The Direct Cost of Treatment of Traumatic Brain Injury in a Sub-Saharan African Country (Benin)

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■ OBJECTIVES: **This is the first socioeconomic study on traumatic brain injury (TBI) undertaken to determine the sociodemographic factors implicated in the occurrence of TBI and to assess the value of the direct cost of the management of TBI at the initial phase in the Hubert Koutoukou Maga National Teaching Hospital of Cotonou.**

■ METHODS: **This was a prospective study with descriptive and analytic aim that took place from January 1 to July 31, 2014. An individual approach of each patient's expenditure was undertaken via the use of a questionnaire on which all expenses were identified systematically. The dependent variable was the global direct cost of care. The independent variables were the type of accident, severity of the TBI, the structures of care, the stay in the resuscitation unit, the duration of hospitalization.**

■ RESULTS: **There were 297 patients with TBI: 258 men (86.9%) and 39 women (13.1%), with a sex ratio of 6.61. The average age of patients was 34.3 ± 12.39 years. The average direct cost of care for TBI was €285.67 ± 310.15. The average cost for severe TBI was €522.08 ± 439.91 versus €188.19 ± 164.83 for mild TBI (odds ratio 5.52; standard deviation: 0.0527–0.6222). The average cost was increased significantly more when the patients went through a peripheral hospital (odds ratio 3.65; standard deviation: 1.819–7.3245).**

■ CONCLUSIONS: **The organization of Benin's health system did not allow for the optimum management of TBI. It seems imperative to develop an insurance system that will allow a proper and effective support for victims of traffic accidents.**

INTRODUCTION

The internationalization, the urbanization, and the motorization of transportation as known in sub-Saharan Africa expose its population to a multitude of traumatic disorders, including traumatic brain injury (TBI). TBI is a major problem in public health. Its social and economic impact is especially important because it is one of the most frequent reasons of death, morbidity, and invalidity in young adults.[1-3] In France, the management of some TBIs represents a cost of approximately €60,000 for each patient at the initial phase, whereas further aid provided could be greater than €150,000, without taking into account the domestic and social consequences of such a situation.[4]

This is the first socioeconomic study on TBI undertaken to determine the sociodemographic factors implicated in the occurrence of TBI and to assess the value of the direct cost of the management of TBI during the initial phase at the Hubert Koutoukou Maga National Teaching Hospital (CNHU/HKM) of Cotonou.

PATIENTS AND METHODS

Benin is a French-speaking, low-income West African country. Its population was, in 2014, 10.6 million inhabitants and its gross domestic product €8.71 billion. In 2014, the annual income per capita was €811.31. The local currency is the franc

Key words
- Africa
- Benin
- Cost
- Traumatic brain injury

Abbreviations and Acronyms
CNHU/HKM: Hubert Koutoukou Maga National Teaching Hospital
TBI: Traumatic brain injury

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(1.00 XOF = 0.00152449 EUR). Life expectancy was 59 years in 2012. The potentially active population (15–64 years) accounted for 52.5% of the population. In 2012, the urban population was estimated to 45.7%.[5,6] The guaranteed minimum wage was €61 per month, and the rate of poverty was 36.2%. There is limited rate of social coverage. Cotonou is the economic capital of Benin, with a population of 700,000 residing inhabitants, but this population increases to approximately 2 million during working hours. Urban transportation is provided mainly by motorcycle taxis. Cotonou's road density is estimated on average to 6.3 km for 10,000 inhabitants on a national level. During the study period, the law on the mandatory wearing of helmet motorcycles was not yet in effect.

The health system is 3-level pyramid: the peripheral level, represented by the communal or district health centers; the departmental level, represented by the departmental hospitals; and the national level, represented by CNHU/HKM. CNHU/HKM has a capacity of 642 beds and comprises an emergency care department, 2 multiskilled resuscitations units, and a total capacity of 24 beds and 12 respirators.

Until now, there has been no systematic emergency care system in place for the admitted patients in Benin. Patients receive medical prescriprtion, they pay in retail pharmacy before the care is provided. Biologic and radiologic tests are performed after a patient's siblings or family has paid. All care services must be prepaid by the victim's family outside the hospitalization fees. The cost of the day at hospital is €9.90 and for a cerebral computed tomography scan is €122.

We conducted an economic-themed prospective study, which took place from January 1 to July 31, 2014, in which we aimed to describe and analyze the direct cost of medical care of a TBI. According to the formula of Schwartz, the size of the sample was estimated to 207 patients. We included in the study all patients older than 15 years of age admitted to the emergency department of the CNHU for a TBI. The patient or parents involved in the filling out of the questionnaire were aware of the study and provided their consent. Thirty-five patients or related parents refused to participate in the study. The data were collected via a standardized questionnaire. The dependent variable was the global direct cost of care. The independent variable was the type of accident, the severity of the TBI, the structure of care, length of stay in the resuscitation unit, and the length of hospitalization.

The data collection technique adopted was the bottom-up approach, which consists of an individual approach on each patient's expenditure via the use of a questionnaire, where all expenses were identified systematically. The cost assessment was done in societal terms. The cost assessment was done during the patient's hospitalization period.

All collected data were computerized and analyzed by Epi Info software, version 6.04d (Centers for Disease Control and Prevention, Atlanta, Georgia, USA) and SPSS, version 20 (IBM Inc., Armonk, New York, USA). The quantitative variables are expressed as mean average and standard deviation; qualitative data and percentage are indicated by a 95th percentile confidence interval. The comparison of qualitative variables was made with the χ^2 test (or the exact Fischer test as appropriate) and the comparison of averages by the Student t test, Mann-Whitney U and Wilcoxon, or analysis of variance, as appropriate. For multivariate analysis, multiple linear regression was used by conducting successive iterations, step by step type, and simultaneously introducing all variables significantly associated to the cost. The odds ratio was calculated with standard deviation. They were considered valid when the standard deviation did not contain 1. A P value less than 0.05 is considered likely statistically significant.

RESULTS

During the study period, 840 trauma patients older than 15 years of age were admitted to the emergency department of CNHU-HKM, of whom 297 had a TBI. There were 258 men (86.9%) and 39 women (13.1%), for a sex ratio of 6.61. The mean age of the patients was 34.3 ± 12.39 years and ranged from 15 to 80 years. The majority of patients (88.9%) did not have insurance, 5.4% had insurance, and 5.7% did not answer this question. The majority of patients (26.6%) were unemployed, craftsman (23.2%) or commercial workers (18.2%), pupils or students (12.1%), civil servants (10.4%), and "taxicab-motorcycle" drivers (9.4%); 46.2% of patients were unschooled or had a primary level education.

Traffic accidents were the main cause identified among 256 patients (86.2%), followed by assaults (6.7%), workplace injury (4.4%), and domestic accidents (1%). In 1.7% of the cases, the reasons were not determined. Among the 256 victims of traffic accidents, 177 (69.1%) were motorcycle drivers, 20 (7.8%) were passengers on a motorcycle, 46 (18%) were pedestrians, 9 (3.5%) were drivers of cars, and 4 (1.6%) were passengers sitting in the rear of these cars. Among the 197 patients on motorcycle, 5 (2.5%) wore a protective helmet. The majority of the accidents occurred at night, with a peak incidence between 6 PM and 9 PM (**Figure 1**).

Patient's transportation to the first center was assumed by firemen in 66.7% of the cases, by motorcycle drivers in 13.1% of the cases, by private vehicles in 9.8% of the cases, by taxi drivers in 2.4% of the cases, by ambulances in 1.3% of the cases, and by paramedics in 0.3% of the cases. In 6.4% of the cases, this information had not been collected. The CNHU-HKM was the first place of arrival in 70% of the cases, peripheral hospitals in 20.2% of the cases, medical restrooms in 5.1% of the cases, and herbalist

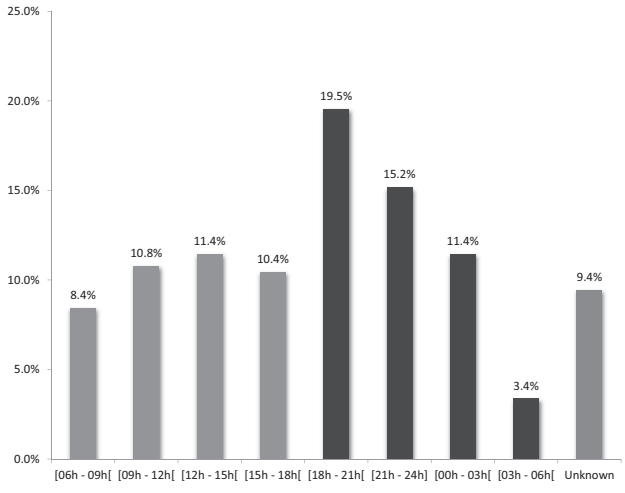

Figure 1. Distribution of patients according to the accident's time of occurrence.