5	961 (11.4)	12 (18.8)	16.9
SII	101 (10.0)	4.2	419 (5.0)	5 (7.8)	5.0
Poisoning	67 (6.6)	2.4	161 (1.9)	3 (4.7)	4.5
Cut wounds	2 (0.2)	12.0	24 (0.3)	-	-
Dog bite	4 (0.4)	3.3	13 (0.2)	-	-
STI	2 (0.2)	2.5	5 (0.1)	-	-
Other	7 (0.7)	7.4	52 (0.6)	-	-
All causes	1010 (100)	8.4	8442 (100)	64 (100)	6.3

LOS = length of stay RTC = Road traffic crashes STI = Soft tissue injury (unspecified)
 SII = Self inflicted injury

Assessment of the utility of specialized services among the admitted cases showed that nearly three-quarters (72%) required X-rays/imaging services, 43.3% required the use of theatre for surgical procedures, 20.0% required blood transfusion, while 1.0% were admitted to the Intensive Care Unit (ICU) (Figure). Of the 10 patients admitted to ICU, 7 (70%) were due to RTC (data not shown).

Figure 1: Use of five selected hospital facilities by hospitalized injury patients Kisumu, western Kenya, January-December, 2003



Discussion

The leading cause of injury among ED visits was assault (41.6%) and was the second most important cause of injury-associated admissions and in-patient CFR. These findings are similar to those of a study from another area neighbouring western Kenya that

previously reported assault as the leading cause of injury with a rate of 40%⁴, Ethiopia which borders Kenya to the north, (48.5%)¹³.

RTC were the second leading cause of injury, as well as the leading cause of hospitalization, and accounted for most injury-associated in-hospital stay and deaths, and majority of these RTC (39.1%) involved public transport occupants, consistent with previous studies that have looked at intercity highways that traverse rural areas^{14,15}. Our findings support the view that the road is a dangerous place in Kenya, with RTC being an important cause of mortality, morbidity and disability⁷ and are estimated to contribute 45-60% of admissions in surgical wards, 75% in the National Spinal Injury Hospital and 3000 death annually^{14,16,17}. This calls for enhanced development of appropriate regulations, legislation, training and enforcement of traffic rules for the protection of general public and loss of assets. Since it has been observed that someone involved in a RTC in Kenya is nine times as likely to die as in the United States¹⁸, our study along with other previous studies suggest that management of trauma remains a significant challenge for regional hospitals serving rural Kenya.

Like what has been observed elsewhere^{4,6,14,19-22}, results from this study show majority of trauma patients to be predominantly individuals in the economically active age group of 21-60 years with a peak at 21-30 years, depleting the economically productive population, which bears a direct impact on the productivity of individuals, families, communities and the country.

Overall, there was no difference in the risk of most injuries by gender in this hospital ED on-site medical records review study, except for assault and cut wounds in which more men were at significantly enhanced risk. This can be attributed to predominance to male domination of most of the hazardous occupations and social activities such as alcohol consumptions^{4,15,23-25}. However, unlike females, we observed fewer cases of burns and poisoning in males. These observed differences by gender call for a well designed study to elucidate risk factors for the specified injuries in the identified high risk groups and provide data that can be used to develop specific community-wide interventions, focusing on particular subpopulations when targeting prevention programmes for selected injuries.

Self-inflicted injuries were rarely reported in the study health facility. Suicides may be underestimated, because the taboo around suicide may preclude reporting, however those who reached the hospital were found to be severely injured to require hospitalization. Although Kisumu is on shores of Lake Victoria, the greatest freshwater lake in Africa, we were surprised of no reported cases of drowning/near drowning as causes of injury, suggesting that injuries leading to immediate death may have been underestimated by our study²⁶.

Our study also assessed the length of hospital stay and utility of specialized hospital services. In comparison to reports on trauma in other East African hospitals, the mean hospital stay of 8.4 days in our study facility is similar to the previously reported^{7,17}. On average, patients with RTC and burns accounted for more than half of the in-hospital stay and together with assault accounted for more than two thirds of all in-hospital injury related deaths. As observed elsewhere, in the absence of Trauma and Injury Severity Score²⁷, our results agree with others that suggest that LOS can be used as a surrogate in epidemiological studies to identify and characterize patients with severe injuries²⁸.

Our findings also show that nearly three quarters (72%) of trauma patients in our study hospital required X-rays and that quite several needed blood transfusion and use of theatre facilities. These have important implications for manpower training and deployment, as well as planning for providing the necessary resources for trauma management in similar publicly funded health institutions that are already facing constrained funding.

The overall in-hospital mortality rate of 6.3 % in our study hospital is comparable to other

previously reported rates of 6-10%^{7,29} by studies in a similar environment, but higher than the 3.5% reported in a recent study at Kijabe mission hospital in Kenya's Rift Valley Province¹⁷. Unlike our study hospital, the Kijabe study was done in a hospital with a well developed protocol for trauma management including triage, adoption of advanced trauma life support (ATLS)[®] guidelines in assessment and resuscitation, and early definitive management of injuries³⁰, suggesting that even in the context of limited resources, a team approach combined with appropriate training and adequate equipment can ensure good outcomes for the majority of injury patients.

Key points

- Assault and RTC were the most frequently reported injuries in the study facility.
- Men were more likely to be hospitalized due to assault and women due burns and poisoning.
- RTC had the highest number of patients requiring ICU services.
- Falls on average resulted in greatest mean LOS.
- Burns had the highest reported CFR.

Study limitations

This study only looked at a single hospital and the use of hospital discharge diagnoses has been found to be problematic³¹, among them being missing data on certain variables, and lack of access to hospitals for patients in many parts of Africa, hence potential for selection bias as patients who did not come to this facility or sought care in other hospitals were not included. We had no direct information on the severity of injuries, hence our use of proxies such as LOS.

Conclusion

Our study shows that the use of non-fatal ED in conjunction with in-patient injury-related mortality data can provide a foundation for injury research for a better understanding of their causes, imperative for policy, practice and estimation of their economic impact.

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References

- Mutasingwa DR, Aaro LE. Injury registration in a developing country. A study based on patients' records from four hospitals in Dar es Salaam, Tanzania. *Cent Afr J Med*. 2001; 47:203-9.
- Smith GS, Barss P. Unintentional injuries in developing countries: the epidemiology of a neglected problem. *Epidemiologic Reviews* 1991; 13:228-66.
- Nantulya VM, Reich MR. The neglected epidemic: road traffic injuries in developing countries. *BMJ*. 2002; 324(7346):1139-41.
- Odero WO, Kibosia JC. Incidence and characteristics of injuries in Eldoret, Kenya. *East Afr Med J*. 1995; 72:706-10.
- Haq A. Analysis of surgical admissions to Coast Province General Hospital, Mombasa: retrospective study (October 1985 to October 1986). *East Afr Med J*. 1988; 65:264-70.
- Muyembe VM, Suleman N. Head injuries at a Provincial General Hospital in Kenya. *East Afr Med J*. 1999; 76:200-5.
- Masiira-Mukasa N, Ombito BR. Surgical admissions to the Rift Valley Provincial General Hospital, Kenya. *East Afr Med J*. 2002; 79:373-8.
- Saidi HS. Initial injury care in Nairobi, Kenya: a call for trauma care regionalisation. *East Afr Med J*. 2003; 80:480-3.
- Kobusingye O, Lett RR. Hospital based trauma registries in Uganda. *Journal of Trauma* 2000; 48:498-502.
- Kinnane JM, Garrison HG, Coben JH, Alonso-Serra HM. Injury prevention: is there a role for out-of-hospital emergency medical services? *Acad Emerg Med*. 1997; 4: 306-12.
- London J, Mock C, Abantanga FA, Quansah RE, Boateng KA. Using mortuary statistics in the development of an injury surveillance system in Ghana. *Bull World Health Organ*. 2002; 80:357-64.
- National Centre for Health Statistics. International Statistical Classification of Diseases, Ninth Revision, Clinical Modification, 4th ed. Washington DC: US Department of Health and Human Services, 1994.
- Osman M, Kebede Y, Anberbir S. Magnitude and pattern of injuries in north Gondar administrative zone, northwest Ethiopia. *Ethiop Med J*. 2003; 41:213-20. *East Afr Med J*. 1995; 72:706-10.
- Odero W. Road traffic accidents in Kenya: An epidemiological appraisal. *East Afr Med J*. 1995; 72:299-305.
- Odero W, Khayesi M, Heda PM. Road traffic injuries in Kenya: magnitude, causes and status of intervention. *Inj Control Saf Promot* 2003; 10:53-61.
- Odero W. Alcohol-related road traffic injuries in Eldoret, Kenya. *East Afr Med J* 1998; 75:708-11.
- Otieno T, Woodfield JC, Bird P, Hill AG. Trauma in rural Kenya. *Injury*. 2004; 35:1228-33
- Anonymous. Accidents in the Third world. *World Development Forum*. 3:1985; 2.
- Rutta E, Mutasingwa D, Ngallaba SE, Berege ZA. Epidemiology of injury patients at Bugando Medical Centre, Tanzania. *East Afr Med J*. 2001; 78:161-4.
- Nordberg E. Injuries in Africa: a review. *East Afr Med J* 1994; 71:339-45.
- Muckart DJ. Trauma-the malignant epidemic. *S Afr Med J*. 1991; 79:93-5.
- Macharia WM, Njeru EK, Muli-Musiime F, Nantulya V. Severe road traffic injuries in Kenya, quality of care and access. *African Health Sciences* 2009; 9(2):118-124
- Moshiro C, Mswia R, Alberti KG, Whiting DR, Unwin N. AMMP Project Team. The importance of injury as a cause of death in sub-Saharan Africa: results of a community-based study in Tanzania. *Public Health* 2001; 115:96-102.
- Odero W, Zwi AB. Drinking and driving in an urban setting in Kenya. *East Afr Med J* 1997; 74:673-9.
- 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: 36-40
- Masson F, Saves M, Salmi LR, Bourde A, Henrion G, Erny P. Injuries in a problematic socioeconomic context: a population-based study in Reunion, Indian Ocean, 1993-1994. GEAR. Groupement d'Etude sur les Accidents a la Reunion. *Int J Epidemiol*. 1997; 26:1033-40
- Boyd CR, Tolson MA, Copes WS. Evaluating trauma care: the TRISS method. Trauma Score and the Injury Severity Score. *J Trauma*. 1987; 27:370-8
- Odero WW, Tierney WM, Einterz RM, Mungai S. Using an electronic medical record system to describe injury epidemiology and health care utilization at an inner-city hospital in Indiana. *Inj Control Saf Promot*. 2004; 11:269-79.
- Andrews CN, Kobusingye OC, Lett R. Road traffic accident injuries in Kampala. *East Afr Med J* 1999; 76:189-94.
- Ali J, Adam R, Butler AK, Chang H, Howard M, Gonsalves D et al. Trauma outcome improves following the advanced trauma life support program in a developing country. *J Trauma*. 1993; 34:890-8
- Smith GS, Langlois JA, Buechner JS. Methodological issues in using hospital discharge data to determine the incidence of hospitalized injuries. *Am J Epidemiol* 1991;134:1146-58