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The burden of road traffic injuries in an emergency department in Addis Ababa, Ethiopia

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Setting: The emergency department (ED) of Zewditu Memorial Hospital, Addis Ababa, Ethiopia.

Objective: To document the proportion, trend, characteristics and outcomes of road traffic injury (RTI) related ED admissions (≥ 15 years) between 2014 and 2015.

Design: A retrospective, cross-sectional study using routinely collected ED data.

Results: Of 10007 ED admissions, 779 (8%) were RTI cases; this proportion peaked in the month of January (11%). Medical records were available for 522 (67%) of these RTI cases. The median age was 28 years and 69% were males. The majority were pedestrians (69%) injured by an automobile (78%). On triage, 32% were classified as needing urgent/immediate intervention. Head injuries (20%) were the second most common injury after lower limb injuries (36%). ED outcomes were as follows: discharged (68%), hospitalised (17%), referred (17%) and died (1%). Among the 78 hospitalised cases, respectively 62% and 16% were admitted to the surgical and orthopaedic departments. Of 146 RTI cases with head injuries, 25% were hospitalised, of whom 82% were admitted to the surgical department.

Conclusion: Our findings can guide policy makers in referral hospitals in improving the planning of hospital resources and the prioritisation of public health needs linked to further urban development. A comprehensive plan to prevent RTIs, particularly among pedestrians in Addis Ababa, is urgently needed.

The global burden of road traffic injuries (RTIs) is growing constantly, with approximately 1.2 million people killed and 20–50 million people injured each year.¹ This major public health problem disproportionately affects low- and middle-income countries (LMICs), and is likely to become a greater problem, with RTI-related deaths and injuries forecast to increase by 80% in LMICs between 2000 and 2020.² RTIs place an immense burden on health care systems, diverting financial and human resources and bed occupancy from other priorities.³

Emergency medical services (EMS), a system of ambulances and emergency departments (EDs) at hospitals, provide critical care for injured or ill patients before they are integrated into other health services.⁴ However, there are several challenges to delivering high quality EMS care in sub-Saharan Africa, including patient overload, poor integration with other health services, limited and inefficient services, poor clinical documentation, and a shortage of physicians and nec-

essary supplies.^{5–7} The epidemiology of conditions presenting to the EMS needs to be studied to make efficient use of the scarce existing human, material and financial resources.⁸

Ethiopia, a country with a low small vehicle/population ratio, is considered one of the countries worst affected by RTIs.⁹ This is due mainly to poor road safety plans and the failure of drivers to abide by the traffic rules.¹⁰ While some studies have highlighted the general burden of RTIs in Ethiopia, the burden of RTIs on hospital EDs is still an under-researched area. A study conducted in the ED of Black Lion Hospital, Addis Ababa, showed that RTI injuries constituted 48% of all ED casualties.¹¹ The study did not capture certain aspects of the RTI burden, however, such as the severity of cases, patient outcomes and the RTI-related workload in other hospital departments.

To address these gaps, our study highlights the overall burden of RTIs in the ED of the Zewditu Memorial Hospital, Addis Ababa. We report on 1) the annual trend in the number and proportion of ED admissions resulting from an RTI, 2) the demographic and clinical characteristics of RTI cases, 3) the RTI outcomes at the end of the ED encounter, and 4) the specific characteristics and outcomes of RTI cases involving a head injury over a 1-year period. The results of this study are expected to guide efforts to improve the preparedness of EDs and the hospital referral departments that manage RTI cases.

METHODS

Study design

This was a descriptive cross-sectional study using retrospectively collected routine hospital data.

Study setting

Ethiopia is one of the most populated countries in sub-Saharan Africa, with 82 million inhabitants. The country comprises nine regions and two city administrations; 16% of its population resides in urban areas.¹² Addis Ababa, the capital city, is the largest city in Ethiopia, with an estimated population of 3.5 million, constituting a quarter of the urban population in the country.¹³ The country is poor, with a per capita gross domestic product (GDP) of US\$1350 in 2013.¹⁴ Like other low-income countries, the national health system has made communicable diseases a priority, with less attention given to non-communicable diseases, including RTI-related injuries. No primary health centres in Ethiopia are equipped to provide trauma care; these services are available at a limited

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number of secondary and tertiary health facilities in the country.

This present study was conducted in Zewditu Memorial Hospital (ZMH), one of the main tertiary referral hospitals in Addis Ababa, serving a population of over 600 000. The hospital provides medical, surgical and emergency care (in-patient and out-patient). ZMH has an average bed capacity of 180, with a staff of 20 physicians and specialists, 200 nurses and 20 pharmacists. The hospital investigation capacity includes laboratory, radiography and ultrasound services. Patients needing computerised tomography (CT) scans or magnetic resonance imaging (MRI) are referred to another public or private hospital at the patient's expense.

The ZMH ED services are available 24 h a day, 7 days a week, with a capacity of 20 beds. The ED is staffed by 1 physician, 25 nurses, 1 emergency officer (masters-level specialist in emergency care), and 3 clinical officers. There are also several trained medical interns, residents and nurse trainees who support the ED services as part of their academic education. The ED at ZMH includes the following areas: reception, triage, resuscitation area, two observation rooms, two admission rooms and one injection or dressing room. The target for maximum patient time in the ED is 24 h. However, in practice, due to the insufficiency of beds in referral departments/hospitals or delays in ED care, patient stays can exceed 24 h. There are two emergency units in the hospital: one designated for children aged <15 years (paediatric emergency care) and the other for cases aged ≥15 years (adult). Due to differences between the two emergency units in terms of ED management and care (e.g., the use of different triage scoring systems) and different case recording procedures, this study focused on the adult emergency unit, which sees the majority of RTI cases.

Management of road traffic injury cases

On arrival at the ED, the severity of a patient's condition is assessed by triage nurses using the Modified Early Warning Score (MEWS). Nurses fill in a triage sheet that includes socio-demographic information and the MEWS. A patient's triage score is colour coded black, red, orange, yellow or green, interpreted as follows: black = death; red = immediate intervention; orange = urgent priority; and yellow or green = keep in waiting area with frequent re-triage. Following triage, patients are assessed by an ED physician or resident who advises on treatment plan, investigations required, emergency consultations with other specialities and referral to other departments. A patient's possible outcome at the end of the ED admission includes hospitalisation (referral to other departments), referral to another facility, ambulatory discharge or death while in the ED.

Study population

The study included all RTI cases aged ≥15 years admitted to the ZMH ED between September 2014 and August 2015.

Data and statistical analysis

The data pertaining to this study were sourced from hospital ED records (ED register, ED triage sheet and

individual patient records) and single-entered into EpiData (version 3.1, EpiData Association, Odense, Denmark). Frequencies and proportions were used to summarise categorical variables, and the mean, median and interquartile range were used to summarise continuous variables. Data were analysed using EpiData Analysis (version 2.2.2.182).

Ethics

Permission to carry out the study was obtained from the ZMH. Local ethics approval was obtained from the Ethics Committee of the School of Public Health, Addis Ababa University, Addis Ababa, Ethiopia. The study met the Médecins Sans Frontières Ethics Review Board (Geneva, Switzerland) approved criteria for studies of routinely collected data and was also approved by the Ethics Advisory Group of the International Union Against Tuberculosis and Lung Disease, Paris, France. As this was a record review study with anonymised data, the issue of informed patient consent did not apply.

RESULTS

Trends in the number and proportion of road traffic injury cases

Between September 2014 and August 2015, of 10 007 ED admissions in total, 779 (8%) were RTI cases (65/month on average). The trend in RTI admissions relative to the total ED admissions per month is shown in Figure 1. RTI admissions were most frequently observed during the month of January (11%) compared to an average of 7% per month during the study period.

Demographic and clinical characteristics of road traffic injury cases

Of the 779 RTI-related ED admissions, 522 (67%) had complete clinical and triage data and were included for further analysis. Table 1 shows the sociodemographic and clinical characteristics of these cases. The median age (interquartile range [IQR]) was 28 (22–24) years, and 69% were male. The majority of cases were pedestrians (69%) living in Addis Ababa (88%), and the RTI was most often caused by an automobile (78%). Only 29% of cases received pre-hospital care either in an ambulance or at another health care facility; 14% arrived at the ED by ambulance. In 41% of cases, the patient was referred from a private or public health facility.

More than half the cases had a yellow (33%) or green (26%) MEWS; these data were not recorded for 9% of cases. Lower limb injuries (36%) were the most frequent injury, followed by head injuries (20%) and upper limb injuries (15%).

Emergency department outcomes of road traffic injury cases

Table 2 shows the ED outcomes of the RTI cases. Two thirds were discharged with medical advice, 17% were hospitalised, 17% were referred to other hospitals and <1% died. Of the 78% of cases requiring hospitalisation, respectively 62% and 16% were admitted to the surgical and orthopaedic departments.

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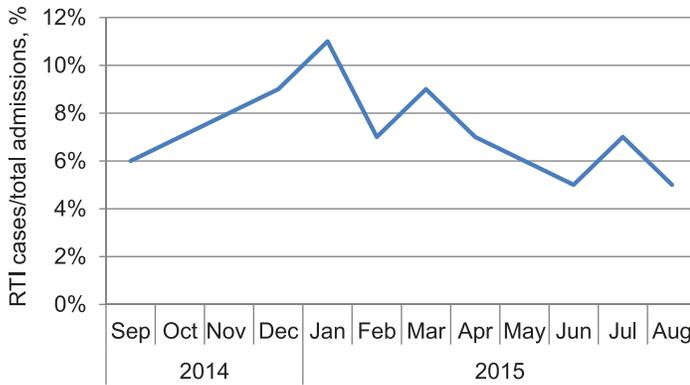


FIGURE 1 Trend of RTI admissions among all cases attending the ED at Zewditu Memorial Hospital, Addis Ababa, Ethiopia, September 2014–August 2015. RTI = road traffic injury; ED = emergency department.

Characteristics and outcomes of road traffic injury cases with a head injury

Table 3 shows the characteristics and outcomes of RTI cases with a head injury. Of the 146 people with head injuries, 104 (71%) were male and the median age was 30 years (IQR 23–40). The majority (66%) were pedestrians, and the RTI was most often caused by automobiles (73%). At triage, 39% had a MEWS of red or orange. Fifty four per cent were discharged home, 25% were admitted (most often to the surgical department) and the rest were referred out (6%) or died (1%) in the ED.

DISCUSSION

This is one of the first studies to present data on the trend and severity of RTI cases seen within the ED of a referral hospital in Addis Ababa, Ethiopia. Over a 1-year period, nearly one in 12 ED admissions was due to a RTI; a greater proportion of these cases presented during the month of January. Seven in 10 RTI cases involved pedestrians living in Addis. Slightly more than a third of the cases were classified red or orange on triage and required immediate attention. Of those requiring hospitalisation, over half were admitted to the surgical department.

A number of operational findings merit discussion. First, the peak in RTI admissions during January coincides with a period of festivities in Ethiopia, centering around the Ethiopian Orthodox celebration of Christmas on 7 January and the epiphany celebration of the Ethiopian Orthodox church on 19 January. During this time, greater population movement leads to a higher volume of vehicles on the road and this, together with a higher number of alcohol-impaired drivers, likely increases the odds of an incident. During this period, it would seem prudent for EDs and the ambulance services in Ethiopia to increase their capacity (human and hospital resources) to prepare for a higher incidence of RTIs. In addition, efforts to strengthen traffic regulations and increase public awareness of the higher risk of RTIs during holiday periods are called for.

Second, our findings indicate that RTI-related ED admissions occur most often in persons aged 25–44 years, males and pedestrians. Without reliable data to confirm the proportion of RTI cases that make it to an ED in Addis Ababa, it is difficult to gauge whether the profile of RTI cases seen in the ED reflects the profile of RTI victims in Addis Ababa in general. Based on the findings of

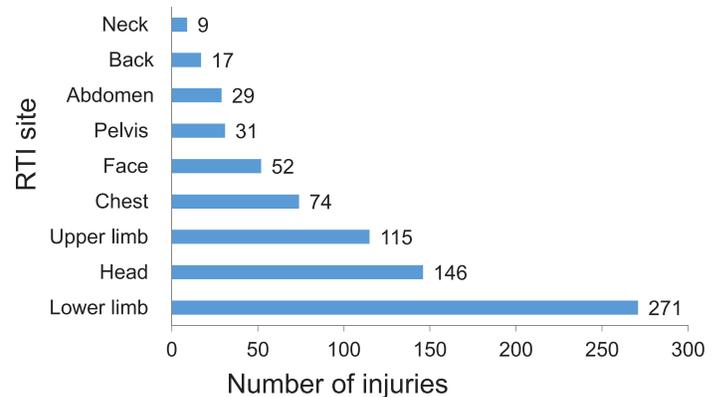


FIGURE 2 The burden of injuries by body site among RTI cases presenting at the ED of Zewditu Memorial Hospital, Addis Ababa, Ethiopia, September 2014–August 2015. *Face injuries include eye and teeth injuries. RTI = road traffic injury; ED = emergency department.

studies from Ethiopia and similar urban settings,^{11,14–17} we suspect that the profile of RTI-related ED cases seen in our study mirrors the profile of RTI cases in general in Addis Ababa and similar low-resource urban cities.

The large proportion of male victims may be a reflection of their increased daily movement for work. The fact that they also represent the most economically productive age group likely has serious economic implications, particularly at a family level. The predominance of pedestrian victims in our study not only reflects their vulnerability as road users, but also highlights insufficient attention to road safety needs (e.g., a lack of pedestrian crossings, poor road design) and reckless driving behaviour. Against a backdrop of resource constraints, these findings support an urgent call for targeted measures, particularly focused on improving pedestrian safety, to try to reduce RTIs.

Third, although the mode of arrival to the ED was missing for a number of cases, when this information was recorded, it showed that only one in five cases arrived at the ED by ambulance—and we suspect that this proportion might have been even lower had data been complete. Similarly, only a small number of cases received pre-hospital first aid care. This highlights the importance of increasing the availability of ambulance vehicles and paramedic staff so that RTI cases are reached and transported to appropriate medical facilities more rapidly. This also requires improving the coordination of the ambulance system and the referral linkage between health centres and referral hospitals. Further studies are needed to better understand the gaps in pre-hospital care, including the proportion of all RTI cases reached by an ambulance in the first place.

Fourth, one third of RTI cases seen in the ED had a triage score of red or orange, a proxy for the severity and workload in the ED due to RTIs. These cases are the most urgent and require immediate intervention. Only two cases were declared dead on arrival, although, in light of the poor ambulance system, it is likely that many RTI victims from far or remote areas do not receive timely transport or lifesaving pre-hospital first aid care and die before arrival at the hospital.

Fifth, although two thirds of cases did not require hospitalisation, the greatest burden of hospitalised RTI cases fell upon the surgical department, followed by the orthopaedic department. This finding can help to inform hospital management on the resources that RTI cases may require for better future planning.

TABLE 1 Sociodemographic and clinical characteristics of RTI cases seen in the ED of Zewditu Memorial Hospital, Addis Ababa, Ethiopia, September 2014–August 2015

Characteristics	Total (<i>n</i> = 522) <i>n</i> (%)
Sex	
Male	362 (69)
Female	160 (31)
Age, years	
15–24	181 (35)
25–34	153 (29)
35–44	76 (15)
≥45	112 (21)
Median [IQR]	28 [22–40]
Living in Addis	
Yes	461 (88)
No	30 (6)
Not recorded	31 (6)
Type of case	
Pedestrian	360 (69)
Driver/cyclist	32 (6)
Passenger	67 (13)
Not recorded	50 (10)
Pre-hospital care	
Yes	153 (29)
No	177 (34)
Not recorded	192 (37)
Mode of arrival to ED	
Ambulance	67 (13)
Other means*	241 (46)
Not recorded	214 (41)
Mode of referral to ED	
Self	206 (39)
Public hospital/health centre	170 (33)
Private hospital/clinic	44 (8)
Police	36 (7)
Not recorded	66 (13)
Vehicle causing RTI	
Automobile†	410 (78)
Motor bike/three-wheeler	27 (6)
Bus	20 (4)
Truck	17 (3)
Not recorded	48 (9)

*Includes walking, private car, taxi, public transportation.

†Private cars and taxis.

RTI = road traffic injury; ED = emergency department; IQR = interquartile range.

Finally, head injuries were the second highest reported injury among RTI victims. Four of 10 cases with head injuries were classified at triage as red or orange, requiring further investigation. The absence of CT technology at the ZMH is a major operational challenge and directly compromises the quality of care provided for trauma victims. Consequently, management decisions are based solely on the clinical evaluation of the patient, which likely leads to both over- and under-diagnosis of severe brain injuries, some of which may be surgically correctable. Unfortunately, data on mortality after hospital admission were not available for review. In addition, more than half of RTI cases with head injury were discharged home, and their final outcomes remain unknown. The burden of RTI victims requiring hospitalisation due

TABLE 2 Clinical profile and treatment outcomes of RTIs in the ED of Zewditu Memorial Hospital, Addis Ababa, Ethiopia, September 2014–August 2015

Variable	Total (<i>n</i> = 522) <i>n</i> (%)
Triage score (MEWS)*	
Red	73 (14)
Orange	95 (18)
Yellow	170 (33)
Green	137 (26)
Black (deceased)	2 (<1)
Not recorded	45 (9)
Patient mobility on admission	
Walking	80 (15)
Walking with help	135 (26)
Stretcher/immobile	76 (15)
Not recorded	231 (44)
Injury type (<i>n</i> = 564)†	
Laceration	360 (69)
Avulsion	18 (3)
Fracture	160 (31)
Dislocation	26 (5)
Outcome at the end of ED care	
Discharged home	356 (68)
Referred to other facility	22 (4)
Hospitalised	87 (17)
Died in ED	4 (1)
Not recorded	53 (10)
Admission by hospital department (<i>n</i> = 87)	
Surgical	54 (62)
Orthopaedic	14 (16)
Medical	6 (7)
Intensive care unit	4 (5)
Not recorded	9 (10)

*Red = <10 min, Orange = <60 min, Yellow = <240 min).

†Gross value for all injury sites involved (patients can have more than one injury type).

RTI = road traffic injury; ED = emergency department; MEWS = Modified Early Warning Score.

to head injuries fell mainly on the surgical department. These findings are consistent with a study in Ethiopia, where RTIs were the second major cause of head injuries after interpersonal fights.¹⁸

Our study findings have a number of policy and practice implications. First, they highlight the importance for EDs and referral departments (surgical departments in particular) to increase their capacity for RTI-related admissions during the holiday periods. Second, they provide an indication of the level of human (including specialist capacity, for example, in management of head injuries) and material resources that need to be planned. Third, they draw attention to the importance of RTI prevention in Ethiopia in achieving one of the new key Sustainable Development Goals (SDGs): halving the number of RTI-related deaths and injuries by 2030.¹⁹ Measures such as improving road safety for pedestrians (e.g., pavements, lighted cross walks and traffic lights) together with reinforcing traffic laws and legislation on the use of alcohol and *khat* chewing while driving (which is known to be a frequent cause for drivers' lack of attention in Ethiopia)²⁰ seem particularly important.

TABLE 3 Head injury characteristics among those with RTIs seen in the ED of Zewditu Memorial Hospital, Addis Ababa, Ethiopia, September 2014–August 2015

Characteristics	<i>n</i> = 146 <i>n</i> (%)
Living in Addis Ababa	
Yes	126 (86)
No	10 (7)
Not recorded	10 (7)
Patient type	
Pedestrian	97 (66)
Driver	10 (7)
Passenger	23 (16)
Motorcyclist	2 (1)
Not recorded	14 (10)
Vehicle causing RTI	
Automobile*	107 (73)
Motorbike/three-wheeler	7 (5)
Bus	10 (7)
Truck	6 (4)
Not recorded	16 (11)
Triage score (MEWS)	
Red	24 (16)
Orange	33 (23)
Yellow	48 (33)
Green	32 (22)
Black (deceased)	0
Not recorded	9 (6)
Outcome	
Discharged home	79 (54)
Hospitalised	37 (25)
Referred to other facility	9 (6)
Died in ED	2 (1)
Not recorded	19 (13)
Admitting department (<i>n</i> = 34)	
Surgery	28 (82)
Medicine	3 (9)
Orthopaedic	2 (6)
Intensive care unit	1 (3)

*Private cars and taxis.

RTI = road traffic injury; ED = emergency department; MEWS = Monitoring Early Warning Score.

Fourth, while this study did not specifically assess the pre-hospital care system, our findings imply that serious shortfalls exist and that these need to be further investigated and addressed. Fifth, our study highlights important constraints in RTI-related data capture both at hospital and at police surveillance level. At the hospital level, RTI-related data on alcohol and *khat* use are not routinely captured. These data are important for estimating the prevalence of the problem and for trying to target measures to curb the problem. Similarly, incomplete and poorly recorded data on variables linked to pre-hospital care and timing of events make it difficult to monitor important aspects of care and care delivery (i.e., performance).

Traffic police reports are the official source of data for RTIs in Ethiopia, but high levels of under-reporting, especially for non-fatal RTIs, are a problem.²¹ This means that there are no reliable baseline data that can be used to monitor the implementation of measures aimed at reducing RTIs and to monitor the coverage of pre-hospital and hospital care for RTI victims.

Strengthening of both hospital and police surveillance systems thus seems crucial.

The main strengths of this study are that it was conducted in one of the main tertiary hospitals in Addis Ababa, thus likely reflecting the operational realities of a public hospital ED in an urban context. In addition, it uses one year of data showing the trend of RTIs, case severity and outcomes at the end of ED encounters. Most importantly, the study follows the Strengthening the Reporting of OBservational Studies in Epidemiology (STROBE) guidelines to ensure quality reporting in observational studies.²²

There were a number of study limitations. First, complete data were not available for one third of RTI cases presenting at the ED, and thus these were not included in the analysis. A brief review of these excluded records suggests that data were generally missing at random. Second, among the medical records included in the analysis, there was approximately 10% of missing data. Third, there was no baseline information recorded in patient files on the actual time of the incidence of RTI, ED admission or outcome at the ED. As such, we are unable to use this information to assess the relative performance of the ED in managing these cases. Fourth, without any reliable data about the proportion of RTI cases who die at the scene of the incident or do not make it to the hospital in time, the generalisability of our results to cases beyond the ED needs to be carefully reasoned. Finally, we did not assess the outcome of the RTI at the end of hospital discharge, which was beyond the scope of this study.

In conclusion, our study findings provide important data on RTI trends, burden and outcomes in one of the tertiary referral hospitals in Addis Ababa. These findings can guide policy makers in improving the planning of hospital resources and prioritising public health needs with further urban development. This study also highlights the mandate of a comprehensive plan for RTI prevention within Addis Ababa and similar cities elsewhere.

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Contexte : Le service des urgences de l'hôpital Zewditu Memorial, Addis-Abeba, Ethiopie.

Objectif : Documenter la proportion, la tendance, les caractéristiques et le devenir des patients (âgés ≥ 15 ans) admis pour des blessures de la route (RTI) entre 2014 et 2015.

Schéma : Une étude rétrospective transversale basée sur des données recueillies en routine par le service des urgences.

Résultats : Sur 10 007 admissions aux urgences, 779 (8%) étaient des cas de RTI ; cette proportion culminait au mois de janvier (11%). Les dossiers médicaux ont été disponibles pour 522 (67%) de ces cas de RTI. Leur âge médian était de 28 ans et 69% étaient des hommes. La majorité était des piétons (69%) blessés par une automobile (78%). Lors du triage, 32% ont été classés comme ayant besoin d'une intervention urgente/immédiate. Les

traumatismes crâniens (20%) étaient au deuxième rang, suivant les blessures des membres inférieurs (36%). Le devenir des patients a été le suivant : sortie (68%), hospitalisation (17%), référence (17%) et décès (1%). Parmi les 78 cas hospitalisés, respectivement 62% et 16% ont été admis dans les services de chirurgie et d'orthopédie. Sur les 146 cas de RTI ayant eu un traumatisme crânien, 25% ont été hospitalisés, dont 82% ont été admis en service de chirurgie.

Conclusion : Nos résultats peuvent guider les décideurs des hôpitaux de référence dans l'amélioration de la répartition des ressources et le choix de priorités en matière de besoins de santé publique liés au développement urbain ultérieur. Il y a un besoin urgent d'un plan complet de prévention des RTI, particulièrement parmi les piétons à Addis-Abeba.

Marco de referencia: El servicio de urgencias del Zewditu Memorial Hospital de Adís Abeba, en Etiopía.

Objetivo: Verificar la proporción de los pacientes (≥ 15 años de edad) que ingresaron al servicio de urgencias (ED) por traumatismos causados por el tránsito (RTI) y analizar las tendencias, las características y los desenlaces de estos casos del 2014 al 2015.

Método: Fue este un estudio transversal realizado a partir de los datos corrientes recogidos retrospectivamente en el ED.

Resultados: De los 10 007 ingresos al ED, 779 correspondieron a casos de RTI (8%); esta proporción fue más alta durante el mes de enero (11%). De estos casos, se pudo recuperar la historia clínica de 522 pacientes (67%). La mediana de la edad fue 28 años y el 69% de los pacientes era de sexo masculino. La mayoría de los pacientes eran peatones (69%) y la causa del accidente había sido un automóvil (78%). Tras la clasificación de los pacientes al

ingreso, se consideró que el 32% precisaba una intervención urgente o inmediata. El traumatismo craneoencefálico fue la segunda lesión más frecuente (20%) después de las lesiones de los miembros inferiores (36%). Los desenlaces clínicos del ED fueron como sigue: alta (68%), hospitalización (17%), remisión (17%) y muerte (1%). De los 78 pacientes hospitalizados, el 62% ingresó al servicio de cirugía y el 16% al servicio de ortopedia. De los 146 casos de RTI con trauma craneoencefálico, 25% de los pacientes se hospitalizaron, de los cuales el 82% en el servicio de cirugía.

Conclusión: Estos resultados pueden orientar a las instancias normativas de los hospitales de referencia a mejorar la planificación de los recursos hospitalarios y a priorizar las necesidades de salud pública en relación con el futuro desarrollo urbano. En Adís Abeba se precisa con urgencia un plan de prevención de los RTI a los peatones.