Journal of
Reward Deficiency Syndrome & Addiction Science

http://dx.doi.org/10.17756/jrdsas.2016-027

Research Article

Open Access

# The Social Cost of Drinking and Driving in the City of São Paulo

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**Received:** July 19, 2016
**Accepted:** September 21, 2016
**Published:** September 23, 2016

**Citation:** Moraes E, Moreira MM, de Campos GM, Laranjeira R. 2016. The Social Cost of Drinking and Driving in the City of São Paulo. *J Reward Defic Syndr Addict Sci* 2(2): 55-59.



Published by United Scientific Group

## Abstract

In this study, we assessed the cost of drinking and driving in the city of São Paulo/SP, Brazil in 2008 using a cost-of-illness assessment. The estimated social cost of drinking-and-driving" varied from 239 million to 283 million BRL in 2008. Although the costs were underestimated due to the scarcity of available data, the present study succeeded in establishing a close approximation of the expenses associated with drinking and driving in São Paulo. Further studies on this topic would be valuable because they could educate policy decision-makers about the need for investments for preventive actions. In addition, data in governmental agencies' databases should be improved.

## Keywords

Drinking and driving, Costs, Alcohol, Traffic accidents

## Introduction

News reporting of traffic accidents involving individuals who have consumed alcohol has become commonplace in the worldwide media. Not by chance, important social changes are occurring due to the concern for the high rates of such accidents: changes in legislation, in drivers' behavior, in the attitude of police, in the availability of research funds, in the number of studies on prevention, and in advertising campaigns. These changes are not surprising, as the consequences of driving motor vehicles after having consumed alcohol, or "drinking and driving," represent one of the main causes of morbidity and mortality worldwide [1].

According to some estimates, approximately 1.2 million people worldwide die every year from traffic accidents [2]. The use of alcohol seems to be involved in 25 to 50% of such accidents [3].

In the United States, approximately 500,000 people suffer trauma, and 17,000 die every year in traffic accidents related to drinking and driving. The total cost to the victims reached US$51.1 billion in 2000 [4].

In Brazil, the 2007 "National Domiciliary Survey on Patterns of Alcohol Consumption", showed that 35% of people drink and drive: 43% of men and 9% of women [5]. According to data supplied by the Institute of Applied Economic Research (IPEA - Instituto de Pesquisa Econômica Aplicada), the estimated total cost of related traffic accidents in Brazil is approximately BRL28 billion per year [6].

Drinking and driving has both biopsychosocial and financial costs to society. Therefore, we sought to estimate the cost to society of drinking and driving in São Paulo, one of the largest cities in the world, with a population of 11,376,685 inhabitants [7].

Here, we provide a description of the methodological procedures applied, the results obtained, and a discussion on the importance and viability of investing in further studies to stimulate interventions to reduce drinking and driving.

## Methods

We chose to perform a *Cost of Illness* assessment, one of the approaches used in Health Economic Evaluation (HEE) [8] to study the social cost of drinking and driving in the city of São Paulo.

This method focuses on the analysis of "cost", including a description of the resources actually used and potential losses, due to a particular disease over a given period of time. In the present study, 2008 was selected as the reference year for cost assessment.

In addition, this method aims to identify the pattern of resource use based on the best available, scientifically valid evidence at the time of the study. Each resource is converted into monetary values, which allows for estimation of the total cost of the investigated disease on the healthcare system [9].

### Costs of traffic accidents

Two types of costs are assessed to measure the total cost associated with traffic accidents. Direct costs include the materials, services, and other resources expended as a consequence of accidents. Thus, medical and hospital bills, rescue of victims and vehicles, employment of police and traffic assistance, rehabilitation, damage to vehicles and other public and private property, and social security and legal costs are all included in these calculations [10]. The indirect costs, in turn, include the opportunity costs of lost work hours and lost participation in leisure activities that result from morbidity or death [11, 12].

The lost productivity that results from morbidity and mortality is assessed using the human capital method, based on data such as the victims' ages, gender, life expectancy, and income. Calculation of the costs associated with death are based on the amount of lost time at work by estimating the loss of future earnings. For that purpose, a 5% discount rate was suggested by the Health Ministry to be used in Brazil [13].

The present study includes a literature review of articles on the consequences of drinking and driving published in indexed journals (electronic databases), non-indexed journals, and technical reports produced by governmental agencies.

The data were collected from appropriate state agencies and from articles published in widely acknowledged specialized journals to ensure the reliability of the results. The resources and expenses used in the calculation included medical and hospital care costs, including material and human resources; costs of damaged vehicles; and lost productivity resulting from transient or permanent interruption of productive activities. Figure 1 shows the resources included in the calculation of cost in this study.

### Direct medical costs

Direct medical costs include the costs of hospitalization and the procedures performed during the hospital stay, including staffing costs, directly associated with traffic accidents. The corresponding data were collected from the Health Ministry Database – System of Hospital Information of the Unified Health System (Sistema de Informações Hospitalares do Sistema Único de Saúde - SIH/SUS – DATASUS) [14] corresponding to codes V01 to V99 (transport accidents) of the 10th edition of the International Statistical Classification of Diseases and Related Health Problems [15].

### Non-medical direct costs

Non-medical direct costs include the costs of the damage to vehicles by collisions. The System of Automobile Statistics (AUTOSEG) of the Superintendence of Private Insurance (SUSEP) [16] was used as the source for these data. That agency receives information from insurance companies, open private pension plan agencies, and saving capitalization associations, using reports sent by insurance companies every six months with data on the policies in vigor and the accidents that occurred. This report provides information on the number of damaged vehicles, average premium rate, average insurance amount, number of accidents, and compensatory damages; these data are classified according to the vehicle's make, model, and year of manufacture, the location, and the insured driver's profile.

### Indirect costs: loss of productivity

Indirect costs include the costs that result from transient or permanent interruption of productive activities due to morbidity and mortality. For this purpose, mortality data were obtained from the Forensic Medicine Institute (Instituto Médico Legal - IML) and the Program for Improvement of the Information on Mortality in the City of São Paulo / Municipal Secretary of Health (Programa de Aprimoramento das Informações de Mortalidade no Município de São Paulo (PRO-AIM / Secretaria Municipal de Saúde) [17]. Morbidity data were obtained from DATASUS.

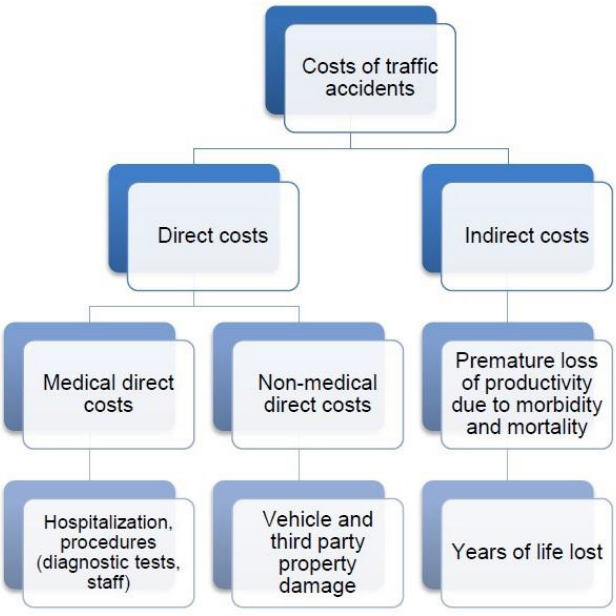


**Figure 1:** Resources and costs associated with traffic accidents.

### Assessment of costs

After collecting the data, we performed descriptive and comparative analyses to identify a profile of the investigated population and to measure the partial costs drinking and driving in São Paulo in 2008. We then used an epidemiological tool to calculate the percentage of traffic accidents associated with alcohol consumption by estimating the population attributable risk (PAR) [18]. This measure calculates the increased probability of being in a traffic accident after exposure to alcohol. Thus, PAR is defined as follows:

$$PAR = \frac{P(RR-1)}{P(RR-1)+1} \times 100 \quad \text{---------- (1)}$$

where $P$ is an estimate of the prevalence of alcohol consumption in traffic accidents, and $RR$ is the relative risk of a particular event at different levels of alcohol use. Therefore, the PAR measures the extent to which an individual with positive blood alcohol content (BAC) is more likely to be involved in a traffic accident compared to individuals with negative BAC. Due to the lack of information on the relative risk of traffic accidents caused by the use of alcohol in Brazil, the $RR$ could not be calculated. We defined $RR$ as 4.9, based on a literature review and a study by Petridou et al. [19].

## Results

### Medical direct costs

Table 1 provides an overview of hospital admissions within the SUS, and their corresponding costs as a function of traffic accidents in the city of São Paulo in 2008. It is worth emphasizing that the cost associated with these accidents reached over BRL11.2 million in that year. Additionally, the difference in the number of hospital admissions and total medical costs according to gender is notable, with a higher number of accidents involving men.

### Non-medical direct cost

According to data from AUTOSEG, BRL472.8 million was the total cost of damage to vehicles and other property from the 89,200 collisions that took place in the city of São Paulo in 2008.

### Indirect costs: loss of productivity

**Morbidity (DATASUS):** Table 1 shows that 9,194 individuals were in the hospital for a total of 58,973 days, or 6.4 days per patient. The annual minimum wage was BRL450.00 in 2008, or BRL15.00 per day. Taking into account the number of work days lost by patients while in the hospital, we estimated that traffic accidents cost BRL884,595 in São Paulo in 2008.

### Mortality

**Source: IML:** In 2008, the IML produced 6,369 reports from São Paulo. It is worth noting that in 1,572 of these reports (24.7%) the item "Traffic Accident: yes or no" was not filled, as shown in Figure 2.

Therefore, that item was completed in 4,797 reports, from which 885 (18.4%) were associated with traffic accidents. Of the reports that were related to traffic accidents, 786 (88.8%) fatalities were reported, 630 (80.2%) men, and 128 (16.3%) women. Gender was not included in 28 reports (3.5%) (Figure 3). Of the 786 fatalities, 317 (40.3%) had positive blood alcohol content. The average age was 40 years, which corresponded with the age range that exhibited the highest prevalence of positive BAC (40 to 44 years old) (Table 2).

**Mortality (PRO-AIM):** According to the data collected by the Municipal Secretary of Health of São Paulo, there were 1,571 fatalities from traffic accidents in 2008. These data are stratified by mode of transport. It is worth noting the difference in the number of traffic fatalities reported by the two databases: 786 according to IML and 1,571 according to PRO-AIM.

**Table 1:** SUS in-hospital morbidity due to transport accidents. São Paulo, 2008 (V01 – V99 Transport accidents).

| Resources and costs | Total | Men | | Women | |
|---|---|---|---|---|---|
| Hospital admissions | 9,194 | 7,391 | 80.4% | 1,803 | 19.6% |
| Hospital services (BRL) | 9,058,067 | 7,294,575 | 80.5% | 1,763,492 | 19.5% |
| Staff services (BRL) | 2,166,530 | 1,752,159 | 80.9% | 414,371 | 19.1% |
| Total AIH value (BRL) | 11,224,598 | 9,046,735 | 80.6% | 2,177,863 | 19.4% |
| Average AIH vale (BRL) | 2,432 | 2,441 | | 2,396 | |
| Hospitalization length (days) | 58,973 | 47,923 | 81.3% | 11,050 | 18.7% |
| Deaths | 437 | 331 | 75.7% | 106 | 24.3% |
| Source: DATASUS | | | | | |

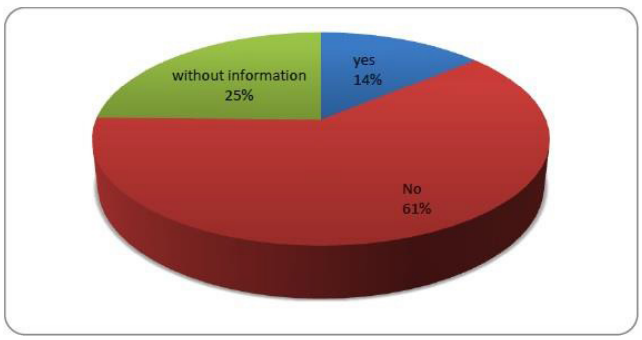


**Figure 2:** Response to "Traffic accident: yes or no" in the reports produced by IML for São Paulo in 2008.

### Estimation of the cost of mortality (Sources: IML and PRO-AIM)

The following data were taken into consideration in the calculation of the cost of mortality:

a) Number of fatal victims = 786 (IML) or 1,571 (PRO-AIM);

b) Years of working life lost = 25, based on an average age at death of 40 years, and retirement at 65 years old, as 80.2% of the victims were male;
c) Minimum wage in 2008 = BRL 450.00;
d) Number of monthly payments per year = 13, including year-end bonus;
e) Discount rate = 5%.

Thus, based on the mortality data supplied by IML, the cost of mortality was BRL 109,204,875. According to PRO-AIM the total cost was BRL 218,270,812.

**Table 2:** Traffic accident with fatalities, distributed by age and positive blood alcohol content. São Paulo, 2008.

| Age range | Fatalities | Positive BAC | |
|---|---|---|---|
| 01 to 04 years old | 3 | 1 | 33.3% |
| 05 to 09 years old | 4 | 1 | 25.0% |
| 10 to 14 years old | 9 | 0 | 0.0% |
| 15 to 19 years old | 48 | 15 | 31.3% |
| 20 to 24 years old | 107 | 43 | 40.2% |
| 25 to 29 years old | 73 | 35 | 47.9% |
| 30 to 34 years old | 53 | 25 | 47.2% |
| 35 to 39 years old | 63 | 34 | 54.0% |
| 40 to 44 years old | 42 | 25 | 59.5% |
| 45 to 49 years old | 45 | 23 | 51.1% |
| 50 to 54 years old | 35 | 15 | 42.9% |
| 55 to 59 years old | 29 | 9 | 31.0% |
| 60 to 64 years old | 20 | 3 | 15.0% |
| 65 to 69 years old | 18 | 6 | 33.3% |
| 79 to 74 years old | 15 | 4 | 26.7% |
| 75 to 80 years old | 13 | 1 | 7.7% |
| Older than 80 years | 20 | 1 | 5.0% |
| Unknown | 189 | 76 | 40.2% |
| Total | 786 | 317 | 40.3% |
| Source: IML | | | |

**Table 3:** Fatal Victims from traffic accidents, according to mode of transport. São Paulo, 2008.

| Mode of transport | Fatal Victims | % |
|---|---|---|
| Pedestrian | 622 | 39.7 |
| Motorcycle | 376 | 23.9 |
| Vehicle (car, bus, etc.) | 285 | 18.1 |
| Bicycle | 52 | 3.3 |
| Unknown | 236 | 15.0 |
| Total | 1,571 | 100.0 |
| Source: PRO-AIM | | |

## Estimation of the total cost of traffic accidents in São Paulo in 2008, in Brazilian real

To estimate the total cost of traffic accidents in the city of São Paulo in 2008 we examined two different scenarios (A and B) using the two different mortality estimations.

Scenario A corresponds to the mortality data collected from the PRO-AIM database, and scenario B corresponds to data from the IML database. The other costs are the same in both scenarios (Table 4).

In total, 40.3% of victims who died in traffic accidents had positive BAC (Figure 3). Therefore, we conclude that 40.3% of the total cost of traffic accidents is attributable to drinking and driving (Table 5).

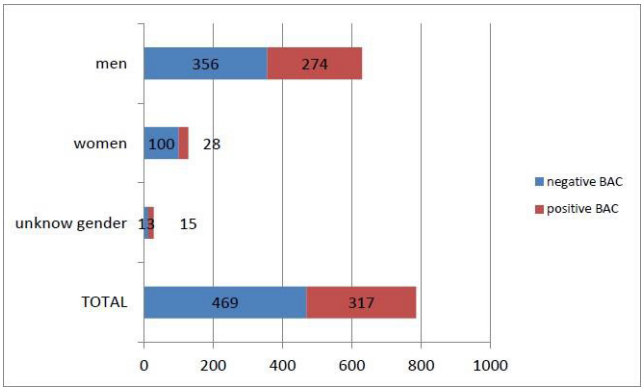


**Figure 3:** Distribution of fatalities caused by traffic accidents stratified by gender and blood alcohol content (BAC) in the city of São Paulo in 2008 (n = 786).

**Table 4:** Total cost of traffic accidents. São Paulo, 2008 (in BRL).

| | Scenario A | | Scenario B | |
|---|---|---|---|---|
| | BRL | % | BRL | % |
| **Direct costs** | **484,073,014** | **68.8** | **484,073,014** | **81.5** |
| Medical | 11,224,598 | 1.6 | 11,224,598 | 1.9 |
| Non-medical | 472,848,416 | 67.2 | 472,848,416 | 79.6 |
| **Indirect costs** | **219,155,407** | **31.2** | **110,089,470** | **18.5** |
| Morbidity | 884,595 | 0.1 | 884,595 | 0.1 |
| Mortality | 218,270,812 | 31.0 | 109,204,875 | 18.4 |
| **Total cost** | **703,228,421** | | **594,162,484** | |

**Table 5:** Total cost of traffic accidents associated with drinking and driving. São Paulo, 2008 (in BRL).

| | Scenario A | | Scenario B | |
|---|---|---|---|---|
| | BRL | % | BRL | % |
| **Direct costs** | **195,081,425** | **68.8** | **195,081,425** | **81.5** |
| Medical | 4,523,513 | 1.6 | 4,523,513 | 1.9 |
| Non-medical | 190,557,912 | 67.2 | 190,557,912 | 79.6 |
| **Indirect costs** | **88,319,629** | **31.2** | **44,366,056** | **18.5** |
| Morbidity | 356,492 | 0.1 | 356,492 | 0.1 |
| Mortality | 87,963,137 | 31.1 | 44,009,565 | 18.4 |
| **Total cost of drinking and driving** | **283,401,054** | | **239,447,481** | |

## Discussion

In light of our results, some important issues could be elucidated, as follows:

- There is agreement in the research on the main costs of drinking and driving;

- Replication or use of the monetary data reported by studies conducted in other countries is not possible, due to the resources assessed and differences in currency;

- Although few studies on this subject have been conducted in Brazil, there is concern about drinking and driving within the academic milieu and in the public. This concern might result in further investment in studies and interventions to prevent the consequences of drinking and driving;

- The results of this study may alert policy-makers and society at large to necessary changes in individual and collective behavior and to the improvements needed in education, health, and public safety to prevent drinking and driving.

An important aspect to be considered is that any researcher who conducts economic evaluation studies must be prepared for the difficulties he or she will unavoidably encounter in the course of the study.

One of the main limitations of this study was the limited access to important data that may have provided additional costs of traffic accidents. Although we had access to the websites of the agencies that hold this information, the data were not available. In fact, some important data are not even surveyed by such agencies.

In addition, when we made direct contact with agencies to request access to their data, our requests were not only denied but sometimes were never acknowledged. Another important issue is the poor quality of the information supplied. The databases were often incomplete, the fields were incorrectly filled, or relevant data were left unreported. Due to these problems in data collection, important resources could not be assessed, including social security costs and expenses associated with the transport of victims and expenses with their families.

Thus, our estimates on the social cost of drinking and driving are an underestimation of the true cost. Even so, our estimates highlight the exorbitant amounts of money spent as a consequence of drinking and driving.

To conclude, we express our hope that our study and future scientific studies will provide compelling evidence for policy-makers. Indeed, these policy-makers might appreciate that the exorbitant costs of drinking and driving might be better spent to reach other goals that are more useful to society at large.

## Acknowledgments

We thank the São Paulo Research Foundation (Fundação de Amparo a Pesquisa do Estado de São Paulo - FAPESP) for its financial support; the National Institute of Science and Technology for Public Policies on Alcohol and Other Drugs (Instituto Nacional de Ciência e Tecnologia para Políticas Públicas do Álcool e Outras Drogas - INPAD) and the Research on Alcohol and Drugs Unit (Unidade de Pesquisa em Álcool e Drogas - UNIAD) for supporting this research and for publicizing information on drinking and driving.

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