

## Epidemiology of Traumatic Brain Injury in Oltenia Region: a Retrospective Study

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**ABSTRACT:** Traumatic brain injury (TBI) represents a common cause of presentation in the emergency room and is considered a major health problem all over the world. Our study objective was to provide a regional perspective from a county hospital regarding epidemiologic aspect of TBI in a single year and to compare it with existing studies. 592 patients fulfilled the inclusions criteria and their characteristics were noted. We observed that the highest rate of TBI was among older people with an age over >60 years with 40.88%, which represented 242 of cases. Middle age adults (40 to 60 years) represented 34.29% whereas young adults were 16.72%. The remaining cases of 8.11% suffered mostly of concussions (80%) and were encountered in the <20 years group. While comparing with the local population of the Dolj County we obtained an incidence of 89.6 per 100.000 people. When discussing gender, we observed that most of the patients were male with a ratio of 2,3:1. Over one year, 132 deaths were cause of TBI, with most of them being related to older age 55.71%, followed by the middle age adults with 37.93%. Direct cost was also assessed with 894.110.523 which represents more than 200.000 euro. Medium cost per patient was 6.296.552 RON, 1414 euro, with most of the patients having a medium admission of 10 days. TBI represents a major problem and perhaps a better assessment and a national program will help enhance the treatment quality and might also help reduce the cost.

**KEY WORDS:** traumatic brain injury, epidemiology, retrospective

### Introduction

Traumatic brain injury (TBI) is an important medical and public health issue worldwide [1]. As a common cause of presentation in the emergency room, it represents a frequent cause of mortality and morbidity in young people, especially in developed countries. While most of the cases are considered mild TBI, patients may have long-term disabilities which surely affects their life [2,3].

European studies have shown that more than 1,6 million people are annually admitted with TBI and 66.000 are declared deceased. The World Health Organization (WHO) has emphasized the fact that 11,5 millions of European citizens have survived a TBI and have long term disabilities, or even cognitive and emotional repercussions. As an important cause of invalidity, immediate response is necessary, and patients who survive require long term supervision and rehabilitation in specific monitoring center with medical personal [4,5].

TBI can result in various disabilities, cognitive problems and psychiatric disorders, depending on the location of the injury and premorbid patient conditions. Thus, a rapid assessment and longtime monitoring clearly will imply high costs. For example, a multicenter

European study has revealed that 798 billion euros have been used to treat head trauma with a median of 5.550 euro/patient, of which 37% were direct medical costs, 23% were non-medical contributions and 40% indirect cost. Indirect costs still represent most of the expanses for these patients especially for invalidity pensions as well as recovery treatments from physiotherapy centers [6-8].

The economic factor is substantial with TBI having a high impact on health when compared to other type of injuries. Thus, assessing patients cost is required to minimize lost productivity and provide a more substantial rehabilitation for patients with TBI [9].

Our study objective is to provide a regional perspective from a county hospital regarding epidemiologic aspect of TBI in a single year and to compare it with existing studies.

### Materials and Method

This is a retrospective study, on a one year period from 1st of January 2016 to 31st of December 2016, which included the documents of the patients who were hospitalized in Emergency County Hospital of Craiova, either through emergency admission or transfer from another smaller hospital. A twelve hour

evaluation was included, as well as discharge papers, budget considerations on each patient with TBI.

The major criteria of inclusion was the TBI definition according to the Center for Disease Control and Prevention (CDC) which suggest that every head or brain trauma along with neurological or neuropsychiatric disorders, skull fracture, intracranial lesions or even death should be considered. A search within the Hospital's medical data base included key words and codes according to the 10th International

Statistical Classification of Diseases and Related Health Problems (ICD-10). Also parameters regarding age, sex, urban or rural environment, surgical intervention, hospitalization days as well as number of deaths were included. Total annual and individual costs were noted. Treatment, critical care therapies and stationary rehabilitation expenses were also included.

Patients which were eventually transferred to other hospitals or which refused to be admitted were not included. Also, we only considered the first admission for each patient.

**Table 1. The 10th International Statistical Classification of Diseases and Related Health Problems (ICD-10) for TBI**

Fracture of the skull	Intracranial injury excluding those with skull fracture
S02.0 Skull	S06.0 Concussion
S02.1 Base of skull	S06.2 Diffuse brain injury
S02.9 Skull and facial bones	S06.4-Epidural Hemorrhage
S02.7 Multiple fractures involving skull and facial bones	S06.5-Traumatic subdural hemorrhage
S02.89 Fractures of other unspecified skull and facial bones	S06.6-Traumatic subarachnoid hemorrhage
	S06.8-Other intracranial injuries
	S06.1-Traumatic cerebral edema
	S06.3-Focal brain injury
	S06.9-Intracranial injury unspecified
	S09.7-Multiple injuries of head
	S09.8-Other unspecified injuries of head
	S09.9-Unspecified injury of head

## Results

592 patients fulfilled the inclusions criteria and their characteristics were noted. We observed that the highest rate of TBI was among older people with an age over >60 years with 40.88%, which represented 242 of cases. Middle age adults (40 to 60 years) represented 34.29% whereas young adults were 16.72%.

The remaining cases of 8.11% suffered mostly of concussions (80%) and were encountered in the <20 years group. While comparing with the local population of the Dolj County we obtained an incidence of 89.6 at 100.000 people.

When discussing gender, we observed that most of the patients were male with a ratio of 2,3:1, thus 415 patients (70.10%) were males and 29.90% were females. Regarding the provenience, most of the patients, 67.74% (401) came from the country side which suggested the fact that lifestyle and education level might be an important factor that may influence TBI, as aggressions, domestic violence, animal attacks occur more frequently.

Over one year, 132 deaths were cause of TBI, with most of them being related to older age 55.71%, followed by the middle age adults with 37.93%.

Direct cost was also assessed with 894.110.523 which represents more than 200.000 euro. Medium cost per patient was 6.296,552 RON (1414 euro), with most of the patients having a medium admission of 10 days.

The costs were definitely higher in patients who had surgery with general anesthesia and surveillance afterwards within intensive care (30%) as those who had indication for CT-scans or MRI.

**Table 2. Patient's characteristics with TBI**

Age	0-20	20-40	40-60	>60
	48	96	212	236
<b>Male</b>	32	63	147	164
<b>Female</b>	16	33	65	72
<b>Rural</b>	38	62	170	131
<b>Urban</b>	10	34	42	105
<b>Deceased</b>	5	21	37	69

## Discussions

According to the WHO, till 2020, TBI will become the third cause of invalidity and mortality worldwide. Besides these aspect it also provides long term disabilities or side effects such as confusion, depression, memory problems, which will involve additional costs per patient over the years. Moreover, imaging explorations should be indicated on the follow up which will enhance the cost even more [7,10].

Our Country lacks in similar studies regarding incidence, risk factors, financial costs as well as other factors that may influence the social impact of TBI. This retrospective study offers a perspective from a regional area of Romania regarding TBI from different points of view and tries to provide a new incentive and awareness for the Oltenia County.

We focused on studying epidemiological parameters that might help assess TBI risk factors and improve costs. While in countries with a high income, most of the TBI occur in motor vehicle's occupants, in medium budget countries and third world countries, TBI are related to vulnerable pedestrians, cyclists and nonetheless country side people. The last class of patients is generally related to the social conditions, with no safety in daily conditions as well as the interhuman factor after alcohol abuse. Sex gender ratio was 2.3:1 women/men which is rather similar to the European ratio from ulticenter studies. Also other countries have reported similar results, such as Austria 2.57:1, Sweden 2.1:1, Italy 1.55:1, France 3.1 and Germany 2.45:1. However, this might not be an entirely good option to compare with some of the countries as the trauma care system has different funding and therefore may lead to conflicting results. The male prevalence might be explained through several factors starting from working spaces either on construction sites with no protection measures, unsafe vehicles and homes, vehicle collision, physical quarrel or even domestic violence induced by alcohol or other substances. This emphasizes the fact that high risk classes should be instructed an also more things should be done to reduce road accidents and injuries in order to prevent some cases of TBI [11-13].

All available protocols and guidelines target to reduce injuries and deaths through various programs, from better understanding and prevention, to immediate health care providers and finally to general follow up and recovery. This implies all levels of support from the

country itself or various organizational programs and approaches from the European Union. Therefore, funding represents a major factor that might influence TBI appearance and evolution.

The financial criteria clearly differentiates TBI by country. Largest differences are encountered in western European countries with 2930 € in Germany, 3490 € in Spain and 3454 € in Sweden. Our study suggested that over a 10 day hospitalization period the median cost was 1414 € which is nearly half than the European average of 2700€. These differences are part of the way costs and parameters are taken into account by each medical system and also by the standard protocols and hospital clinical care and administrative approach. Consecutively another aspect that might suggest the low level of cost per patient in our study might also be due to the fact that most of the mild trauma do not present for investigations or people that have already suffered a TBI do not return for follow up examination [14,15].

## Conclusions

TBI represents a major problem and perhaps a better assessment and a national program will help enhance the treatment quality and might also help reduce the cost. Without a doubt a national survey on every region might be important to better understand how to prevent and treat such situations.

## Author contributions

A.L. Zorilă and R.Ş. Ţolescu performed the archive search and wrote the paper. M.V. Zorilă, R.E. Zăvoi and D. Cernea assessed the results and reviewed the text

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