Pedestrian traffic injuries in Mexico: A country update

Martha Híjar, Ph.D., Eduardo Vazquez-Vela, M.D. and Carlos Arreola-Risa, M.D.

1 National Institute of Public Health of Mexico, 2 Director of the National Council for Accident Prevention of Mexico, and 3 Emergency Department and Shock Trauma Unit, Hospital San José, School of Medicine, Tec de Monterrey

Abstract
Road traffic injuries in general and pedestrian injuries in particular are a major public health problem in Mexico, especially in large urban areas. Analysis of mortality and road crashes at the national level was done using routine data recorded on death certificates. Fatality rates for different age groups were estimated by region for the year 2000. These data were supplemented by a cross-sectional study of pedestrian injuries in Mexico City based on death certificates information for pedestrians who lived and died in Mexico City between 1994 and 1997. Participant observation of physical spaces where crashes occurred was carried out. The spaces were filmed and in-depth interviews of survivors conducted. Road traffic crashes were responsible for approximately 17,500 deaths in Mexico during 2000. The mean age of the victims was 37 years. Mexico lost an average of 30 years of productive life for each individual who died in a traffic crash – 525,000 years in 2000. An estimated 9500 pedestrians are injured each year, with a ratio of approximately 13 nonfatal injuries to every 1 death.

Introduction
Motor vehicle traffic injuries in Mexico affect four distinct populations: the occupants of motor vehicles, bicyclists, motorcyclists, and pedestrians. Researchers and policymakers long viewed vulnerability, exposure conditions, and risk factors involved in the occurrence of motor vehicle traffic injuries to be the same among these four groups. The need to differentiate these factors is illustrated by the fact that in Mexico City, 54% of deaths due to traffic injuries occurring between 1994 and 1995 were adult pedestrians. An estimated 9500 pedestrians are injured each year, with a ratio of approximately 13 nonfatal injuries to every 1 death.

While aggregated data on traffic crashes and injuries are useful in making regional comparisons and evaluating the burden at the macro level, spatial and local data on characteristics of crashes and risk factors are more useful for identifying the nature of the problem at the individual and community level. This is especially true in developing countries such as Mexico, where the road users, mainly pedestrians, street vendors, and cyclists share and struggle for road space with motor vehicles. Traditional epidemiological studies focus on the analysis of some risk factors at the individual level. They do not allow for the identification of determining social factors by which one may define interventions according to the complexity of the problem.

This paper discusses the different approaches used in Mexico to identify the magnitude of the traffic injury problem, with a focus on the pedestrians. Public health research can help identify the causes of road traffic injuries and contribute to solutions that will positively impact the affected populations and society at large.
nomenon of road traffic injuries in Mexico is particularly endemic to urban areas, with pedestrians bearing the largest burden of injuries and fatalities, this study, completed in 2000, used a combination of quantitative (mortality and spatial analysis of fatal pedestrian injuries) and qualitative methods (nonparticipatory observation and in-depth interviews) to identify the social, contextual, and environmental determinants underlying the occurrence of pedestrian injuries in Mexico City.

Materials and methods

National mortality data

In Mexico, the routine data on pedestrian crash events are registered only in those cases where the injured person has died on site, not for any deaths occurring later in a hospital or other health facility. Since nearly 50% of pedestrian fatalities occur at the site of the traffic crash, the geographical distribution of fatalities is biased toward deaths that occur at the crash sites. Another limitation in data quality is that registration of deaths in Mexico is the responsibility of the state, region, or county where the person lived, not where the crash occurred. This makes it difficult to identify the location of all crashes, because in cases where death occurs at the hospital, there is no record of the exact location of the crash. Another limitation is that the death certificate is recorded at the place where the injured person usually lived and not where the event happened. For example, for a person who died in a road traffic crash in Mexico City but lived in the state of Morelos, the death is recorded in Morelos but not in Mexico City. These practices lead to inaccurate spatial data. These limitations should be kept in mind when interpreting the routine data on traffic injuries and deaths in Mexico.

Pedestrian injuries in Mexico City

To gain a better understanding of the pedestrian injury problem, a cross-sectional study was conducted, based on death certificates of people who lived in Mexico City and died there as the result of a collision between a motor vehicle and a pedestrian between January 1994 and December 1997. This period was selected due the availability of all the death certificates. Mexico City has 16 regions, which, for the purposes of this article, will be identified by number. Crude mortality rates were calculated by gender and age. A trend analysis was conducted using five-year age groups and totals by gender, using the simple linear regression analysis method, whose slope is recorded through the beta coefficient. The standardized mortality ratio (SMR) was calculated by gender for each region of the city with 95% confidence intervals.

Geographical mortality analysis

A Geographic Information System (GIS) was used to map the sites where a fatal pedestrian crash occurred using GPS coordinates, with data recorded only for cases where the victim died at the site of the collision. Based on the information recorded on the death certificates, including the collision site, address, region and neighborhood, a geographical analysis was performed based on a manual digitalization of each death certificate. The information was processed using the Map-Info program, with which maps were drawn showing death rates by region.

Physical spaces observation

The physical space where the greatest aggregate rates of pedestrian fatalities occurred was observed and recorded. Four spaces were selected for observation using a filming technique. During the analysis, observations were separated into five groups: (1) the existence of a signal infrastructure, traffic lights, pedestrian bridges, etc., (2) description of the traffic patterns, including vehicles, drivers, and pedestrians, (3) description of spaces, (4) driver and pedestrian behaviors, and (5) regulation violation patterns on the part of drivers and pedestrians.

In-depth interviews

Semi-structured in-depth interviews were conducted with pedestrians who had previously been injured by motor vehicles. A public hospital in Mexico City allowed the researchers to interview hospitalized patients who consented to be interviewed. Cases were selected from pedestrians who survived and sought care at the hospital during the month prior to the interview. Twelve interviews were conducted using the theoretical saturation criterion, a method used for qualitative analysis.

Results

National mortality data

The trend of recorded deaths caused by road traffic injuries for different regions of the country is shown in Figure 1. The data show that 17,500 deaths due to road traffic injuries were recorded in Mexico in the year 2000. The data indicate that death rates varied by region from 28.7 per 100,000 inhabitants in Baja California Sur to 7.9 per 100,000 inhabitants killed in Chiapas. In general, states located in the north and central regions of the country show the highest rates compared to the states located in the south. The same figure shows the distribution of pedestrian injuries by region. The highest pedestrian mortality rates are concentrated in the central region of Mexico, which includes major urban areas such as Mexico City. Examining the rate of road traffic injuries by composition, fatal pedestrian injuries account for over half of the road traffic injury deaths in more urban regions of the country.

Figure 2 shows the mortality distribution from road traffic injuries in Mexico by age and external cause. Figure 2 (Part
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a) shows the age profile for road traffic fatalities by E-Code classification (E810–E825) in Mexico for the year 2000, while Part B gives the breakdown for pedestrians alone and Part C all others (E826–829). The pedestrian injuries affect mostly older people – age 55 years and above. The age distribution for male and female fatalities was similar, as shown in Figure 3.

Figure 4 shows the overall crude mortality rate for fatal pedestrian injuries in Mexico City during the period of January 1994 to December 1997 was 7.14 per 100,000 population (CI 95%; 6.85–7.42), 10.6 per 100,000 (CI 95%; 10.1–11.1) for males, and 4.0 per 100,000 (CI 95%; 3.66–4.24) for females. When the analysis of trends by age group and sex was done, we found a marked increase for both sexes in the group 0 to 14 years, in the group of 10–14 year olds for males, and in the group 50 years or more for females. As can be seen in Figure 4, there are important differences in the standardized mortality ratio for different regions of Mexico City.

Geographical analysis of mortality

In the geo-reference process, only 1152 deaths were included (43.5%), representing those for which the death certificate included information on the exact site of the pedestrian

Figure 1. Mortality by road traffic* and pedestrian** injuries, Mexico.

Figure 2. Mortality due to road traffic injuries by age and external cause, Mexico, 2000.
injury. Despite the incompleteness of the data, we considered it fundamental to include GIS map analysis in order to specify spatial variables. Thus, in Figures 5 and 6, results are shown at the neighborhood level, with locations with high concentrations of crashes and injuries clearly identified. These locations are concentrated in 10 neighborhoods spread throughout different districts.

Physical spaces observation

In order to analyze the spatial conditions, activity for the four locations, selected for observation based on their high concentration of traffic fatalities, was captured using a filming technique. This enabled the analysis of movement of people and vehicles, traffic characteristics, attitudes of each one of the actors during daily movement, and conditions and use of existing safety infrastructure. Observations taken from the filmed points coincided with respect to the following characteristics: (1) All four observation points were large avenues with heavy vehicular traffic dividing zones with high pedestrian mobility; (2) the greatest percentage of vehicles consisted of public transport vehicles and taxis, and a lesser proportion of private vehicles; (3) the tendency toward violation of traffic rules by drivers and pedestrians, as well as street vendors; and (4) lack of use of pedestrian bridges, where they exist; and complete lack of signals and spaces, such as crosswalks and islands, for the safe movement of pedestrians.

In-depth interviews

A qualitative approach was used to help understand the pedestrian injury phenomenon from a social and personal perspective. Only interviews with injured pedestrians were
Figure 5. Density of cases of pedestrian deaths by place of occurrence, Mexico City, 1994–1997.

Figure 6. Concentration of pedestrian deaths at street level, Mexico City, 1994–1997.
completed, since drivers involved in collisions declined to be interviewed.

A total of 12 interviews were conducted, with 9 males and 3 females aged 17–65 years. Half of the subjects were born in Mexico City and had adequate experience as pedestrians. Most of the crashes occurred in places that were very close to the victims’ residence and took place during weekends or in the night hours.

Eleven of the 12 interviewed pedestrian victims said they had never driven, and a very few said they knew the road signals well. This is a population that does not know how to drive or does not drive regularly and finds it difficult to accurately judge the speed of an oncoming vehicle.

Eleven of the 12 traffic crashes investigated were hit-and-run cases, probably because the drivers were frightened by current legislation in Mexico City, which holds the driver to be the guilty party independent of the circumstances of the event. Another observation was that the families of the victims paid for all medical expenses, since none of the victims in these cases had any health insurance, nor were they affiliated with any social security institution. Most of the victims were heads of families and financial providers.

With respect to accident reconstruction, injured pedestrians’ reports coincided in stating that the injury occurred while the pedestrian was crossing a wide street, with vehicles stopped at a red light. In the most serious cases, crash victims were not aware of the presence of the oncoming vehicle until they felt the blow.

Interviews revealed other underlying risk factors at the location, such as the presence or absence of pedestrian bridges and crossings. Some of the factors identified by the interviews were the lack of pedestrian bridges in dangerous locations or the presence of bridges that were poorly located or were unsafe for some population groups. Some interview participants described particular pedestrian crossings as dangerous. As a result, most people interviewed said they never used the pedestrian bridges or did so only occasionally.

Discussion

In Mexico, the victims of motor vehicle crashes are mostly poor, not well educated, and unlikely to have either social security health coverage or life insurance. Young working-age males, the traditional breadwinners of nuclear families in Mexican society, account for the majority of road traffic injury deaths across all age groups. The loss or disability of the family member who provides the primary economic support can precipitate poverty in the affected household and can negatively impact the extended family. This occurs independently of the psychological stress, violence, and other family disruption that may also result. Orphans represent yet another set of social and economic costs to their extended families and communities. The second leading cause of orphaned children in Mexico is the loss of parents in traffic crashes.

The most important result from the study in Mexico City was the determination of the risk factors related to pedestrian injuries, such as dangerous crossings, the existence or nonexistence of pedestrian bridges, and the reasons bridges were not used. Pedestrian bridges are accepted as useful elements, although there is a shared opinion that they are badly located, unsafe, and cannot be used by some sectors of the population, including older pedestrians, mostly women, the handicapped and people moving merchandise. Most people interviewed said they never used them or did so only occasionally. This kind of information is extremely valuable for defining more adequate interventions according to the local characteristics where the crashes occur – not only from a spatial perspective, but also considering epidemiology and social context.

Another important finding was that injured pedestrians are generally those who do not drive or do not know how to drive. Added to this, the high percentage of hit-and-run cases represents a significant finding with respect to the financial burden a hit-and-run incident imposes on the victim and the victim’s family. If one considers that none of the victims interviewed had any health insurance or social security coverage, the burden of medical expenses adds to total injury costs.

This study also focused on the importance of the location of the crash, which led to the conclusions of this study that (1) the location of fatal crash cases and the circumstances under which the crash occurred should be entered on all death certificates; (2) analysis of mortality rates must be based on place of residence and place of occurrence of the fatality; and (3) since pedestrian deaths occur mainly in urban areas, analyses of the most dangerous locations should be done and publicized routinely, especially in large cities.

To understand the road traffic injury problem in Mexico, studies should go beyond simple analyses of traffic regulations violation. In most cases, road traffic crashes occur during competition for the same road space. The crashes are mostly a problem affecting low-income populations in a differentiated manner that increases inequalities for an already disadvantaged population. Research to find a common platform and process for stakeholder interaction at the national level will be the critical next step.

In regard to data quality, efforts are needed to establish improved injury surveillance systems through existing institutions within the ministries of health in each state of the Mexican Republic and through the National Data Center. Furthermore, it is important to create a reliable, comprehensive database on road traffic injuries. Accurate data will help to determine the exact nature and extent of the burden, will be useful for the identification of trends, key to the design and evaluation of prevention programs, and will help to define future policies and actions to prevent and control the problem of traffic injuries.

Measures need to be implemented urgently. Governmental institutions and different groups from society must participate as active stakeholders integrated in a solid coalition.
References


