ESTIMATION OF THE ECONOMIC IMPACT OF ROAD TRAFFIC INJURIES IN BELIZE

Final Report

AUGUST 2010

Pan American Health Organization
Regional Office of the World Health Organization

MINISTRY of HEALTH
equal health for all

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The study was researched and written by the Instituto Nacional de Salud Publica in Mexico, a WHO-PAHO Collaborating Center for Injuries and Violence research.

The financial and technical support for the completion of the study was provided by the Pan American Health Organization/World Health Organization, through its Country Office in Belize.

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Foreword

Road Traffic Incidents are a global public health problem. The extent of the problem in Belize is such that it places an enormous social and economic burden on our country

Every day it seems we hear news of yet another traffic incident. Every day our hospitals around the country see the injuries that result. Yet in Belize and the region, the risk factors, the underlying causes of these events, have received limited attention. Road traffic injuries represent a major challenge that requires concerted efforts for effective and sustainable prevention. But also, precisely because road traffic incidents are not in fact 'accidents' in the real sense of the word, there are opportunities for us to intervene to make our country a safer and healthier place to live.

Road traffic injuries have been among the leading causes of hospitalization and death in Belize for many years. Young adult males in Belize District are the most affected group. Human error and less than optimum road and vehicle conditions are frequent causes for these injuries and represent areas in which well structured interventions will lead to positive results.

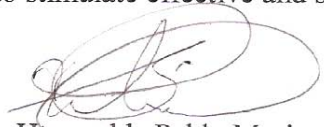
Children, pedestrians, cyclists and the elderly are among the most vulnerable of road users. The Ministry of Health must work with its partners to demonstrate that road traffic injuries are preventable and to promote safer practices.

Wearing of seat belts and use of safety helmets; not drinking and driving; not speeding; being visible in traffic; good lights, brakes and tyres – these are a few of the good practices which if adopted could quickly make our roads a safer place for all of us.

This study makes particular reference to the staggering economic burden caused by this important public health challenge. The extent of the social damage extends beyond our knowledge but is likely to be even more burdensome for our young nation.

Belize has lost too many young lives. I have seen too many of our families devastated. The Ministry of Health, working closely with the Pan American Health Organisation and our other partners has decided to highlight this public health issue so that as a nation, as Belizean brothers and sisters, we can all decide to take the necessary steps to make our roads safer and reduce the terrible impact of road traffic incidents in Belize. Our country needs a systematic approach to this problem and my Ministry is prepared to take a leading role in our national response.

The findings of this study provide even more compelling evidence for action. I am confident that our people and our nation have the discipline and the willingness to implement the changes that could undoubtedly save so many lives, so many Belizean families. I thank the authors and all those who have helped in this important research. It is my greatest wish that we will use the information to stimulate effective and sustained action.



Honorable Pablo Marin
Minister of Health

Foreword

This report represents a significant milestone in the prevention of road traffic injuries in Belize, a priority area for the Ministry of Health (MOH) and the technical cooperation program of the Pan American Health Organization/World Health Organization (PAHO/WHO).

Road traffic injuries (RTI) have long been identified as a major cause of death and disability in Belize, as in other countries in the Central American and Caribbean regions, and globally. Efforts were made to develop a National Road Safety Strategic Plan and establish a multisectoral National Road Safety Committee. Some of the adverse effects of RTI were always evident – the loss and disablement of loved ones; the negative impact on payments by the Social Security Board; and the statistical tables that ranked "Transport Accidents" 6th as a cause of death among all ages in 2006, 8th in 2007, and 5th in 2008.

However, perhaps because of a lack of documented evidence of the economic and financial burden of RTI, not only for the individuals involved and their families, but also for the society at large and the Government of Belize, the resources provided to the Road Safety Committee and the Road Safety Strategic Plan were not adequate for a sustained response to this multi-faceted challenge.

The First United Nations Global Road Safety Week in April 2007 was observed in Belize with PAHO/WHO's support. This resulted in strengthened resolve in the MOH and the Road Safety Committee to take action to prevent RTI and mitigate their negative effects, not only on those personally involved, but also on the health system. This study of the economic impact of RTI in Belize is one of the results of that strengthened resolve, and aims to present, in "hard" terms that national development agencies and international partners can appreciate, an idea of the true cost of these avoidable events.

PAHO/WHO is pleased to have supported the study, and looks forward to promoting, supporting, and participating in the multisectoral implementation of its recommendations.

D. Beverley Barnett
PAHO/WHO Representative
Belize

August 2010

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In addition, we acknowledge the time of those Medical Doctors that kindly answered the health provider survey in order to estimate ambulatory care. These specialists are: General Surgery: Dr. Jesús D. Ken; Neurosurgery: Dr. Joel Cervantes; Urology: Dr. Marcos Rugama; Rehabilitation: Dr. Barbara Pérez; Orthopedics and Traumatology: Dr. Hailu Hurrissa.

This study was developed and implemented by the National Institute of Public Health Mexico under the leadership of Dr. Martha Híjar Medina; MSc Ileana Heredia Pí and MSc Ricardo Pérez Núñez were in charge of data compilation, analysis and writing of the final report. Administrative support was provided by Rafael Hernández Ayala and Itzel Cuevas Castañeda.

Special thanks to the Pan American Health Organization/World Health Organization for the technical and financial support which led to the completion of the study.

Executive Summary

Background: Road traffic injuries (RTI) have an important negative impact at all levels. RTI cause a high number of sick leave days and produce an elevated amount of healthy life years lost. All this has serious consequences on Belizean society as a whole. With the high rate of road traffic injuries in Belize, there is a need to document the economic burden of RTI in the country. Such information will be of great value, as it will facilitate local planning and programming for injury prevention and the promotion of road safety.

Objective: To estimate the economic cost of road traffic injuries in Belize.

Methods: A cross-sectional study that estimated the cost of road traffic injuries in Belize during 2007 was conducted using secondary cost data and assuming the health system and social perspectives. Two major databases were analyzed: the mortality database, containing all deaths during 2001-2007, and the national hospital discharge database, containing all discharges during 2007. Additionally, a third database containing all emergency ambulance services provided by BERT to persons involved in RTI in the Belize District during 2007 was analyzed. A descriptive analysis was performed for all databases. Central tendency and dispersion measures were calculated for the continuous variable (mean, median, standard deviation, maximum and minimum value) as well as frequencies and percentages for the categorical variables.

Years of Potential Life Lost (YPLL) were estimated using the life expectancy of Belize for 2008 reported by PAHO (76.1). The difference between age at death and life expectancy was calculated for each injured, subsequently the total number of YPLL was estimated summing all individual YPLL. Indirect cost associated with premature death was estimated using the human capital approach, taking two different salaries as reference: the minimum wage for 2007 and the Belizean average income of 2007. Costing was done in 2007 Belize Dollars after adjusting by inflation using the Belize National Consumer Price Index. Costs accrued after one year or more were also discounted at an annual rate of 3% and 5%. Total estimation of RTI economic costs used a decision tree model approach. Multi-way sensitivity analysis was carried out in order to incorporate uncertainty in the estimations.

Results: A total of 63 (or 61 if adjusted) people died as a consequence of RTI during 2007 (a mortality rate of 20.72 deaths per 100,000 inhabitants), 338 were hospitalized and a total of 565 slightly injured was estimated. A total of 2,501 Years of Potential Life were Lost in Belize due to premature death. All this translated in a total economic cost of BZ$31,966,045 due to RTI during 2007. This figure represents 1.26% of Belizean GDP during 2007. The great majority of the cost is for fatal injuries, specifically on indirect cost attributed to premature death. Direct cost was estimated at BZ$491,549, of which 2.09% was spent on fatalities, 61.61% on severely injured and 36.30% on slightly injured.

Conclusions: These results make evident the great problem that RTI cause to the health system in Belize and to the society as a whole. The economic cost estimations make clear the need to prevent RTI utilizing a strategic and multisectoral approach that focuses on addressing the main problems identified.

I. Background

Over the past years there has been a significant increase in the number of traffic accidents on the major highways and roads in Belize. Between 2004 and 2006 the Police Department reported approximately 6,295 collisions. A total of 128 of the collisions were identified as fatal, and resulted in 143 deaths. Most of these deaths occurred in 2004, with a slight decrease in 2005 and 2006. An analysis of the data showed that between 2004 and 2006 70% of all accidents occurred in the Belize District, followed by the Orange Walk District with approximately 14%. Statistics from the National Health Information Surveillance Unit of the Ministry of Health indicate that in 2005, death as a result of road traffic injuries (RTI) was identified as the fourth leading cause of death in general, regardless of age and sex.

Road traffic injuries are identified as a significant contributor to the overall burden of diseases in the country. There are not enough data available currently to determine accurately the cost of RTI in the country. In order to understand the need for action, it is imperative that a comprehensive understanding of the cost of RTI is developed. There is an urgent need to calculate the economic cost of accidents in Belize, and to evaluate the consequences of accidents that can be avoided by undertaking road safety measures. This will serve to not only to identify the economic cost from a public health perspective, but the potential economic benefits from reducing RTI by developing and implementing appropriate interventions (with a multi-sector approach). In general, this study will aid decision-making, justifying the need for implementing a meaningful road traffic safety program.

Road traffic injuries can have significant negative impact on a country at all levels, as they cause a high number of sick days and an elevated amount of healthy life years lost. All this has serious consequences on society as a whole. In Mexico, for example, it has been documented that RTI are the second leading cause of orphaned children, which has implications in terms of poverty perpetuation in low and middle income countries such as Mexico.[1] Moreover, since RTI affect the young population in its most productive years, the economic cost in terms of medical treatment, rehabilitation, and loss of productivity tends to be high, having repercussions on society's economies.[1, 2]

Cost of illness studies translate the adverse effects of diseases or injuries into monetary terms, the language of decision and policy makers. Following Rice, these estimates could be used to: a) define the magnitude of the disease or injury in dollar terms; b) justify intervention programs; c) assist in the allocation of research dollars on specific diseases; d) provide the basis for policy and planning relative to prevention and control initiatives; and e) provide an economic framework for program evaluation.[3] As a consequence, there is an urgent need to document the economic burden that current RTI rates represent for Belize, providing information of great value in terms of injury prevention and safety promotion.

II. Objectives

General Objective

The main objective of this study is to estimate the economic cost of road traffic injuries in Belize during 2007.

Specific Objectives

1. To estimate the direct cost of RTI (fatal and non-fatal), from the perspective of the health system.

2. To estimate the indirect cost (loss of productivity) for both fatal and non-fatal RTI, adopting the social perspective.
3. To propose a methodological approach to monitor the national economic burden of RTI in Belize.

III. Methods

a) Study design

A cross-sectional study that estimated the cost of road traffic injuries in Belize during 2007 was conducted from the health system and social perspectives.

b) Operational definitions

For the purpose of this study, injury is defined as any "physical damage to a person caused by an acute transfer of energy (mechanical, thermal, electrical, chemical, or radiation energy) or by the sudden absence of heat or oxygen".[4] Severity of injuries is categorized in three mutually exclusive categories following previous proposals[5]:

- Fatal injury: an injury that causes the death of the injured person in the first 30 days[a] after the accident occurred.
- Non fatal severely injured: either a person remains in the hospital as an 'in patient', or if any one of the following injuries are sustained whether or not he or she is detained in hospital: fractures, concussions, internal injuries, crushing, severe cuts and lacerations, or severe general shock requiring medical treatment. This category would include deaths occurring after 30 days.
- Non fatal slightly injured: an injury of a minor character such as a cut, sprain or bruise.

Direct costs are usually defined as any resources consumed as a result of any injury or crash that might otherwise be used for increasing the societal wellbeing.[7] Direct costs are those generated by the resources used in treating or coping with any injury or crash, including expenditures for medical care and the treatment (hospital care, physician services, nursing home care, drugs and other medical needs). Given the availability of information, in this study direct costs only included the following categories by severity level:

- Fatal injuries: ambulance and pre-hospital care services and hospitalization.
- Severe injuries: ambulance and pre-hospital care services, hospitalization, post-discharge ambulatory medical consultations and rehabilitation.
- Slight injuries: ambulance and pre-hospital care services, emergency room (E.R.) hospital-based services, ambulatory medical consultations, and rehabilitation.

Indirect costs are defined as the societal productivity losses, which account for the individual's inability to perform his or her major activities, as a result of the injuries.[7] They include the societal costs of morbidity, disability, and premature mortality and represent the impact, present and future, of opportunities lost to the individual as a consequence of the injuries. Therefore, indirect costs estimated for this study included:

[a] Here we are using the 30-day definition of a road traffic fatality proposed by World Health Organization (WHO), although Belizean official definition includes all people dying the first year after the collision. WHO took this decision based on research which showed that most persons who die as a result of a collision succumb to their injuries within 30 days of sustaining them and that, while extension of this 30-day definition resulted in a marginal increase of the total figures, it required a disproportionately large increase in surveillance efforts (**6.***Global status report on road safety: time for action*. Geneva, Switzerland: World Health Organization; 2009.). In order to facilitate international comparisons it was of great interest to make this adjustment.

- Mortality costs: the present value of future earnings lost for those who died prematurely as a result of RTI.
- Morbidity costs: the value of productivity losses due to illness.
- Disability costs: costs of the transitory or permanent disability. For these estimations we used the value of disablement pensions awarded due to road traffic injuries

c) Study population

Study population was defined as all road traffic injured persons in Belize during 2007 according to ICD-10 criteria.[8] This included the following ICD-10 codes: V02-V04 (.1, .9), V09 (.2, .3, .9), V12-V14 (.3-.9), V19.4-V19.6, V20-V28 (.3-.9), V29-V79 (.4-.9), V80.3-V80.5, V81.1, V82.1, V83-V86 (.0-.3), V87.0-V87.8, V89.2, V89.9.

d) Information sources

Fundamental to developing cost of illness studies of specific diseases or injuries are the incidence and specific costs data. Estimates of the numbers and rates of injuries are presented in this study by severity level.

Epidemiological Data

Fatal injuries

To obtain the total number of people who died as a consequence of RTI, the mortality database containing all deaths during 2001-2007, was analyzed (see **table I**). In addition, administrative records from Belize Police Department were useful for the sensitivity analysis performed.

Years of Potential Life Lost (YPLL) were calculated by subtracting the 2008 life expectancy at birth of Belize reported by the Pan American Health Organization/World Health Organization (PAHO/WHO) (76.1)[9] from the age of the person, in accordance to the methodology proposed and used by PAHO/WHO.[10] Total number of YPLL was estimated summing all individual YPLL.

Serious injuries

The national hospital discharge database, containing all discharges during 2007, was used to estimate the total number of people hospitalized (assuming that all of them had serious injuries). For the sensitivity analysis, figures obtained from a literature review were used to simulate potential scenarios considering the possibility of hospital under-registration.

Mild injuries

Since specific information on the number of people attended in E.R. hospital-based services was not available, administrative records from Belize Police Department were used to estimate the number of people with mild injuries. In addition, for the sensitivity analysis, figures obtained from a literature review were used to simulate potential scenarios considering the possibility of hospital under-registration.

Table I. Available variables for analysis by database, Belize 2007

Database	Variables of interest
Mortality	sex, age, ethnicity, civil status, schooling, occupation, type of road user, place of death, district of residence and occurrence, hospital that registered the death, and date of occurrence
Discharge	sex, age ethnicity, civil status, schooling, occupation, type of road user, admittance, district of residence and occurrence, name of hospital and description of service, discharge condition and dates (of admittance and discharge)
Emergency Ambulance Services (BERT)	age, sex, type of service provided (if received medical attention at the scene and if it was transported), date of occurrence

Utilization of health services

Emergency Ambulance Services

A database containing all Emergency Ambulance Services provided by BERT[b] on RTI patients during 2007 was also analyzed. Although this information was only for Belize District, it allowed us to estimate the proportion of severely injured people that received ambulance and pre-hospital care services for the entire country.

Ambulatory health care services utilization

In order to estimate the post-discharge utilization figures a health provider survey was carried out. Experienced medical doctors of different specialties[c] were consulted and asked to fill in the proportion of RTI patients that would be hospitalized based ICD-10 diagnosis.[d] In addition, they were asked to estimate the proportion of patients that would potentially use ambulatory health services[e] (and the number of medical consultations) for both hospitalized and non-hospitalized patients. The questionnaire employed for this purpose is presented in **annex a,** which was adapted to specific medical conditions for each medical specialty. Other frequently used ICD-10 codes of injuries in hospitalized are presented in **annex b**.

In cases where specialists did not fill out the questionnaire to provide missing information, those figures (both proportion that use and number of consultations) were assumed to be those of a similar injury (from an anatomical and severity perspective). In cases when this was not possible, the median of the number of ambulatory medical consultations (and/or rehabilitation) of all the other injuries was imputed. [f] This survey also allowed us to estimate utilization figures of those severely injured non-hospitalized and those slightly injured non-E.R. users.

Cost Data

The complexity in determining the costs and resources used in patients with RTI or national health services expenditure figures (aggregated) for Belize was the greatest challenge faced due

[b] Belize Emergency Response Team, located in Belize District.
[c] Specific medical specialties were: General Surgery, Maxilo-Facial Surgery, Neurosurgery, Ophthalmology, Urology, Orthopedics & Traumatology and Rehabilitation.
[d] These ICD-10 diagnoses were taken from the hospital discharge database.
[e] Ambulatory services include rehabilitation.
[f] The total number of rehabilitation consultations estimated for each patient was included in the total number of ambulatory medical consultations.

to the unavailability of specific data. However, in order to obtain a cost approximation, an estimate of the annual cost of RTI treatment and its complications (death) for patients with RTI was performed.

Ambulance and pre-hospital care services costs

Estimations for ambulance and pre-hospital care services used secondary data provided by BERT. Using a Top-Down approach the total expenditure figures[g] of this institution was prorated by all services provided in order to estimate an approximate "cost per-run". This cost was assumed for each district, although BERT's services are only provided in Belize District.

Hospitalization, E.R. hospital-based services and ambulatory medical care costs

Secondary data were used to estimate direct costs of hospitalization, E.R. services and ambulatory medical care services. As part of an effort to ensure that the available resources are used equitably and efficiently, the World Health Organization has assembled regional databases on the costs, impact on population health, and cost-effectiveness of key health interventions, called WHO-CHOICE (*CHO*osing *I*nterventions that are *C*ost *E*ffective). This effort started in 1998 with the development of standard tools and methods which have been used to generate regional databases.[h] More information on specific econometric techniques employed to estimate country specific costs could be consulted elsewhere.[11]

This information presents the estimated cost per hospital stay and per outpatient visit by hospital level (see **table II**). Unit costs are specific to public hospitals, with occupancy rate of 80% and representing the "hotel" component of hospital costs, i.e. excluding drugs and diagnostic tests, and including other costs such as personnel, capital, and food costs. Additionally, estimations of health centre costs are available. They present cost per visit for primary care facilities, i.e. health centers, at different levels of population coverage, and include all cost components, including depreciated capital items, but exclude drugs and diagnostics.[11]

Table II. Costs estimated by WHO-CHOICE for 2005 (and conversion to 2007)[11]

HOSPITAL COSTS

Cost per bed day by hospital level*

	Int $ 2005	LCU 2005	LCU 2007†
Primary	51.99	54.59	58.24
Secondary	67.83	71.22	75.98
Tertiary	92.64	97.28	103.78

Cost per outpatient visit by hospital level*

	Int $ 2005	LCU 2005	LCU 2007
Primary	17.36	18.23	19.45
Secondary	24.63	25.86	27.59
Tertiary	36.43	38.26	40.82

HEALTH CENTRE COSTS

Cost per visit at health centre by population coverage for a 20 minute visit**

	Int $ 2005	LCU 2005	LCU 2007
50%	27.59	28.97	30.91
80%	28.62	30.05	32.06
95%	36.15	37.96	40.50

Int $: International Dollars; LCU: Local Currency Units

* public facility, 80% occupancy rate, excludes drugs and diagnostics

** public facility, at different population coverage, excludes drugs and diagnostics

Source: http://www.who.int/choice/country/blz/cost/en/index.html

† Local currency was converted to 2007 Belizean Dollars, using the National Consumer Price Indices (February 1991 - February 2009)

[g] Total figures correspond to the sum of the following cost categories: salaries, fuel, maintenance, utilities, medical supplies, insurance, and equipment. Medical supplies are subsidized by Belize Ministry of Health. In the same way maintenance is subsidized by Cisco Construction- Free labor.

[h] Belizean cost figures are available at: http://www.who.int/choice/country/blz/cost/en/print.html

WHO estimates are presented in international dollars and local currency units of 2005. However, all costs in this study are presented in 2007 Belizean Dollars and adjusted for inflation by means of the National Consumer Price Index.[i] Costs accrued after one year or more were discounted at the annual rate of 3% and 5%.

Other relevant information

Information about the population figures was obtained from the World Bank online database (http://ddp-ext.worldbank.org). Data on life expectancy for 2008 was obtained from PAHO.[9]

The Belize Social Security Board (SSB) provided information on the average income of Belizeans. Data from this institution provided the total number of work days lost as a result of RTI, as well as information useful to estimate post-discharge working days lost. Finally, the SSB also provided critical data on the number of disablement pensions awarded due to RTI by degree of incapacity.

e) Determining direct costs of RTI

Information from the questionnaire filled out by medical specialists showed the types of services utilized by RTI patients. This information is presented in **table III**. The table also shows mean, median, and mode of hospital stay, obtained from the hospital discharge database. By multiplying the mean figures of utilization per unitary cost, direct costs were estimated for Belize.

In this sense, all E.R. medical consultations, specialized medical consultations and rehabilitation were assumed to be tertiary outpatient visits to hospital services (BZ$ 40.82, see **table II**). In the same way, given the fact that more than 63% of the hospital discharges received attention at the Karl Heusner Memorial Hospital (KHMH) and since hospital costs do not consider drugs and diagnostic tests, we decided to use the cost per bed-day of a tertiary hospital level (BZ$103.78, see **table II**). Finally, hospital stay among those who died was assumed to be the same as those who survived. Other assumptions and decisions are presented in **annexes c and d**.

Table III. Utilization of health care services by RTI patients

	Hospitalized			Non-Hospitalized	
	Hospital stay (days)	Ambulatory medical consultations	Rehabilitation (consultations)	Ambulatory medical consultations	Rehabilitation (consultations)
Mean	5	4.87	19.71	4.63	2.11
Median	2	3	2	3	2
Mode	1	2	0	2	2

f) Determining indirect costs of RTI

As mentioned, indirect costs included loss of productivity due to disease and death. Cost estimation was performed using the human capital approach, in which the productivity cost was

[i] Belize National Consumer Prices Index is available at: http://www.cso.gov.bz/dms20uc/dynamicdata/docs/20090409130517_2.pdf

estimated as the future reduction in gross income due to mortality and/or morbidity. This approach estimates the potential productivity loss due to the reduction of remunerated time.

Two methods were used for estimating indirect cost, although only Method II was used for the final estimations figures:

- Method I: Using minimum wage for 2007 (BZD$3 per hour, BZ$24 per day, BZD$45 hours per week).
- Method II: Using the Belizean average income of 2007, documented by the Belize Social Security Board (SSB).

As a result, indirect costs estimation due to premature death takes as reference the Belizean life expectancy of 2008 documented by PAHO (76.1 years)[9] and were calculated as follows:

$$\text{Indirect cost of fatal RTI} = \textit{Loss of output (death)} = \sum_{0}^{n} \frac{S}{(1+r)^n} \qquad (1)$$

where: S= salary
r = discount rate
n = number of Years of Potential Life Lost due to premature death

For morbidity figures, indirect costs included the post-discharge average time injured people spent at home recovering from their injuries (72 days). This information was provided by Belize Social Security Board.

g) Estimation of total RTI economic costs

Total estimation of RTI economic costs used a decision tree model approach as presented in **figure I**. The decision tree allows us to disaggregate patients by fatal and non fatal injuries. The latter is also disaggregated in severely injured and slightly injured. In addition the decision tree follows the natural history of disease, starting with the pre-hospital medical attention at scene, continuing with the hospital-based care (hospitalization versus E.R. only), then the utilization of ambulatory health services and finally disaggregating ambulatory services into rehabilitation services. Each tree branch has a probability of occurrence and a specific cost associated. In this way, total cost per tree branch corresponds to the multiplication of unitary cost per total number of injured estimated for that specific branch. In **annexes c and d** all these assumptions are presented in more detail.

The individual total cost of RTI for this study was thus obtained after adding direct costs to indirect costs of those hospitalized and those who only received emergency care, as shown in the equation below:

$$\sum_{i}^{n} TC_{ikw} = \sum_{i=1}^{n} DC_{ikw} + \sum_{i=1}^{n} IC_{ikw} \qquad (2)$$

Where:

TCikw = Total economic cost of individual *i*, kind of care received *k*, and severity of injury *w*
DCikw = Direct individual cost *i*, kind of care received *k*, and severity of injury *w*
ICikw = Individual indirect cost *i*, kind of care received *k*, and severity of injury *w*
k = Type of care received (emergency care, hospitalization, ambulatory medical consultations and rehabilitation)
w = Severity of injury (fatal, severe, slight)

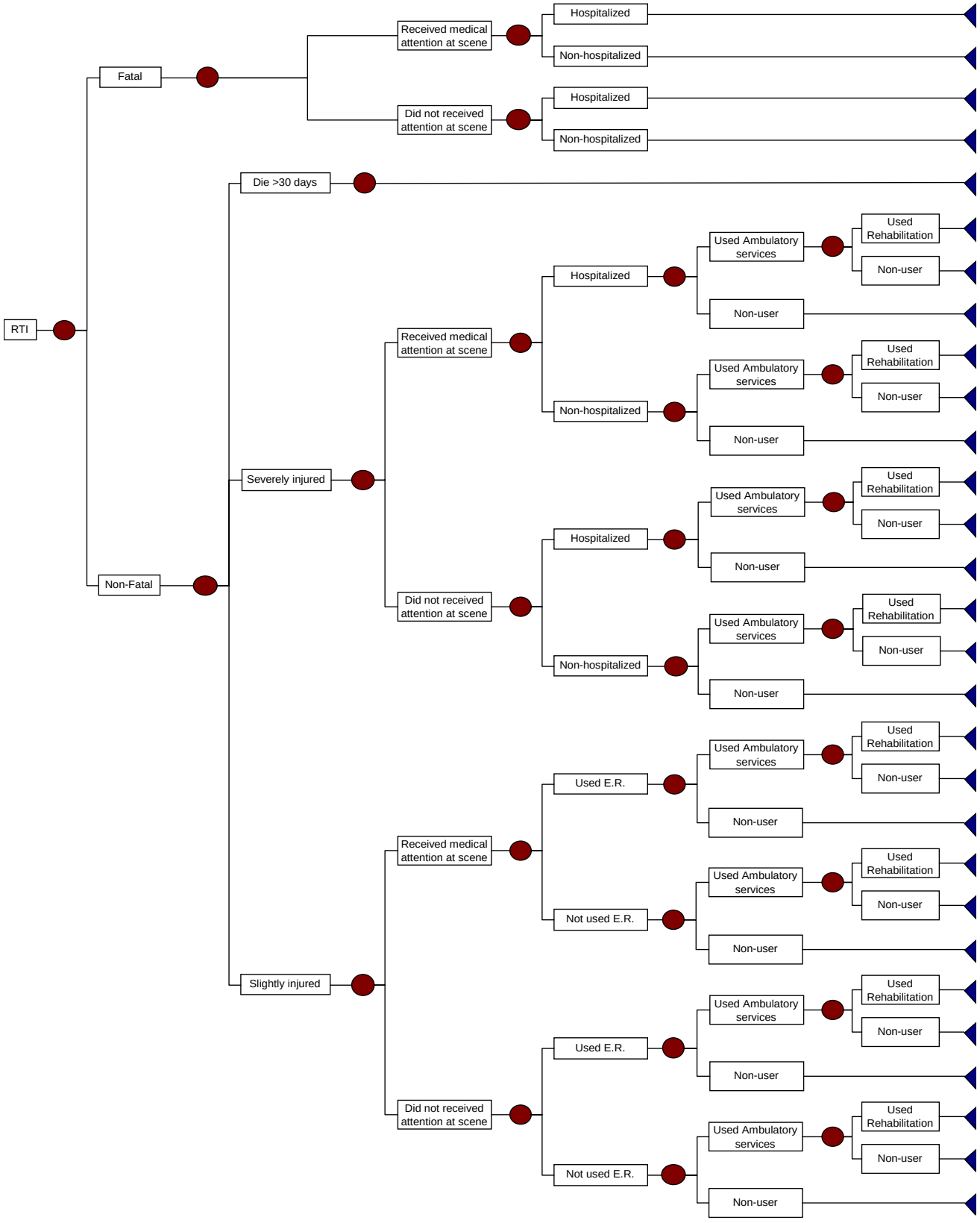
The economic cost of RTI in Belize was estimated in the following manner:

$$TC\,(Belize) = \left(AEC_d * \sum_{i=1}^{n} D \right) + \left(AEC_s * \sum_{i=1}^{n} S \right) + \left(AEC_{sl} * \sum_{i=1}^{n} SL \right) \quad (3)$$

Where:

TC = Total Economic Cost of RTI
AECd = Average economic cost per RTI death *f*
AECs = Average economic cost of severely injured
AECsl = Average economic cost of slightly injured *sl*
D = total number of RTI deaths registered in 2007
S = estimation of the total number of severely injured
SL = estimation of the total number of slightly injured estimated

Figure I. Decision tree to model the economic cost of Road Traffic Injuries in Belize, 2007



h) Analysis

A descriptive analysis was performed for all databases. Central tendency and dispersion measures were calculated for the continuous variable (mean, median, standard deviation, maximum and minimum values) as well as frequencies and percentages for the categorical variables using STATA 9.2.[12] To evaluate mortality rate trend we performed a Poisson regression model using Bootstrap standard errors.

i) Sensitivity Analysis

Uncertainty around some of the model's assumptions was explored using a multi-way sensitivity analysis. The analysis was performed for variables such as: prevalence and incidence figures (death-hospitalized-attended at E.R.) and for discounted rates (0%, 3% and 5%). This part of the analysis was carried out with software @risk 5.5.[13] In **annexes c and d** the specific values used for different assumptions are presented in more detail.

IV. Results

a) Epidemiology of road traffic injuries in Belize

Mortality

During 2007 a total number of 63 people died as a consequence of RTI, most of whom were men (79.4%) as shown in **table IV**. This figure is equivalent to a total of 61 people if adjusted by WHO's 30-day definition.[j] Mean age was 37 (median=33) and almost 90% of all injured were between 15 and 74 years of age. It was not possible to determine the type of road user most affected, since most of deaths were coded as "Other & Unspecified" (see **annex e**). Greater coding efforts should be made in the future in order to appreciate the actual situation in Belize, since most of the prevention strategies are different for different road users.

Most of deaths took place in Belize District (76.2%) and 50.8% of all deaths occurred in a hospital. This contrasts with the discharge database that shows that only 4 individuals died during hospitalization in the same year. This could be due to two reasons; (1) patients could have died in emergency room services and thus would not be coded as hospital discharges, (2) or patients are under-registered in the database for hospital discharges. In both cases, an analysis of the actual situation should be carried out for clarification. **Table V** shows the socio-demographic variables of those who died as a result of RTI by sex. Statistically, only in occupation are men and women different. Fewer women are wage-earners than men; however, the type of occupation for women is unknown.

This translates in a mortality rate of 20.72 deaths per 100,000 inhabitants. **Graph I** shows an evident decrement in RTI mortality rate trends during 2001-2007. This was statistically significant when analyzed with a Poisson regression model: on average, the relative risk of dying as a consequence of RTI in Belize decreased in 7.1% each year (Confidence Interval at 95%: 3.4% - 11%, see **table VI**).

[j] Adjustment factor is 0.97. Total number of deaths multiplied by 0.97 equals the 61 deaths.

Table IV. Descriptive analysis of RTI deaths in Belize, 2007

	Variables	Descriptive statistics, RTI deaths						
		2001	2002	2003	2004	2005	2006	2007
		% (N=86)	% (N=75)	% (N=74)	% (N=58)	% (N=72)	% (N=66)	% (N=63)
Individual Characteristics	**Sex**							
	Women	18.6%	21.3%	18.9%	24.1%	26.4%	24.2%	20.6%
	Men	81.4%	78.7%	81.1%	75.9%	73.6%	75.8%	79.4%
	Age groups							
	0 - 14 years	10.5%	13.3%	5.4%	22.4%	13.9%	13.6%	6.3%
	15 - 29 years	29.1%	26.7%	40.5%	37.9%	36.1%	30.3%	33.3%
	30 - 44 years	24.4%	37.3%	27.0%	19.0%	22.2%	27.3%	27.0%
	45 - 59 years	14.0%	13.3%	14.9%	10.3%	15.3%	13.6%	20.6%
	60 - 74 years	17.4%	4.0%	10.8%	6.9%	9.7%	13.6%	9.5%
	75 or more years	4.7%	5.3%	1.4%	3.4%	2.8%	1.5%	3.2%
	Ethnicity							
	Creole	33.7%	38.7%	41.9%	32.8%	48.6%	31.8%	44.4%
	Garifuna	2.3%	0.0%	4.1%	3.4%	1.4%	6.1%	4.8%
	Mestizo	50.0%	45.3%	36.5%	44.8%	36.1%	53.0%	44.4%
	Other	14.0%	16.0%	17.6%	19.0%	13.9%	9.1%	6.3%
	Nationality							
	Foreigner	0.0%	2.7%	5.4%	3.4%	5.6%	1.5%	0.0%
	Belizean	83.7%	88.0%	93.2%	96.6%	86.1%	98.5%	100.0%
	Civil Status							
	Common Law	10.5%	10.7%	12.2%	12.1%	6.9%	13.6%	11.1%
	Divorced	0.0%	0.0%	2.7%	0.0%	0.0%	0.0%	0.0%
	Married	19.8%	26.7%	28.4%	15.5%	23.6%	31.8%	19.0%
	Single	40.7%	38.7%	43.2%	60.3%	59.7%	54.5%	68.3%
	Unknown	24.4%	22.7%	13.5%	12.1%	8.3%	0.0%	0.0%
	Widowed	4.7%	1.3%	0.0%	0.0%	1.4%	0.0%	1.6%
	Schooling							
	None	23.3%	17.3%	10.8%	19.0%	31.9%	15.2%	4.8%
	Primary	7.0%	12.0%	20.3%	29.3%	38.9%	62.1%	68.3%
	Secondary	2.3%	0.0%	4.1%	10.3%	15.3%	12.1%	7.9%
	Tertiary	0.0%	2.7%	2.7%	0.0%	4.2%	6.1%	4.8%
	Unknown	67.4%	68.0%	62.2%	41.4%	9.7%	4.5%	14.3%
	Activity- Occupation							
	Wage-earner	51.2%	57.3%	51.4%	53.4%	36.1%	66.7%	65.1%
	Non remunerative activity	23.3%	12.0%	24.3%	15.5%	38.9%	10.6%	7.9%
	Unknown	25.6%	30.7%	24.3%	31.0%	25.0%	22.7%	27.0%
Death and Medical Attention information	**Place of death**							
	Hospital	36.0%	37.3%	43.2%	36.2%	38.9%	40.9%	50.8%
	Road-street	47.7%	34.7%	32.4%	53.4%	56.9%	54.5%	42.9%
	Home-Farm-Workplace	1.2%	4.0%	5.4%	0.0%	0.0%	3.0%	3.2%
	Route to Hospital	3.5%	0.0%	0.0%	0.0%	2.8%	1.5%	0.0%
	Unknown	11.6%	24.0%	18.9%	10.3%	1.4%	0.0%	3.2%
	District of residence							
	Belize	36.0%	32.0%	35.1%	36.2%	38.9%	21.2%	50.8%
	Cayo	27.9%	21.3%	29.7%	32.8%	18.1%	22.7%	12.7%
	Corozal	14.0%	16.0%	10.8%	8.6%	18.1%	21.2%	7.9%
	Orange Walk	12.8%	16.0%	5.4%	13.8%	16.7%	7.6%	12.7%
	Stann Creek	5.8%	10.7%	16.2%	6.9%	5.6%	22.7%	4.8%
	Toledo	3.5%	4.0%	2.7%	1.7%	2.8%	4.5%	11.1%
	District of death occurrance							
	Belize	55.8%	54.7%	59.5%	46.6%	63.9%	62.1%	76.2%
	Cayo	17.4%	18.7%	13.5%	25.9%	2.8%	1.5%	0.0%
	Corozal	9.3%	12.0%	9.5%	5.2%	13.9%	10.6%	4.8%
	Orange Walk	10.5%	8.0%	2.7%	13.8%	13.9%	6.1%	9.5%
	Stann Creek	4.7%	2.7%	12.2%	8.6%	4.2%	16.7%	3.2%
	Toledo	2.3%	4.0%	2.7%	0.0%	1.4%	3.0%	6.3%
	Hospital that registered death							
	Belmopan Hospital	10.5%	10.7%	6.8%	12.1%	0.0%	0.0%	0.0%
	Central Region – Belize District	55.8%	54.7%	59.5%	46.6%	63.9%	62.1%	76.2%
	Corozal Town Hospital	9.3%	12.0%	9.5%	5.2%	13.9%	10.6%	4.8%
	Orange Walk Hospital	10.5%	8.0%	2.7%	13.8%	13.9%	6.1%	9.5%
	Punta Gorda Hospital	2.3%	4.0%	2.7%	0.0%	1.4%	3.0%	6.3%
	San Ignacio Town Hospital	7.0%	8.0%	6.8%	13.8%	2.8%	1.5%	0.0%
	Southern Regional Hospital	4.7%	2.7%	12.2%	8.6%	4.2%	16.7%	3.2%

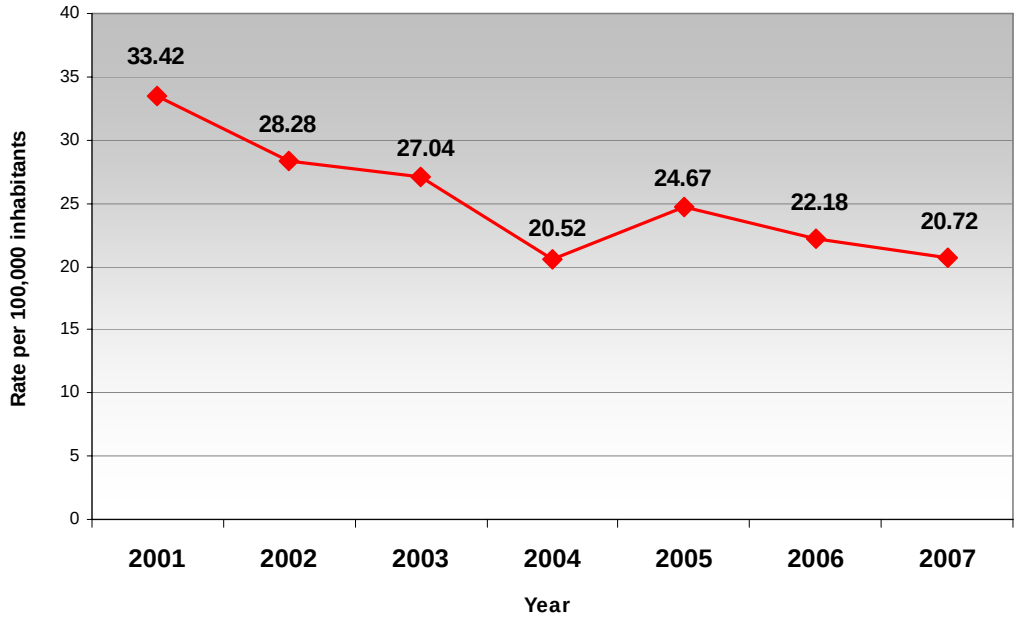
Continue…

Death and Medical Attention information	**Weekday**							
	Monday	15.1%	14.7%	16.2%	15.5%	4.2%	16.7%	14.3%
	Tuesday	7.0%	14.7%	6.8%	5.2%	8.3%	24.2%	12.7%
	Wednesday	12.8%	18.7%	17.6%	1.7%	9.7%	7.6%	6.3%
	Thursday	3.5%	10.7%	8.1%	13.8%	13.9%	7.6%	15.9%
	Friday	8.1%	9.3%	14.9%	13.8%	13.9%	19.7%	14.3%
	Saturday	24.4%	13.3%	17.6%	31.0%	27.8%	15.2%	23.8%
	Sunday	29.1%	18.7%	18.9%	19.0%	22.2%	9.1%	12.7%
	Month							
	January	12.8%	6.7%	18.9%	3.4%	6.9%	4.5%	4.8%
	February	9.3%	6.7%	10.8%	12.1%	9.7%	13.6%	6.3%
	March	7.0%	13.3%	9.5%	5.2%	8.3%	9.1%	7.9%
	April	3.5%	8.0%	5.4%	6.9%	6.9%	18.2%	3.2%
	May	8.1%	6.7%	8.1%	5.2%	9.7%	3.0%	17.5%
	June	7.0%	14.7%	12.2%	24.1%	8.3%	6.1%	1.6%
	July	12.8%	10.7%	6.8%	6.9%	9.7%	6.1%	3.2%
	August	9.3%	5.3%	8.1%	6.9%	13.9%	12.1%	3.2%
	September	4.7%	4.0%	6.8%	8.6%	8.3%	4.5%	12.7%
	October	4.7%	5.3%	2.7%	5.2%	8.3%	3.0%	14.3%
	November	11.6%	6.7%	4.1%	8.6%	2.8%	10.6%	14.3%
	December	9.3%	12.0%	6.8%	6.9%	6.9%	9.1%	11.1%

Table V. Socio-demographic variables of RTI deaths by sex, Belize 2007

Socio-demographic variables	Sex		P-value
	Women (%)	Men (%)	
Age groups			
0 - 14 years	15.38	4	
15 - 29 years	30.77	34	
30 - 44 years	15.38	30	**0.533**
45 - 59 years	23.08	20	
60 - 74 years	15.38	8	
75 or more years	0	4	
Ethnicity			
Creole	46.15	44	
Garifuna	7.69	4	**0.922**
Mestizo	38.46	46	
Other	7.69	6	
Nationality			
Foreigner	0	0	**- - -**
Belizean	100	100	
Civil Status			
Common Law	15.38	10	
Married	7.69	22	**0.156**
Single	69.23	68	
Widowed	7.69	0	
Schooling			
None	15.38	2	
Primary	61.54	70	
Secondary	0	10	**0.231**
Tertiary	7.69	4	
Unknown	15.38	14	
Activity - Occupation			
Wage-earner	7.69	80	
Non remunerative activity	76.92	14	**0.000**
Unknown	15.38	6	
Type of road user			
Occupant of heavy transport or bus	7.69	0	**0.048**
Other & Unspecified	92.31	100	

Graph I. Mortality rate trend in Belize, 2001-2007



Note: figures presented in this Graph are those reported without adjusting for WHO's 30-day definition

Table VI. Poisson regression model to evaluate mortality trend in Belize, 2001-2007 (bootstrap standard errors)

	Variable	IRR	SE	Z	P-value	Confident Interval 95%
5000 iterations	Year	0.9290	0.0186	-3.6800	0.0000	0.8932 - 0.9662
Poisson Goodness of fit test: X2=3.241706, P=0.6628 Pseudo R= 0.1887 Log likelihood= -22.934696						
7500 iterations	Year	0.9290	0.0180	-3.8100	0.0000	0.8944 - 0.9649
Poisson Goodness of fit test: X2=3.241706, P=0.6628 Pseudo R= 0.1887 Log likelihood= -22.934696						
10000 iterations	Year	0.9290	0.0189	-3.6200	0.0000	0.8927 0.9668
Poisson Goodness of fit test: X2=3.241706, P= 0.6628 Pseudo R= 0.1887 Log likelihood= -22.934696						

IRR: Incidence Rate Ratio; SE: Standard error

Note: figures presented in this Graph are those reported without adjusting for WHO's 30-day definition

Morbidity

Hospitalizations

During 2007, 338 hospital discharges as a result of RTI were recorded in all public hospitals in Belize. Of them, 74.85% were men, with a mean age of 29 years (Standard Deviation = 18, Median = 26). Less than 78% were between 15 – 74 years of age. As can be seen in **table VII**, most road users were also classified as "Other & unspecified" (see **annex e**). The great majority of hospital discharges were reported by KHMH, the only tertiary level hospital in Belize. Only 2.66% of all RTI hospitalized died during hospitalization (N=8).

Table VIII also shows the breakdown of socio-demographic variables by sex. Men and women are statistically different in three different variables: age, schooling, and occupation. Women hospitalized tend to be younger than men, especially in the group of age 0–14 years. In addition, more women had not attended school than men and finally, a lower proportion of women are wage earners and in a greater percentage of women, the occupation is unknown.

BERT reported a total of 47 severely injured people attended to only in Belize District (41.96% of the total number of hospitalized in Belize District the same year).

Mild injuries

No information was available on patients with mild injuries after a collision. Similarly, no information on emergency room hospital-based medical attention was available. Only BERT reported a total of 145 persons with mild injuries received attention in the Belize District (an estimated 77.54% of the total number of non-hospitalized mildly injured in Belize District the same year). Using this information a total of 565 mildly injured was estimated.

Table IX presents all emergency ambulance services provided by BERT in Belize District during 2007. A total of 222 ambulance services were solicited during 2007 although 24 of them did not require any service. From the rest, 73.2% were for mildly injured, 23.7% for severely injured and only in 3% the injured died. The great majority of people attended were men (71.7%) and 82.3% were between 15 – 74 years of age. Of all injured, 90.4% received treatment and were transferred to a medical institution.

Table VII. Descriptive analysis of all hospital discharges due to RTI, Belize 2007

	Variables		2007 Descriptive statistics % (N=338)
Individual Character-istics	Sex		
		Women	25.15%
		Men	74.85%
	Age groups		
		0 - 14 years	20.41%
		15 - 29 years	37.28%
		30 - 44 years	24.26%
		45 - 59 years	12.72%
		60 - 74 years	2.96%
		75 or more years	2.37%
	Ethnicity		
		Creole	78.11%
		Ketchi or Ketchi-Maya	1.78%
		Mestizo	15.98%
		Mopan Maya	1.78%
		Other	2.37%
	Nationality		
		Foreigner	0.59%
		Belizean	48.82%
		Unknown	50.59%
	Civil Status		
		Common Law	14.50%
		Divorced	0.00%
		Married	17.75%
		Single	58.88%
		Unknown	8.28%
		Widowed	0.59%
	Schooling		
		None	21.89%
		Primary	42.90%
		Secondary	15.68%
		Tertiary	3.55%
		Unknown	15.98%
	Activity - Occupation		
		Wage-earner	37.87%
		Non-remunerative activity	35.21%
		Unknown	26.92%
Medical Attention & Occurrence	Admittance		
		Emergency	83.14%
		Outpatient	16.86%

District		Residence	Discharge
	Belize	33.14%	63.61%
	Cayo	27.51%	15.68%
	Corozal	10.36%	3.55%
	Orange Walk	5.92%	6.80%
	Stann Creek	13.02%	4.14%
	Toledo	10.06%	6.21%

Hospital		RTI as % of total
	Belmopan Hospital	1.56%
	Corozal Town Hospital	1.10%
	KHMH CONSOLIDATION	2.47%
	Orange Walk Hospital	0.92%
	Punta Gorda Hospital	1.51%
	San Ignacio Town Hospital	1.02%
	Southern Regional Hospital	0.47%

Medical Attention & Occurrence	Description of Service	
	ACCIDENT & EMERGENCY	0.30%
	GENERAL MEDICINE	9.47%
	GYNAECOLOGY	0.30%
	IN-PATIENT SERVICES	18.93%
	PAEDIATRIC	12.43%
	SURGICAL SERVICES	52.37%
	Discharge condition	
	Alive	89.35%
	Dead	2.37%
	Self-Discharge	2.66%
	Transferred	5.33%

Weekday	Admission
Monday	11.83%
Tuesday	9.47%
Wednesday	10.06%
Thursday	17.16%
Friday	12.72%
Saturday	19.82%
Sunday	18.93%

Month	Admission
January	8.88%
February	7.40%
March	7.99%
April	7.99%
May	7.69%
June	7.10%
July	11.83%
August	6.51%
September	7.69%
October	7.69%
November	9.17%
December	10.06%

Table VIII. Socio-demographic variables by sex of hospital discharges for RTI Belize 2007

Socio-demographic variables	Sex		P-value
	Women (%)	Men (%)	
Age groups			
0 - 14 years	35.29	15.42	
15 - 29 years	32.94	38.74	
30 - 44 years	20	25.69	**0.005**
45 - 59 years	8.24	14.23	
60 - 74 years	1.18	3.56	
75 or more years	2.35	2.37	
Ethnicity			
Creole	77.65	78.26	
Ketchi or Ketchi-Maya	0	1.98	
Mestizo	18.82	15.02	**0.639**
Mopan Maya	1.18	1.98	
Other	2.35	2.77	
Nationality			
Foreigner	1.18	0.4	
Belizean	48.24	49.01	**0.717**
Unknown	50.59	50.59	
Civil Status			
Common Law	10.59	15.81	
Married	22.35	16.21	
Single	60	58.5	**0.485**
Unknown	7.06	8.7	
Widowed	0	0.79	
Schooling			
None	28.24	19.76	
Primary	40	43.87	
Secondary	14.12	16.21	**0.075**
Tertiary	7.06	2.37	
Unknown	10.59	17.79	
Activity - Occupation			
Wage-earner	17.65	44.66	
Non remunerative activity	25.88	27.27	**0.000**
Unknown	56.47	28.06	
Type of road user			
Cyclist	9.41	5.93	
Motorcyclist	2.35	1.19	**0.422**
Car occupant	0	1.19	
Other & Unspecified	88.24	91.7	

Table IX. Emergency ambulance services for RTI, Belize District 2007

Variables		Type of injury							
		Slightly		Serious		Fatal		Total	
		N	%	N	%	N	%	N	%
Sex	Women	41	28.3%	8	17.0%	0	0.0%	**49**	**24.7%**
	Men	102	70.3%	37	78.7%	3	50.0%	**142**	**71.7%**
	Missing values	2	1.4%	2	4.3%	3	50.0%	**7**	**3.5%**
Age	*Mean age*	*29.61*	- -	*28.439*	- -	- -	- -	- -	- -
	0 - 4 years	3	2.1%	0	0.0%	- -	- -	**3**	**1.6%**
	5 - 9 years	2	1.4%	3	6.4%	- -	- -	**5**	**2.6%**
	10 - 14 years	4	2.8%	3	6.4%	- -	- -	**7**	**3.6%**
	15 - 19 years	18	12.4%	5	10.6%	- -	- -	**23**	**12.0%**
	20 - 24 years	27	18.6%	7	14.9%	- -	- -	**34**	**17.7%**
	25 - 29 years	26	17.9%	7	14.9%	- -	- -	**33**	**17.2%**
	30 - 34 years	18	12.4%	4	8.5%	- -	- -	**22**	**11.5%**
	35 - 39 years	10	6.9%	5	10.6%	- -	- -	**15**	**7.8%**
	40 - 44 years	3	2.1%	3	6.4%	- -	- -	**6**	**3.1%**
	45 - 49 years	9	6.2%	1	2.1%	- -	- -	**10**	**5.2%**
	50 - 54 years	6	4.1%	1	2.1%	- -	- -	**7**	**3.6%**
	55 - 59 years	3	2.1%	0	0.0%	- -	- -	**3**	**1.6%**
	60 - 64 years	1	0.7%	1	2.1%	- -	- -	**2**	**1.0%**
	65 - 69 years	1	0.7%	0	0.0%	- -	- -	**1**	**0.5%**
	70 - 74 years	1	0.7%	1	2.1%	- -	- -	**2**	**1.0%**
	75 or more years	1	0.7%	0	0.0%	- -	- -	**1**	**0.5%**
	Missing values	12	8.3%	6	12.8%	- -	- -	**18**	**9.4%**
	0 - 14 years	9	6.2%	6	12.8%	- -	- -	**15**	**7.8%**
	15 - 24 years	45	31.0%	12	25.5%	- -	- -	**57**	**29.7%**
	25 - 49 years	66	45.5%	20	42.6%	- -	- -	**86**	**44.8%**
	50 - 74 years	12	8.3%	3	6.4%	- -	- -	**15**	**7.8%**
	75 or more years	1	0.7%	0	0.0%	- -	- -	**1**	**0.5%**
	Missing values	12	8.3%	6	12.8%	- -	- -	**18**	**9.4%**
Weekday	Monday	10	6.9%	3	6.4%	1	16.7%	**14**	**7.1%**
	Tuesday	8	5.5%	2	4.3%	1	16.7%	**11**	**5.6%**
	Wednesday	19	13.1%	5	10.6%	0	0.0%	**24**	**12.1%**
	Thursday	23	15.9%	6	12.8%	0	0.0%	**29**	**14.6%**
	Friday	20	13.8%	7	14.9%	2	33.3%	**29**	**14.6%**
	Saturday	32	22.1%	17	36.2%	2	33.3%	**51**	**25.8%**
	Sunday	33	22.8%	7	14.9%	0	0.0%	**40**	**20.2%**
Month	January	6	4.1%	4	8.5%	1	16.7%	**11**	**5.6%**
	February	13	9.0%	5	10.6%	2	33.3%	**20**	**10.1%**
	March	13	9.0%	1	2.1%	0	0.0%	**14**	**7.1%**
	April	7	4.8%	7	14.9%	0	0.0%	**14**	**7.1%**
	May	28	19.3%	8	17.0%	2	33.3%	**38**	**19.2%**
	June	7	4.8%	1	2.1%	0	0.0%	**8**	**4.0%**
	July	24	16.6%	5	10.6%	0	0.0%	**29**	**14.6%**
	August	10	6.9%	6	12.8%	0	0.0%	**16**	**8.1%**
	September	9	6.2%	2	4.3%	0	0.0%	**11**	**5.6%**
	October	9	6.2%	4	8.5%	0	0.0%	**13**	**6.6%**
	November	6	4.1%	1	2.1%	0	0.0%	**7**	**3.5%**
	December	13	9.0%	3	6.4%	1	16.7%	**17**	**8.6%**
Type of service provided	Treated on site only	8	5.5%	0	0.0%	0	0.0%	**8**	**4.0%**
	Treated & Transport	135	93.1%	44	93.6%	0	0.0%	**179**	**90.4%**
	Air transportation	1	0.7%	0	0.0%	0	0.0%	**1**	**0.5%**
	No treatment provided	1	0.7%	3	6.4%	6	100.0%	**10**	**5.1%**
	TOTAL	**145**	**73.2%**	**47**	**23.7%**	**6**	**3.0%**	**198**	**89%**

No service provided	24	**11%**
Grand Total	222	**100%**

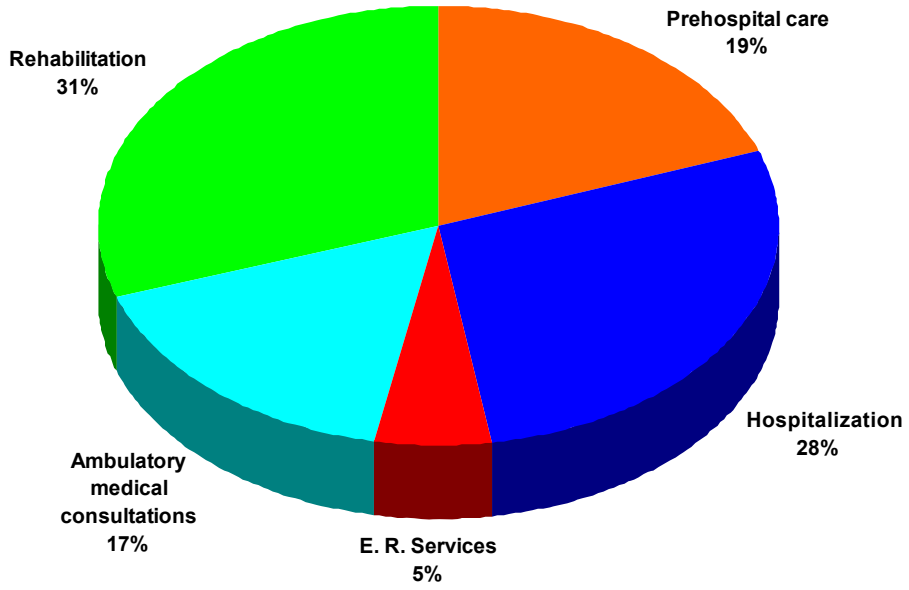
Source: BERT administrative records

b) Economic cost of road traffic injuries

Direct Cost

A total of BZ$491,549 was estimated for direct costs during 2007, of which 2.09% was spent on fatalities, 61.61% on severely injured and 36.30% on slightly injured. **Graph II** shows that most of the cost was estimated for rehabilitation (31%), while hospitalization required 28%, prehospital care 19% and ambulatory medical consultations 17%. From this graph, the potential underestimation of hospitalization costs is evident, due to the fact that drugs and diagnostics are not included in unitary cost estimations used for this analysis.

Graph II. Health System costs estimated for Belize, by type of service, 2007



Note: it is important to consider that cost of hospitalization does not include drugs and diagnostic tests, which could represent a great proportion of hospitalization costs in this kind of patient

Indirect Cost

A total of 2,501 Years of Potential Life were Lost in Belize during 2007 due to RTI. This translates in a social loss of BZ$28,812,671 attributed to indirect cost due to productivity loss (Method II, discount rate of 0%, see **table X**). In this sense, an average of BZ$457,344 is lost with each death. **Table XI** disaggregates indirect cost by District for both methods and considering different scenarios in terms of discount rates. Belize District is where more indirect cost is lost: 51.18% of the total or BZ$15,898,752.

Table X. Indirect costs associated with premature death in Belize during 2007 (in Belizean Dollars)

		N	Summ	Mean	S.D.	Mediana	Min.	Max.
Method I	Indirect cost due to premature death (D. rate 0%)	63	17,557,722	278,694	125,308	302,562	0	534,222
	Indirect cost due to premature death (D. rate 3%)	63	9,892,493	157,024	49,742	175,352	0	216,249
	Indirect cost due to premature death (D. rate 5%)	63	6,945,926	110,253	31,064	123,172	0	136,957
Method II	Indirect cost due to premature death (D. rate 0%)	63	28,812,671	457,344	205,634	496,512	0	876,672
	Indirect cost due to premature death (D. rate 3%)	63	16,233,833	257,680	81,628	287,758	0	354,870
	Indirect cost due to premature death (D. rate 5%)	63	12,097,741	192,028	52,312	213,593	0	236,213

N: number of observations; S.D.: standard deviation; D. rate: discount rate.

Indirect costs due to premature death take as reference the Belizean life expectancy of 2008 documented by PAHO.

Method I: Using minimum wage for 2007.

Method II: Using the Belizean average income of 2007.

Table IX. Deaths, Years of Potential Life Lost and indirect costs associated in Belize by District, 2007

		2007
Total number of deaths (district of residence)	**Belize (district)**	32
	Cayo	8
	Corozal	5
	Orange Walk	8
	Stann Creek	3
	Toledo	7
	BELIZE (COUNTRY)	63
Years of potential life lost* (district of residence)	**Belize (district)**	1,380
	Cayo	371
	Corozal	214
	Orange Walk	238
	Stann Creek	105
	Toledo	194
	BELIZE (COUNTRY)	2,501

		discount rate 0%	discount rate 3%	discount rate 5%
Indirect cost (minimum wage, district of residence)	**Belize (district)**	9,688,302	5,275,624	3,657,132
	Cayo	2,603,016	1,409,934	975,254
	Corozal	1,498,770	807,031	562,125
	Orange Walk	1,669,356	1,140,381	851,385
	Stann Creek	739,206	463,378	336,629
	Toledo	1,359,072	796,145	563,402
	BELIZE (COUNTRY)	17,557,722	9,892,493	6,945,926

		discount rate 0%	discount rate 3%	discount rate 5%
Indirect cost (average wage, district of residence)	**Belize (district)**	15,898,752	8,657,434	6,356,828
	Cayo	4,271,616	2,313,738	1,692,128
	Corozal	2,459,520	1,324,358	979,781
	Orange Walk	2,739,456	1,871,394	1,488,855
	Stann Creek	1,213,056	760,415	586,808
	Toledo	2,230,272	1,306,494	993,341
	BELIZE (COUNTRY)	28,812,671	16,233,833	12,097,741

* PAHO life expectancy of Belize for 2008 - Age at death in people less than life expectancy.

In addition, injured people hospitalized stayed an average of 5 days in the hospital. This represents an average of BZ$152 of indirect cost per RTI hospitalization and a total of BZ$50,912 lost for this cause (**table XII**).

Table XII. Indirect costs in RTI hospitalizations in Belize during 2007 (in Belize Dollars)

		N	Sum	Mean	S.D.	Median	Min.	Max.
Method I	Indirect Cost associated to time	336	38,184	114	194	48	24	2,112
Method II	Indirect Cost associated to time	336	50,912	152	259	64	32	2,816

N: number of observations; S.D.: standard deviation.

Indirect costs in Method I take as reference the Belizean minimum wage of BZ$3 per hour, BZ$24 per day. Individuals with less than 1 day of hospitalization are assumed as BZ$24. Method II uses the average Belizean wage reported by Social Security Board (BZ$960 per month, BZ$32 per day).

Total Economic Cost of RTI

Aggregated figures are presented in **table XIII**. As can be observed, the basal model estimated a total economic cost of BZ$31,966,045 due to RTI during 2007 (Method II, discount rate of 0%). The great majority of the cost is due to fatal injuries, specifically to indirect cost attributed to premature death. All economic cost estimated represents 1.26% of Belizean GDP during 2007, and 4.03% of total Governmental Budget for the same year (**table XIV**).

Table XIII. Economic impact of RTI in Belize during 2007 by severity level and cost type (in Belizean Dollars)

Severity		Direct Cost	Indirect Cost*	Total
Fatal		10,267	30,348,870	**30,359,137**
Non-Fatal	**Severe**	302,847	1,105,930	**1,408,777**
	Slight	178,435	19,696	**198,131**
Total		**491,549**	**31,474,496**	**31,966,045**

* Indirect costs with discount rate of 0% under the Basal Model assumptions.

Table XIV. Road traffic injuries costs as percentage of GDP and Governmental budget, 2007

	2007
GDP	2,534,000,000
GOB	793,314,354
MOH	86,426,216
MOH Budget as percentage of GOB Budget	10.89
MOH Budget as percentage of the GDP	3.41

	Discount rate		
	0%	3%	5%
Total Cost of RTI	31,966,045	19,209,088	14,676,865
Cost of RTI as percentaje of GDP	1.26%	0.76%	0.58%
Cost of RTI as percentaje of GOB Budget	4.03%	2.42%	1.85%
Cost of RTI as percentaje of MOH Budget	36.99%	22.23%	16.98%

Table XV shows the basal model results compared to the sensitivity analysis figures (simulation).

Table XV. Economic cost estimated for Belize, 2007

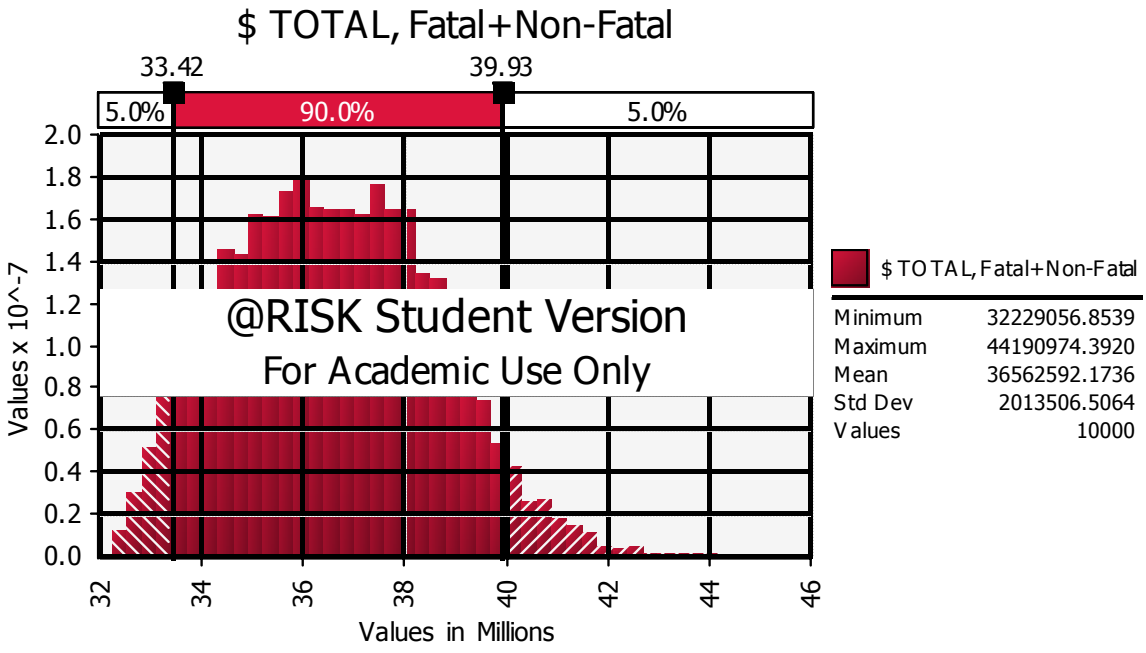
Concept			Total Cost						Total number of injured	
			Basal*			Average of Simulation* with:				
			Tasa 0%	Tasa 3%	Tasa 5%	Tasa 0%	Tasa 3%	Tasa 5%	Basal	Simulation
Fatal	Dead	Hospitalized	3,978,735	2,308,703	1,715,383	4,326,085	2,510,256	1,865,139	8	
		No Hospitalization	26,380,403	15,293,478	11,354,574	28,683,450	16,628,620	12,345,850	53	
		TOTAL	30,359,137	17,602,180	13,069,957	33,009,540	19,138,880	14,210,990	61	
Non-fatal		Die >30 days	7,941	7,941	7,941	8,634	8,634	8,634	2	
	Hospitalized	Hospitalization	1,314,206	1,314,206	1,314,206	2,049,484	2,049,484	2,049,484	338	528
		Ambulatory users	51,930	51,930	51,930	80,985	80,985	80,985	261	
		Rehabilitation users	170,891	170,891	170,891	266,502	266,502	266,502	212	
	E.R. users	ER Services	34,322	34,322	34,322	235,563	235,563	235,563	471	3,235
		Ambulatory users	44,790	44,790	44,790	307,409	307,409	307,409	237	
		Rehabilitation users	17,378	17,378	17,378	119,270	119,270	119,270	202	
		TOTAL (hospital + E.R.)	1,582,273	1,582,273	1,582,273	3,429,848	3,429,848	3,429,848	854	
		Non-Users of health services	- - -	- - -	- - -	- - -	- - -	- - -	83	
TOTAL	Fatal + Non-Fatal		31,966,045	19,209,088	14,676,865	36,562,590	22,691,930	17,764,040	997.772	4,523

Both models (basal and simulation) use the average income reported by Social Security Board to estimate indirect cost figures (BZ$960 per month).

*Simulation figures consist on the average of the 10,000 iterations for different distributions of uncertant parameters (carried out with @Risk software).

Graph III shows the distribution of total economic cost estimated in all 10,000 iterations of the simulating model. As can be seen, 90% of all estimations fell between BZ$33,419,373 and BZ$39,927,485.

Graph III. Sensitivity Analysis of Total RTI costs in Belize, 2007 (discount rate of 0%)



Finally it is important to consider that this economic cost estimation would be underestimated if we do not consider disablement as result of RTI. Information provided by the Social Security Board presented in **table XVI** shows that at least 2 persons were disabled in 2007 in a collision.

Table XVI. Disablement pensions awarded due to Road Traffic Injuries by degree of incapacity (Source: Social Security Board)

Year	Degree of incapacity										Total
	25-29%	30-39%	40-49%	50-59%	60-69%	70-79%	80-89%	90-99%	100% (a)	100% (b)	
2005	0	0	1	0	0	0	0	0	0	0	**1**
2006	0	0	2	0	0	3	0	0	0	0	**5**
2007	0	0	0	0	0	0	1	0	0	1	**2**
2008	0	1	0	0	0	0	0	0	1	1	**3**

(a) Normal cases of total permanent incapacity.

(b) Cases to which a special award was made because the Insured Person needs constant help of another person.

v. Conclusions

The usefulness of cost of illness studies for health systems is in justifying the design and implementation of specified intervention programs, and making evident the economic loss that the illness presents, with its specific and current mortality and morbidity rates. In the same way, these studies help the resource allocation process by contributing to determination of the importance of each illness from an economic perspective, and highlighting medical care and specific research needs. In addition, they provide a basis for the planning and establishment of political and public health initiatives for prevention and control, and an economic-referenced framework for the next evaluation of the programs and implemented interventions.[3]

Information generated in this study will allow District and National authorities of Belize to have valuable information for decision making. This also allows understanding the real magnitude of a problem that so far seems reflected only in causes of mortality and social security payments. Therefore, the economic assessment of a problem of this extent will allow visualization of the potential resource savings that can be applied to other social or health problems. In this sense, our results make evident the great problem that RTI cause to the health system in Belize and the society as a whole. From the results of the economic cost estimations, there is urgent need to prevent RTI through a strategic and multisectoral approach that focuses on the principal problems detected.

This study faced great methodological challenges due to the lack of specific information, such as costs and number of non-hospitalized injured people. Although secondary cost information used might underestimate the real problem, it gives a general idea of the magnitude of the problem, in economic terms. Future efforts should consider the use of primary data to evaluate to what extent these estimations change.

In the same way, problems in current information systems were evident. This was the case in the codification of external causes of death, as most of deaths and hospitalizations were coded as "Other & Unspecified". This coding problem did not allow the estimation of cost per type of road user nor the analysis of the medical attention characteristics of different road users. Greater coding efforts should be made in the future in order to better appreciate the type of problem Belize faces in terms of road safety. This would be invaluable information for policy making, since most of the prevention strategies are different depending on the type of road user that is most affected. In addition, no information was available on the number of E.R. hospital-based services provided, as well as the number of ambulatory services provided (including rehabilitation). In this sense it is important to consider that better information systems would translate in better estimations of the economic cost of this important public health problem.

The methodology used to estimate indirect costs could overestimate actual figures since it gives more weight to deaths that occurred at an early stage of life, according to some perspectives such as the Investment-Producer-Consumer model perspective. This conceptual framework originally proposed by Garder[14] argues that during the investment period (less than 18 years of age), the people only receive from society (negative value) while during the production period they give back to society (positive value). However, this should also take into account country preferences on how society values life at different age periods. In addition, some authors think that there are costs households would have incurred without suffering RTI that could only be evaluated using counterfactuals (control groups-scenarios), which was not considered in the present study.[15]

The WHO estimates RTI cost represents 1% of the GDP in low-income countries, while in medium- and high-income countries the cost can reach 1.5% and 2% of GDP, respectively.[16] This study documents that the total economic cost of RTI in Belize accounts for 1.6% of the GDP in the study year. In this regard, Dinesh Mohan argues that the method used may influence the final estimation. When he analyzed the differences between low- and high-income countries, he found that estimations in high-

income countries tend to be more detailed and comprehensive, since they include willingness to pay, quality adjusted life years, and healthy life years.[17] According to Mohan, if the willingness to pay method had been used in India, the total cost of RTI would have increased from 0.8% to 2% of GDP. He also highlights some problems, such as lack of access to health services and technology, which, together with few work opportunities for people with disabilities, contribute to underestimation of the RTI cost in low- and medium-income countries. Using epidemiologic information from countries with better registers shows how estimations from different countries would also increase to 2% of the GDP.[17] Without a doubt this might be the case in the Belize estimations.

VI. Recommendations

- It is important to strengthen the information system for road traffic injuries; epidemiological surveillance is important, but it must be linked to data from other sources such as the police and BERT, among others, so as to have a better idea as to the magnitude of the problem. See annex with information that should be collected at the primary level.

- Belize should strive to have one common data base for RTI for the country, with data provided by different sectors such as police, health, transportation, City Council Traffic Department, BERT, and other key partners.

- Fatal and non-fatal injuries should be coded properly and clearly illustrate the type of road users.

- Epidemiological information should be enhanced so as to determine the number of injured attended to in the emergency room and other hospital-based services at the different health facilities, and ambulatory follow up of RTI should also be quantified.

- There is need to estimate unitary cost of different health services, such as bed-day, ambulatory medical consultations (specialized and non-specialized), average cost of emergency room hospital based consultation, cost of rehabilitation therapies, etc.

VII. References

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VIII. Annexes

a) Questionnaires used to estimate ambulatory medical and rehabilitation consultancies

b) More frequent ICD-10 codes of injuries reported in hospital discharge database, Belize 2007

c) Input distribution for the Sensitivity Analysis

d) Other assumptions

e) Type of road user

f) Total economic cost of fatal and non-fatal road traffic injuries in Belize during 2007: results from the sensitivity analysis (discount rate of 0%)

g) Data needed for Economic Study on Road Traffic Injuries

a) Questionnaires used to estimate ambulatory medical and rehabilitation consultancies

Instituto Nacional de Salud Pública / National Institute of Public Health (México)

Centro Colaborador de Investigación de lesiones y violencia OMS-OPS /

WHO-PAHO Collaborating Centre for Injuries and Violence Research

"Estimation of the economic impact of road traffic injuries in Belize"

The project titled "Estimation of the economic impact of road traffic injuries (RTI) in Belize" is a research conducted by the National Institute of Public Health (Mexico) with the objective to estimate direct, indirect cost and national economic burden of RTI in Belize. This Economic impact study was commissioned by the National Road Safety Committee in support of activities outlined in the National Strategic Plan to reduce Road Traffic Injuries in Belize. Technical and financial support was provided by PAHO/WHO Country Office and the Epidemiology Unit of the Ministry of Health.

To conduct the study is relevant to obtain information about the medical care utilization in road traffic injured patients. For this reason, the research group decided to lead an experts' panel with doctors of major experience in the treatment of these patients. The following questionnaire claims to obtain information related to the road traffic injuries more frequently attended at the medical service where you work. The diagnoses are in agreement to the International Classification of Diseases (ICD.10). Please read each statement carefully. Note that questions are open. If you would like to make more detailed comments please use the reverse of this questionnaire. Ensure that you emphasize the question number that your comment refers to.

ID Number:	
Institution:	
Medical specialty:	
Expertise time:	

1.- According to your experience, of injured people who are attended in the **(name of Unit/department)** those that come with injuries as result of road traffic accident appear in the following proportion according to the type of injury. Add in the empty cells those diagnoses that you consider as relevant and they have not been included in this list. Notice that the numbers that you provide must add the unit or 100 %.

Injuries	Proportion (%)
1.-	
2.-	
…	
n.-	

2.- Of the road traffic injured patients with some of the following injuries, what proportion of each injury , are attended only at the emergency service, in others words, what proportion does not need to be hospitalized. Add in the empty cells those diagnoses that you consider as relevant and they have not been included in this list.

Injuries	Proportion (%)
1.-	
2.-	
…	
n.-	

3.- Of the road traffic injured patients that do **not** need hospitalization and present some of the following injuries, what is the proportion, for each injury, that need a follow-up in ambulatory medical consultation?, and in those cases, what is the average number of ambulatory medical consultations needed for patient in the ambulatory follow-up? Add in the empty cells those diagnoses that you consider as relevant and were not included in this list.
Note: In case of injuries that you consider do not need follow-up in ambulatory medical consultation mark zero in the corresponding line.

Injuries	Proportion of patients that require ambulatory medical consultations (%)	Average number of ambulatory medical consultations
1.-		
2.-		
…		
n.-		

4.- Of the road traffic injured patients that do **not** need hospitalization and present some of the following injuries, what is the proportion, for each injury that needs a follow-up in rehabilitation consultation?, and in those cases, what is the average number of rehabilitation consultations needed for this patients? Add in the empty cells those diagnoses that you consider as relevant and were not included in this list.
Note: In case of injuries that you consider do not need rehabilitation consultation mark zero in the corresponding line.

Injuries	Proportion of patients that require rehabilitation consultations (%)	Average number of rehabilitation consultations
1.-		
2.-		
…		
n.-		

5.- Of the road traffic injured patients that **need hospitalization** and present some of the following injuries, what is the proportion for each injury, of patients that need a follow-up in ambulatory medical consultation?, and in those cases, what is the average number of ambulatory medical consultations needed for patient in the ambulatory follow-up?
Add in the empty cells those diagnoses that you should consider as relevant and were not included in this list.
Note: In case of injuries that not need of follow-up in ambulatory medical consultation mark zero at the corresponding line.

Injuries	Proportion of patients that require ambulatory medical consultations (%)	Average number of ambulatory medical consultations
1.-		
2.-		
…		
n.-		

6.- Of the road traffic injured patients that **need hospitalization** and present some of the following injuries, what is the proportion, for each injury, that needs rehabilitation consultation? What is the average number of rehabilitation consultations needed for patients? Add in the empty cells those diagnoses that you consider as relevant and were not included in this list.
Note: In case of injuries that not need rehabilitation mark zero in the corresponding line.

Injuries	Proportion of patients that require rehabilitation consultations (%)	Average number of rehabilitation consultations
1.-		
2.-		
…		
n.-		

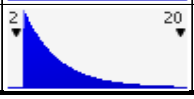
b) More frequent ICD-10 codes of injuries reported in hospital discharge database, Belize 2007

Frequency	ICD-10 code	Injury Description
55	S09.9	Unspecified injury of head
41	Non-specified	
38	T07	Unspecified multiple injuries
12	S72.9	Fracture of femur, part unspecified
10	S42.3	Fracture of shaft of humerus
10	S82.2	Fracture of shaft of tibia
8	S06.2	Diffuse brain injury
8	S39.9	Unspecified injury of abdomen, lower back and pelvis
6	T14.9	Injury, unspecified
5	S06.0	Concussion
5	S42.4	Fracture of lower end of humerus
5	S82.8	Fractures of other parts of lower leg
4	S02.9	Fracture of skull and facial bones, part unspecified
4	S09.7	Multiple injuries of head
4	S52.0	Fracture of upper end of ulna
4	S72.0	Fracture of neck of femur
3	S02.2	Fracture of nasal bones
3	S02.6	Fracture of mandible
3	S05.9	Injury of eye and orbit, unspecified
3	S06.4	Epidural haemorrhage
3	S42.0	Fracture of clavicle
3	S72.3	Fracture of shaft of femur
3	T08	Fracture of spine, level unspecified
2	J93.9	Pneumothorax, unspecified
2	R10	Abdominal and pelvic pain
2	S01.9	Open wound of head, part unspecified
2	S09.2	Traumatic rupture of ear drum
2	S22.3	Fracture of rib
2	S32.8	Fracture of other and unspecified parts of lumbar spine and pelvis
2	S37.0	Injury of kidney
2	S42.2	Fracture of upper end of humerus
2	S43.0	Dislocation of shoulder joint
2	S52.2	Fracture of shaft of ulna
2	S52.7	Multiple fractures of forearm
2	S52.8	Fracture of other parts of forearm
2	S59.9	Unspecified injury of forearm
2	S61.9	Open wound of wrist and hand part, part unspecified
2	S73.0	Dislocation, sprain and strain of joint and ligaments of hip
2	S82.0	Fracture of patella
2	S82.3	Fracture of lower end of tibia
2	S92.9	Fracture of foot, unspecified
2	T02.9	Multiple fractures, unspecified

c) Input distribution for the Sensitivity Analysis

@RISK Model Inputs

Performed By: rperez
Date: Martes, 24 de Noviembre de 2009 06:18:55 p.m.

Name	Cell	Graph	Function	Min	Mean	Max
# Deaths	E13		RiskUniform(Assumptions!E63,Assumptions!E70,RiskName("# Deaths"))	61	66	72
# Deaths >30 days	H28		RiskUniform(Assumptions!F63,Assumptions!F70,RiskName("# Deaths >30 days"))	2	2	2
Weight, # Severely Injured : 1Death	H71		RiskTriang(Pond_Agreg!H19,Pond_Agreg!H19,Pond_Agreg!H16,RiskName("Weight, # Severely Injured : 1Death"))	5.520	8.680	15.000
Weight, #E.R. per 1 Hospitalized	H153		RiskExpon(3.4229,RiskShift(1.999),RiskTruncate(Pond_Agreg!N19,Pond_Agreg!N8),RiskName("Weight, #E.R. per 1 Hospitalized"))	-∞	6.715	+∞

d) Other assumptions

- Pre-hospital care: BERT's figures of "Top down" cost estimations (using information provided by BERT) and utilization weights (for hospitalizations: number of hospitalized in Belize District, less number of severely injured attended by BERT in 2007). In the same way, the proportion of severely injured and slightly injured that was transported (transferred) to hospitals was used (both to hospitalization or E.R. ambulatory services).

Belize District	Serious	112
	Weight: proportion of severely injured receiving ambulance & pre-hospital care	0.419642857
	Minor injuries	187
	Weight: proportion of slightly injured receiving ambulance & pre-hospital care	0.77540107

	Slightly (proportion)	Serious (proportion)
Treated on site only	0.055172414	0
Treated & Transport	0.931034483	0.936170213
Air transportation	0.006896552	0
No treatment provided	0.006896552	0.063829787

- Both death figures, health sector and police, were adjusted to meet WHO's 30-day definition of RTI death. Basal model uses health sector's figure and simulation analysis incorporates both. In this sense, for those who die >30 days the cost assumed was: direct cost for 30 days of hospital stay and indirect cost for 30 days

- For the simulation (sensitivity analysis), estimations of the number of severely injured and slightly injured people per recorded statistical death were used from previous studies.[6, 16-22]

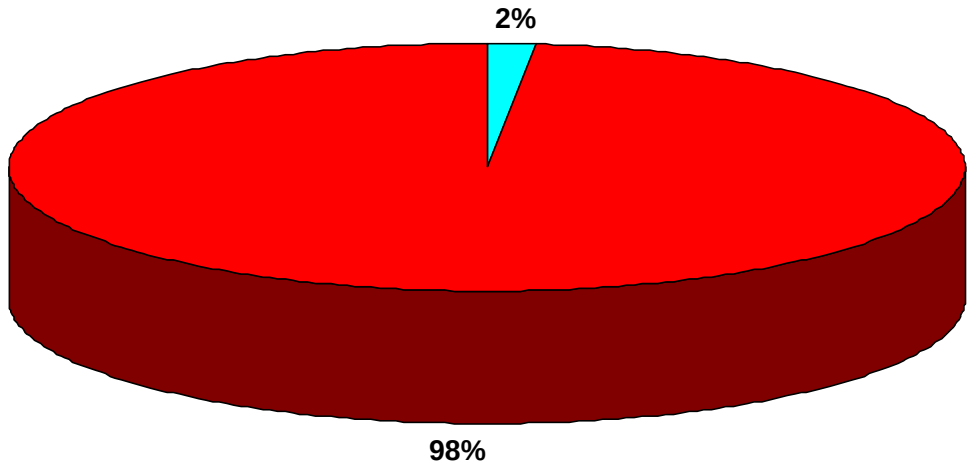
- In ER users one day salary was considered as Indirect Cost. This was assumed since slightly injured people would at least lose one day for medical treatment. We consider this is a conservative scenario due that sometimes injured lose more than one day and they hardly lose less than that.

- Results of the health provider Survey showed the following weights (percentages) used:

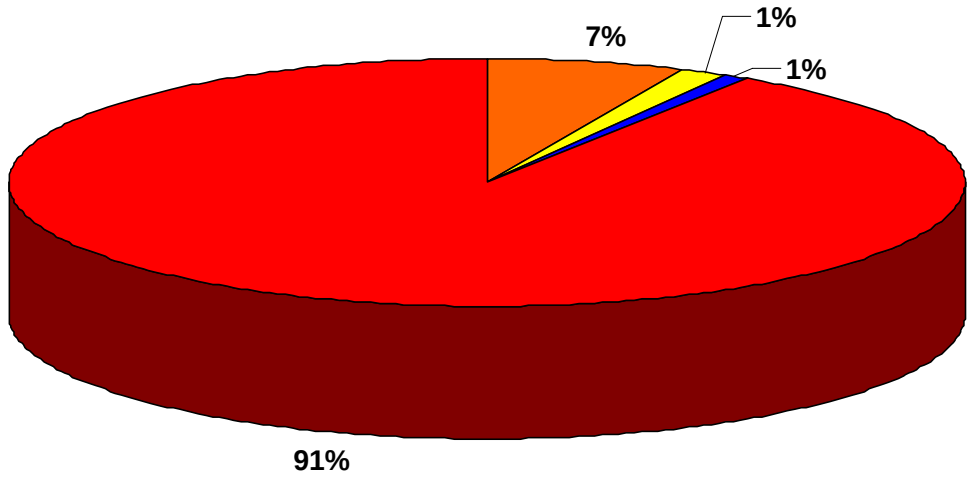
	Hospitalized	Non-Hospitalized
% of all patients that use ambulatory	77.24%	44.30%
% of ambulatory users, using rehab.	81.28%	85.36%

e) Type of road user

I) Type of road user dead



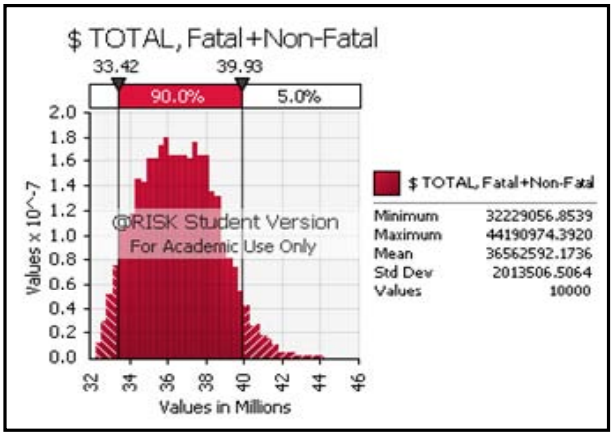
II) Type of road user hospitalized

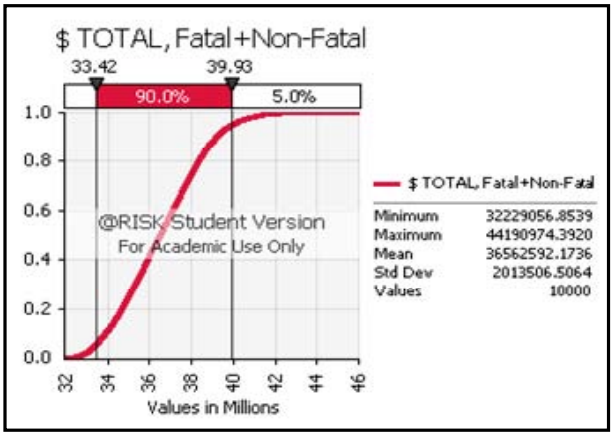


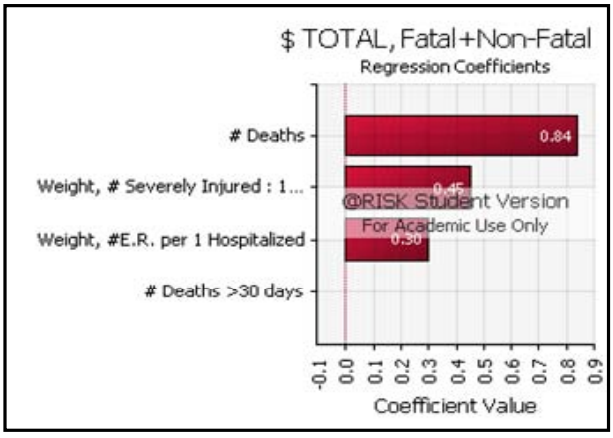
f) Total economic cost of fatal and non-fatal road traffic injuries in Belize during 2007: results from the sensitivity analysis (discount rate of 0%)

@RISK Output Report for $ TOTAL, Fatal+Non-Fatal

Performed By: rperez
Date: Martes, 24 de Noviembre de 2009 06:18:20 p.m.







Simulation Summary Information	
Workbook Name	Cost Simulation (Belize 2007).xls
Number of Simulations	1
Number of Iterations	10000
Number of Inputs	4
Number of Outputs	21
Sampling Type	Latin Hypercube
Simulation Start Time	11/24/09 18:16:32
Simulation Duration	00:00:22
Random # Generator	Mersenne Twister
Random Seed	2932

Summary Statistics for $ TOTAL, Fatal+Non-Fatal			
Statistics		**Percentile**	
Minimum	32,229,057	**5%**	33,419,372
Maximum	44,190,974	**10%**	33,909,145
Mean	36,562,592	**15%**	34,333,964
Std Dev	2,013,507	**20%**	34,678,717
Variance	4.05421E+12	**25%**	35,018,487
Skewness	0.226537561	**30%**	35,325,339
Kurtosis	2.560563452	**35%**	35,625,561
Median	36,500,155	**40%**	35,914,538
Mode	37,448,994	**45%**	36,203,152
Left X	33,419,372	**50%**	36,500,155
Left P	5%	**55%**	36,806,709
Right X	39,927,485	**60%**	37,116,503
Right P	95%	**65%**	37,423,904
Diff X	6,508,112	**70%**	37,692,149
Diff P	90%	**75%**	38,003,074
#Errors	0	**80%**	38,338,247
Filter Min	Off	**85%**	38,699,485
Filter Max	Off	**90%**	39,200,522
#Filtered	0	**95%**	39,927,485

Regression and Rank Information for $ TOTAL, Fatal+Non-Fatal			
Rank	**Name**	**Regr**	**Corr**
1	# Deaths	0.841	0.850
2	Weight, # Severely Injured : 1Death	0.453	0.412
3	Weight, #E.R. per 1 Hospitalized	0.301	0.249
4	# Deaths >30 days	-0.002	0.013

g) Data needed for Economic Study on Road Traffic Injuries

In order to develop a comprehensive understanding of the economic cost of road traffic injuries, the following are some of the information that is necessary to conduct a thorough analysis. The information highlighted in "green" was available and were used in this study; while the information highlighted in "red" was unavailable.

Fatal	# or % of deaths that received emergency medical attention at scene	# or % were hospitalized (and total number of hospital days / average hospital stay)
		# or % died at scene
	# or % of deaths that did not receive emergency medical attention at scene	# or % were hospitalized (and total number of hospital days / average hospital stay)
		# or % died at scene

Potential sources: Death certificates and hospital discharge data-bases

Non fatal	**# or % of severely injured** (Definition: Either a person is detained in hospital as an 'in patient', or if any one of the following injuries are sustained whether or not he or she is detained in hospital: fractures, concussion, internal injuries, crushing, severe cuts and lacerations, or severe general shock requiring medical treatment. This category would include deaths occurring after 30 days)	# or % of severely injured that received emergency medical attention at scene	# or % were hospitalized (and total number of hospital days / average hospital stay)	# or % died after 30 days		
				# or % survived	# or % used ambulatory services (and total / average number of medical consultations)	# or % used rehabilitation (and total / average number of sessions)
						# or % did not use rehabilitation
					# or % did not used ambulatory services	
			# or % were not hospitalized	# or % died after 30 days		
				# or % survived	# or % used ambulatory services (and total / average number of medical consultations)	# or % used rehabilitation (and total / average number of sessions)
						# or % did not use rehabilitation
					# or % did not use ambulatory services	
		# or % of severely injured that did not receive emergency medical attention at scene	# or % were hospitalized (and total number of hospital days / average hospital stay)	# or % died after 30 days		
				# or % survived	# or % used ambulatory services (and total / average number of medical consultations)	# or % used rehabilitation (and total / average number of sessions)
						# or % did not use rehabilitation
					# or % did not used ambulatory services	
			# or % were not hospitalized		# or % used ambulatory services (and total / average number of medical consultations)	# or % used rehabilitation (and total / average number of sessions)
						# or % did not use rehabilitation
					# or % used ambulatory services	
	# or % of slightly injured (An injury of a minor character such as a cut, sprain or bruise)	# or % of slightly injured that received emergency medical attention at scene	# or % used ambulatory services (and total / average number of medical consultations)			# or % used rehabilitation (and total / average number of sessions)
						# or % did not use rehabilitation
			# or % did not use ambulatory services			
		# or % of slightly injured that did not receive emergency medical attention at scene	# or % used ambulatory services (and total / average number of medical consultations)			# or % used rehabilitation (and total / average number of sessions)
						# or % did not use rehabilitation
			# or % did not use ambulatory services			

Potential sources: Hospital discharge data-bases, emergency health services reports, ambulatory health services reports, rehabilitation services reports, national health surveys

Other epidemiologic information	% of RTI that present permanent disability	Potential sources
		Hospital records, previous studies, national health surveys

		Cost Information	Expenditure Information
Emergency medical services	Ambulance services	Average cost "per travel"	Total expenditure in a given year
			Total number of services provided (same year)
			% of services provided as result of a RTI (same year)
	E.R. units (hospital based)	Average cost per patient attended at ER	Total expenditure of ER facilities in a given year
			Total number of patients attended (same year)
			% of patients attended as result of a RTI (same year)
Hospitalization		Average cost per day bed	Total expenditure of hospital(s)
		Average cost per RTI patient	Total number of hospital discharges
			% of hospital discharges with RTI diagnosis
Medical consultation		Cost per ambulatorymedical consultation (general practitioner)	Total expenditure in ambulatory medical consultations
		Cost per ambulatory specialized medical consultation (specialist)	
Rehabilitation services		Cost per rehabilitation medical consultation	Total expenditure in rehabilitation
		Cost per therapeutic session of rehabilitation	% of expenditure for RTI patients

Other Useful Information

	Category	Information requirements (for a given year)	Possible data source
Other information	Salary / Income	Minimum/legal wage	Treasury department
		Average wage of population (surveys)	
	Sick leaves	Total number of sick leaves	a) Social security; b) Insurance companies
		Total expenditure in sick leaves	
		# or % of sick leaves due to RTI	
		Total expenditure paid for sick leaves due to RTIs	
		Total number of disabilities registered	
		# or % of disabilities that are consequence of RTIs	