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Factors Associated with Traffic Crashes in Pasto, Colombia: 2005-2006

Adam L. O'Bryant

ABSTRACT

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Factors Associated with Traffic Crashes in Pasto, Colombia: 2005-2006
(Under the direction of Karen Gieseker, Faculty Member)

Road traffic injuries (RTI) currently rank as the 11th leading cause of death world wide and the leading cause of injury related deaths worldwide. Globally, road traffic crashes kill over 1.2 million people per year with over 90% of the deaths occurring in low and middle income countries. Pedestrians, cyclists, and motorcyclists, collectively called vulnerable road users, are often times the unfortunate victims. Therefore, the purpose of this study was to identify the factors that are associated with traffic fatalities as well as the factors that are associated with being a vulnerable road user in traffic injuries and traffic fatalities in Pasto, Colombia. The results from this study showed that males had increased odds of being involved in a traffic fatality (OR=2.16 95%;CI 1.03-4.53). Rural road users are more likely to be involved in fatal traffic crashes than their urban counterparts (OR=5.92 95%;CI 3.00-11.71) Other groups such as young adults, vulnerable road users, and those not using safety equipment were also more likely to be injured or die in a traffic crash. Interventions specifically targeting these groups are needed.

Factors Associated with Traffic Crashes in Pasto, Colombia: 2005-2006

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06/2001	A project that examined and compared American and Mexican populations' antibiotic resistance. This study involved working in Mexico for 2 weeks.

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CHAPTER I: INTRODUCTION

1.1 BACKGROUND

Injuries account for 9% of global mortality and result in many more hospital visits and permanent disabilities annually (World Health Organization, 2008). Unintentional injuries consist of traffic collisions, falls, burns, drownings, and poisonings while intentional injuries consist of acts of war, self-inflicted violence, and violence from assault. Many injuries, especially those referred to as "accidents", were once thought to be unavoidable. However, a growing amount of evidence over the last few decades has provided evidence that certain interventions and policies can prevent and reduce injuries.

Road traffic injuries (RTI) are the 11th leading cause of death world wide and the leading cause of injury related deaths worldwide (Peden et. al, 2004; World Health Organization, 2002). Globally, road traffic crashes lead to over 1.2 million deaths per year with over 90% of these deaths occurring in low and middle income countries. Another 20-50 million people are injured or disabled yearly in road crashes and by the year 2020 road traffic injuries are predicted to become the third largest contributor to the global burden of disease (Peden et. al, 2004).

Economically, the impact of traffic injuries on the nations of the world is dramatic with national economic loss ranging from 1% to 2% of the Gross Domestic Product (GDP) (Jacobs et al., 2000). As countries develop economically, death rates from many of the diseases that had previously impacted the country usually fall. One exception to this is traffic injuries, which generally tend to increase as economic growth increases among developing countries (Kopits and Cropper, 2005). Another problem is that many of the lower and middle income countries that are believed to have the highest fatality

rates in traffic crashes have very little or incomplete data. Thus, current global figures are most likely underestimated (Peden et. al, 2004; Ameratunga et al, 2007).

Road crashes are also the number one killer of all children and young adults aged 10-24 in the world (The Task Force for Child Survival and Development, 2007). Most of the young people killed in traffic crashes are vulnerable road users such as pedestrians, cyclists, and motorcyclists (Peden et. al, 2004). These vulnerable road users are forced to share what are often times cramped and poorly designed roads with automobiles, leaving them exposed to traffic injuries or death.

Over the last two decades little advancement has been made in reducing the number of injuries and fatalities due to traffic crashes within most of the lower and middle income countries while high income countries have seen large reductions in both areas. Many of the prevention measures implemented successfully in the higher income countries, such as safety belts and airbags focus on four-wheel vehicles, therefore minimizing their impact on lower and middle income countries. Viable prevention measures adapted to the circumstances in low and middle income countries are needed.

1.2 PURPOSE

The majority of deaths resulting from road crashes occur in low and middle income countries. Many of these countries are also plagued with over representation of vulnerable road users within their traffic crash data. Identifying characteristics of those captured in the injury surveillance system in Pasto, Colombia may help to aid prevention measures within Colombia and other low and middle income countries. Therefore the following study will primarily examine the following hypotheses of the fatality data from traffic crashes in Pasto, Colombia.

1.3 HYPOTHESES

1. Null: Vulnerable transportation users are not associated with an increase in fatalities from road crashes.

   Alternative: Vulnerable transportation users are associated with an increase in fatalities from road crashes

2. Null: Male gender is not associated with an increase in fatalities from road crashes.

   Alternative: Male gender is associated with an increase in fatalities from road crashes.

3. Null: Being a 15-29 year old is not associated with an increase in fatalities from road crashes.

   Alternative: Being a 15-29 year old is associated with an increase in fatalities from road crashes.

4. Null: Driving at night is not associated with an increase in fatalities from road crashes.

   Alternative: Driving at night is associated with an increase in fatalities from road crashes.

5. Null: Use of Safety equipment is not associated with a reduction of fatal injuries among road users.

   Alternative: Use of Safety equipment is associated with a reduction of fatal injuries among road users.

6. Null: Rural areas are not associated with an increase in fatalities from road crashes.

   Alternative: Rural areas are associated with an increase in fatalities from road crashes.

Additional analyses of the factors that influence being a vulnerable road user will also be performed.

1. Null: Male gender is not associated with an increase in likelihood of being a vulnerable road user in the fatality and injury datasets.

   Alternative: Male gender is associated with an increase in likelihood of being a vulnerable road user in the fatality and injury datasets.

2. Null: Being a 15-29 year old is not associated with an increase in likelihood of being a vulnerable road user in the fatality and injury data sets.

   Alternative: Being a 15-29 year old is associated with an increase in likelihood of being a vulnerable road user in the fatality and injury datasets.

3. Null: Driving at night is not associated with an increase in likelihood of being a vulnerable road user in the fatality and injury datasets.

   Alternative: Driving at night is associated with an increase in likelihood of being a vulnerable road user in the fatality and injury datasets.

4. Null: The use of safety equipment is not associated with a reduction in likelihood of being a vulnerable road user in the fatality and injury datasets.

   Alternative: The use of safety equipment is associated with a reduction in likelihood of being a vulnerable road user in the fatality and injury datasets.

5. Null: Rural areas are not associated with an increase in likelihood of being a vulnerable road user in the fatality and injury datasets.

   Alternative: Rural areas are associated with an increase in likelihood of being a vulnerable road user in the fatality and injury datasets.

CHAPTER II: REVIEW OF LITERATURE

The literature for this study focused on the principal risk factors that influence traffic crashes globally. Although there are other possible risk factors that are not included in this literature review, variables that were measured in this study have been specifically focused upon.

2.1 VULNERABLE ROAD USERS

A vulnerable road user is considered to be anyone using a bicycle or a motorcycle, as well as all pedestrians. Several studies have shown that these groups tend to be over-represented among crash victims (Nantulya and Reich, 2003; Peden et al., 2004) and are also at high risk of disability resulting from traffic crashes (Mayou and Bryant, 2003). Much of the burden of vulnerable road user traffic crashes is within the low and middle income countries with pedestrians being the most frequently injured road users in Latin America and the Caribbean (Hijar et al., 2003; Hijar et al., 2004; Odero and Garner, 1997). In Colombia, vulnerable road users account for 68% of traffic fatalities and 66% of the traffic injuries. Pedestrians alone account for more than one-third of traffic deaths (Fondo de Prevención Vial, 2007).

An example of the types of vulnerable road users that are most affected by traffic crashes comes from a study in Mexico. This study found that none of the pedestrians injured in the study had insurance, which typically left payment responsibilities up to the family because the injured person was most often the bread winner of the family (Hijar et al., 2003). Under these circumstances, family members of the victim only stop paying for treatments when all of their assets are gone, consequentially leading the entire family into long-term debt (Pryer, 1989). The individual injured could also lose their job and

continually suffer from health problems because of the inability to continue their treatments (Over et al., 1992).

A reduction in the number of traffic injuries among vulnerable road users in many of the high income countries can be attributed to the reduction of cyclists and pedestrians on highways and streets that has taken place over the last two decades. It is estimated that the number of pedestrian trips per person fell by 20% between 1985 and 1999 in the United Kingdom (Mohan, 2002). Pedestrian traffic fatalities that do occur in these higher income countries are often times linked to alcohol. In the United States for example, pedestrians who are fatally injured are more likely to be drinking than are the drivers and over one-half of all pedestrian fatalities for persons 16 to 60 years of age are alcohol related (Voas, Tippetts, and Fisher, 2000).

A similar decrease of vulnerable road users within middle and low income countries over the next 15 years would not be expected as large portions of the populations in these countries continue to use bicycles, motorcycles, or walking as their main mode of transportation. Therefore, the problems that exist will not be easily resolved and there is a need for prevention or reduction measures to be put in place. First, an injury surveillance system should be established and monitored by professionals in order to monitor the epidemic so that measures such as appropriate legislation and road and vehicle standards can be put in place (Trinca et al., 1988). In order to receive the maximum amount of benefits for resources, safety measures that are likely to work in any location or environment should especially be promoted. Examples include mandatory use of daytime running lights and helmets for motorcycles, the later of which has been

estimated to reduce crash fatalities by 37% (Branas and Knudson, 2001; Chiu et al., 2000; Elvik, 1996; NHTSA, 2008; Radin et al., 1996; Shults et al., 2001).

There is also the need for safety standards for the front ends of motor vehicles in order to minimize the severity of injury that vulnerable road users incur during crashes with four wheeled motor vehicles. Such standards include lower bumpers constructed of softer materials that absorb more of the impact as well as an air bag located on the outside of the car that deploys on impact, protecting the vulnerable road user's cranium during contact with the hood and windshield (Crandall, Bhalla, and Madeley, 2002). Traffic calming measures such as enforcement of lower speed limits have also been shown in the past to lower pedestrian injuries (National Academy of Science, 1984). Measures that separate vulnerable road users from motor vehicle traffic, such as sidewalks and bike paths, have been found to be very effective in reducing crashes in various countries and provide an affordable and sustainable solution for lower income countries (Lott and Lott, 1976; Kuner et al., 1990; Zegeer, 1984; Ossenbruggen et al., 2001).

2.2 GENDER

In Colombia, males accounted for 96% of traffic deaths and 93% of traffic injuries in 2006 (Fondo de Prevención Vial, 2007). Similar patterns exist in other countries as well, with males in Ireland being 10 times more likely to die in a fatal crash than females. A study from the United Kingdom reported that male drivers between the ages of 17-20 are involved in over 4 times as many injury crashes as males overall and almost twice as many accidents as girls their own age (Clarke et al., 2006). In the United States, fatal crashes for young driver male drivers between the ages of 15 to 20 years of

age increased by 5% between 1995 and 2005, while 15 to 20 year old females involved in a fatal crash decreased by 1% during the same time period.(NHTSA, 2007).

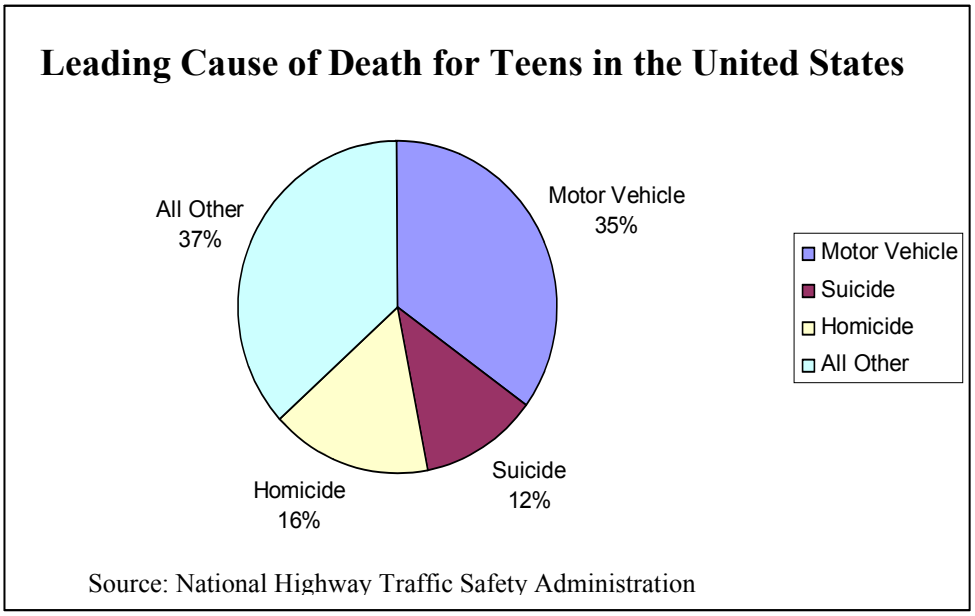
As the number of female drivers and their amount of driving has increased in many western countries (McKenna et al., 1998; Meadows and Stradling, 1999; Popkin, 1991; Vehicle Administration, 1980-1997; Wylie, 1995) the number of accidents by female drivers has increased (Laapotti and Keskinen, 2002; McKenna et al., 1998; VALT, 1980-1999). Even among the high risk 18-24 year old group, one study showed that males and females have approximately the same amount of involvement in injury crashes per million miles traveled. The number of males involved in fatal crashes per million miles traveled, however, far out numbered females (Williams, 2003). Therefore, when taking into account exposure (miles traveled), young males and females have almost the same amount of involvement in overall driver crashes with males being more likely to be involved in serious crashes.

Many studies have concentrated on some of the possible reasons for the differences that exist among male and female drivers. Meadows and Stradling (1999) concluded that females are more safety oriented drivers and Wells-Parker et al. (1996) concluded that women tend to have lower risk profiles. A study from Sweden compared young female and males learning how to drive and found that females study more theory than males and that females practice more driving skills in different environments during supervised training than males (Nyberg and Gregersen, 2007).

2.3 AGE

Those between the ages of 15 to 24 in Colombia account for only 11% of traffic crashes but 19% of traffic fatalities (Fondo de Prevención Vial, 2007). In the United

States the leading cause of death for 15 to 20 year olds are motor vehicle crashes, as driver fatalities rose by 4% between 1995 and 2005 (NHTSA, 2007). A study performed on young drivers in the United Kingdom aged 17-25 years of age found that the younger male drivers in the study, 17-19 years of age, were significantly more likely to be involved in night time accidents, rear end collisions, and rural curve accidents (Clarke et al, 2006). Other studies have also shown that driving experience is a factor in traffic crashes but not to the same level as age (Levy, 1990; Williams et al., 1983). Age has been shown to be very important in terms of the level of crash risk, with the youngest drivers being most at risk (Levy, 1990).



In Finland one study showed that there were differences amongst drivers, depending on their age. Driving for fun or leisure as well as driving during evenings, at night, and with passengers was more typical for young drivers than for middle-aged drivers. The most typical driving for middle-aged drivers was going to and from work. Driving at night was overrepresented in young drivers' fatal accidents as compared to the amount of young drivers' driving at night. For young male drivers slippery road

conditions were overrepresented in self-reported accidents whereas for young females slippery road conditions seemed to increase the propensity for fatal accidents (Laapotti et al, 2006). During the presence of passengers, crash risk has been shown to increase considerably for drivers aged 16 years compared to drivers of the same age with no passengers. The relative risk of death was 1.39 for 16-year old drivers with one passenger, 1.86 for those accompanied by two passengers, and 2.82 for those with three or more passengers (Chen et al., 2000).

Also, at issue within many countries is the increasing amount of older adults (age 65 years and older) that are driving as compared to years past. The United States experienced a 17% increase in older licensed drivers from 1994 to 2004. In 2005 older adults in the United States accounted for 15% of all traffic fatalities and 20% of pedestrian fatalities (NHTSA, 2005). While there is evidence that many older adults restrict their driving because of certain limitations, such as impaired vision, (Ragland et al., 2004) there is also evidence that a significant portion of older drivers do not avoid driving situations that put them at a higher risk of crashing (such as night driving or driving in unfamiliar areas) (Okonkwo et al., 2007).

In the literature, prevention methods studied for reducing traffic injuries or crashes among young drivers varied. One study looked at creating communication messages and special training for young drivers to target their specific areas of need. Messages that use persuasive, emotional messages are the most effective on young drivers (Berg, 2006). If such campaigns are used to promote safety issues, then it would be important to target adolescents even before the legal driving age because there is evidence that shows that safety attitudes are formed at an early age (Berg, 1994). In the

United States the majority of states have instituted a graduated licensing program. Most of these programs consist of three-stage systems in which there is an extended learner period for the new driver to practice under supervision, followed by a period in which the newly licensed driver has restrictions on high risk driving (such as not being able to drive at night, or with a passenger), and then full licensure (Williams, 2005). Graduated licensing programs have been credited with helping to reduce traffic crashes by 20-30% among young adults, as well as a helping to reduce fatal crashes among 16 year olds by 20% (NHTSA, 2007; Shope and Molnar, 2003; Simpson, 2003; Williams et al., 2005).

2.4 NIGHT TIME CRASHES

Almost half of the deaths from traffic crashes occur at night in Colombia and 64% of traffic injuries are at night (Fondo de Prevención Vial, 2007). There are many factors that lead to higher night time risks than daytime risks for drivers (Saunders, 1997). Impaired vision and the inability to see other objects such as fellow drivers or pedestrians beyond the limited range of a vehicle's headlights, present challenges for night time drivers (Leibowitz et al., 1998). Visual problems from oncoming headlights can also be a problem, particularly among older drivers as their night vision and ability to cope with glare from other light sources declines with age (Mortimer and Fell, 1989; Maycock, 1997). As humans tend to be sleepier at night, various studies have looked at the times of night in which the risk of traffic crashes increase, specifically between 12 midnight and 6 A.M. (Horne, 1992). One study in particular found a strong association between sleepiness in car drivers and the risk of a crash in which a car occupant was killed (Connor et al., 2002).

There is also the possibility that the reasons for the occurrence of night time accidents have more to do with the types of people on the road at night and their reasons for driving at night, such as high percentages of young drivers or those that have been out drinking, rather than an actual reduction in visibility (Clarke et al., 2006). Multiple studies have shown that young drivers as compared to more experienced drivers are at an increased risk for more severe crashes, as well as a higher injury and fatality rate when driving at night (Akerstedt and Kecklund, 2001; Dohert et al., 1998; Massie et al., 1995, 1997; Rice et al., 2003; Williams, 1985; Willams and Karpf, 1983; Williams and Lund, 1985). A study by Akerstedt and Kecklund in Sweden in 2001 showed that drivers 18-24 years old had a traffic crash risk that was ten times higher than those 65 years of age or older. In Alberta, Canada a night time roadside survey found that alcohol was detectable in the systems of 13% of drivers tested, with 3% of these drivers being over the blood alcohol legal limit (Belton et al, 2005). A study carried out in the state of Connecticut found that there is substantially less seat belt usage at night than during the day, indicating either a change in behavior by drivers or a change in the types of people that are on the road during the day and at night (Chaudhary and Preusser, 2006).

Several of the more important prevention measures that can be implemented for night time crashes have already been covered in this literature review, including night time driving restrictions for young drivers and legislation and enforcement of drinking and driving laws. Another prevention measure found in the literature is improvement in street lighting which Elvik determined could reduce night time fatalities by as much as 65% and night time injuries by 30% (Elvik, 1995).

2.5 USE OF SAFETY EQUIPMENT

The effectiveness of seat belts has been established in various studies (National Highway Traffic Safety Administration, 1984; Latimer and Lave, 1987; Mueller et al., 1988; Rivara et al., 2000). Seat belts are estimated to reduce serious injuries from motor vehicle crashes by 55% and fatalities by 50% (Forjuoh, 2003). In the United States the use of safety belts has increased by 65% since the early 1980s (National Highway Traffic Safety Administration, 2004). Various studies have attributed this large increase in seat belt usage to seat belt enforcement laws, principally primary enforcement laws that allow for enforcement officers to issue a citation whenever they observe an unbelted passenger or driver (Escobedo et al 1992; Eby et al., 2002; Houston and Richardson, 2002; Centers for Disease and Prevention, 2004; Rivara et al., 1999). Such a large increase in lower income countries would be very difficult to obtain because of the lack of resources that lower income countries have. It is believed that over half of vehicles in many lower income countries do not have functional seat belts and that some vehicles imported from high income countries lack functional seat belts as well (Forjuoh, 2003). In this environment, legislation to require the use of seat belts would be ineffective.

Approximately 45,000 cyclists were injured in traffic crashes in the United States in 2005 and cyclists accounted for about 13 percent of all non-motorist traffic fatalities (NHTSA, 2005). Head injury poses the greatest risk to cyclists, accounting for about three-quarters of deaths and one-third of emergency department visits (Baker, 1993; Bjornstig, 1992; Elkman, 1997; Friede, 1985; Thompson, 1989; Sacks, 1991). A study from Singapore showed that wearing a helmet while bicycling is associated with a reduction in head and facial injuries as well as a lower Injury Severity Score (ISS) (Heng

et al., 2006). A study that looked at the effectiveness of legislation on mandatory helmet use among youth up to 16 years old credit the helmet ordinance as well as public awareness of helmet use as the principal contributors to a decrease in head injuries (Pardi et al., 2007).

Mandatory helmet laws for motorcyclists in the United States led to an estimated 20-30% reduction in crash injuries (World Health Organization, 2004). The fatality rate per 100,000 in Colombia was reduced from 9.7 in 1995 to 3.6 in 2001 after helmet laws were introduced in 1996 (Espitia-Hardeman et. al, 2008). Other countries also experienced similar results such as in Malaysia where there was a 30% reduction in motorcycle deaths after a new helmet law was implemented. Mandatory helmet laws for motorcyclists are critical in places such as Asia, where motorcycles are often times used as a family vehicle. Laws making the use of helmets mandatory while driving a motorcycle can dramatically increase the use of helmets by motorcyclists. In Italy, helmet use increased by 76% within two years after a helmet law was implemented (World Health Organization, 2004).

As motorcycles are relatively inexpensive and easy to use the group most likely to use motorcycles and in turn incur more motorcycle crashes are, young adults (Reeder et al., 1996). A study from Sweden reported that the likelihood of being injured in a motorcycle crash peaked at age 17 and decreased thereafter. The same study also linked parental socio-economic status with motorcycle crashes. Sixteen year olds whose parents were self employed ran a 2.5 times greater risk of being involved in a motorcycle crash,

compared to other 16 year olds whose parents belonged to the highest socio-economic category (Zambon and Hasselberg, 2006).

In Mexico, a study was carried out in which parents from 3 different socioeconomic strata were interviewed on their knowledge and practice of childhood safety. The differences among socioeconomic groups were most pronounced among the use of safety devices (such as car seats) and transportation. The authors suggest that social marketing could be used as a tool to improve childhood safety among these groups as well as making safety devices more readily available (reduction in price, available in more stores) (Mock et al., 2002). A study investigating whether seat belts were as effective on children as adults, found that children wearing seatbelts were 2-10 times safer than those not wearing seat belts. The authors also reported that 40% of children in their study were not wearing seat belts (Halman et al., 2002).

2.6 RURAL VERSUS URBAN AREAS

In 2006, the fatality rate per 100 million vehicle miles traveled was reported as being 2.4 times higher in rural areas of the United States as compared to urban areas (NHTSA, 2008). Investigations that were carried out in the 1980s in several different states found that rural traffic injury fatality rates were higher than urban rates (Grunby, 1989; Leicht, 1986). Studies from other countries have documented higher occurrences of traffic crash fatalities in urban areas as well. A study in Ghana reported that the majority of traffic fatalities and injuries occurred in rural areas and that the crashes that occurred on rural roads were generally more severe (Afukaar et al., 2003). In Taiwan researchers found that both males and females had higher standardized mortality ratios in rural areas (Yancy et al., 1997) and a study in Quebec, Canada found that severe crashes

are more common in rural areas (Thouez et al., 1991). In Colombia, close to 8% of rural crashes are fatal, while less than 2% of urban crashes result in a fatality (Fondo de Prevención Vial, 2007)

Many different explanations are available in the literature as to why such differences between urban and rural areas occur. One such explanation is that rural crash victims may not receive medical attention as quickly as their urban counterparts because the crashes often occur in remote areas (Muelleman and Mueller, 1996; Muelleman et al., 1993; Mueller et al., 1988; Bentham, 1986; Clark, 2003). Another explanation is that rural roads may not be as safe as urban roads, with some lacking guardrails, traffic control devices, and traffic law enforcement. Combining the lack of sufficient traffic law enforcement with higher speed limits often times means that traffic crashes in rural areas are more severe than those in urban areas (Zwerling, 2005).

2.7 USE OF ALCOHOL

On average, ten traffic crashes occur daily and four deaths occur weekly as a result of alcohol use in Colombia (Fondo de Prevención Vial, 2007). Studies have shown that alcohol can increase the seriousness of injuries in traffic crashes as well as the chance of being involved in a crash (Segui-Gomez et al., 2007). In 2005, about 39% of all traffic fatalities and 254,000 injuries were attributed to crashes in the United States in which alcohol was involved (NHTSA, 2007). Almost all adult Americans drive and about a quarter of these drivers admit to consuming alcoholic beverages within two hours of driving a motor vehicle (Gallup, 2001). A report prepared for the United States National Highway Traffic Safety Administration concluded that many of the features of

drunk driving were similar across differing ethnic groups (Voas, Tippetts, and Fisher, 2007).

High levels of drinking and driving have also been found in other countries as well. A study carried out in Spain found that 53% of participants reported "never" drinking and driving, with 30% of the participants actually acknowledging that they drink and drive "sometimes" (Segui-Gomez et al, 2007). In Mexico a study collecting data from traffic crash victims found that 9.4% of participants had consumed alcohol in the previous six hours. The same study found that a quarter of those that suffered from severe injuries had consumed alcohol (Hijar et al, 1998). A study carried out in Auckland, New Zealand found that 30% of car crash injuries in their study population were attributable to alcohol and concluded that drinking alcohol before driving was strongly associated with injury crashes (Connor, 2004).

Most of the successful prevention measures for drunk driving involve the enactment of laws and their enforcement. Laws that lower the legal limit of the driver's blood alcohol concentration (BAC) in combination with enforcement have been shown to reduce drunk driving. Setting low BAC levels, such as 0.05% or lower, have been shown to significantly reduce alcohol-related driving fatalities (Shults et al., 2001). Once drunk drivers have been caught, it is important that their punishment be swift. One way in which this is achieved is by suspension of the driver's license once the police citation has been given, then followed up by therapy or counseling to counter the potential for relapse (McKnight and Voas, 2001; Homel, 1981; Wells-Parker et al., 1995). A group specifically at risk for drinking and driving are young drivers because of their inexperience driving and tendency to experiment with drinking. Common preventive

measures such as school based programs have largely been found to be ineffective (Barbor et al., 2003). More effective measures include the use of graduated licensing programs for young drivers as well as legislation that increases the minimum age in which one can obtain their driver's license and consume alcohol (Barbor et al., 2003; Ulmer et al., 2000).

2.8 COLOMBIA

The country of Colombia is located in South America and borders five different countries as well as both the Pacific Ocean and the Caribbean Sea. The democratic country, with its 45,000,000 inhabitants, is divided into 32 departments. Pasto is the capital city of one of Colombia's southern most Departments, Nariño. Pasto has a population of over 400,000 people and is known for having one of Colombia's most frequently active volcanoes, Galeras (CIA, 2008).

Traffic injuries are one of the leading causes of morbidity and mortality in Colombia. In 1995 the Colombian government began to target the high rates of traffic injuries by implementing programs and policies, such as road safety campaigns, road improvements, and creation of a new mass transit system. The programs have made an impact as traffic fatalities in Colombia dropped from 7, 874 in 1995 to 6,063 in 2002. The reduction of fatal crashes in Bogotá, the capital of Colombia, was even more dramatic going from 1,387 in 1995 to 697 in 2002. Bogotá has benefited from the implementation of programs such as mandatory closing of alcohol serving establishments by 1:00A.M. and programs that restrict driving in the city at certain hours and days (Rodriguez et al. 2003) .

Although progress is being made in Colombia there was still a four-fold increase in traffic related injuries from the year 1986 to the year 2000, while fatalities during the same period almost doubled. A large percentage of these high numbers can be attributed to pedestrians, making up 40% of the fatalities and 32% of the injured. Pedestrian traffic injuries in Colombia are concentrated in the urban areas of the country, indicating a need for more effective intervention programs targeting pedestrians in these areas (Rodríguez et al., 2003; INMLyCF, 2001).

Please see Appendix A for a map of Colombia showing the location of Pasto.

CHAPTER III: METHODS AND PROCEDURES

3.1 SOURCE OF DATA

The data for this project came from an injury surveillance system in Pasto, Colombia that includes fatal and nonfatal injuries. This surveillance system was implemented in various hospitals in Colombia, El Salvador, and Nicaragua through collaboration of the Pan American Health Organization, the Centers for Disease Control and Prevention, as well as the Ministry of Health in each of the three countries. During implementation of the surveillance system special forms were prepared for injury data collection. The first form is the Injury Surveillance System in Emergency Room Clinical Report and hereafter will be referred to as the ISS Clinical Report (see Appendix B) and the second form is the Traffic Accident Fatality Form (see Appendix C). Upon presentation of a case in the hospital Emergency Room, personnel in the Emergency Department completed the ISS Clinical Report and forwarded it on to the Statistical Office of the hospital for data entry. The Traffic Accident Fatality Form was completed for those sustaining fatal injuries from the traffic crash. The following two paragraphs will act as a rough translation of the ISS Clinical Report and Traffic Accident Fatality Form from Spanish to English.

The ISS Clinical Report collects identifying information as well as information about the injury or event that occurred. In the first section of the report "Datos De Identificación" the following information is recorded: Name, Age, Sex, Occupation, Education, Insurance, Address, and Telephone number of the person injured. The second section "Datos Generales Del Evento" is where the general event data is recorded and includes the following data: Address where the event occurred, Date and hour of the

event, Intentionality of the event (accident, suicide, violence), Place where the event occurred (including but not limited to at school, home, work, street, or bar), Activity the injured person was performing when the event occurred, Cause/Mechanism of the injury (including but not limited to a traffic crash, fall, burn, gun shot), Alcohol use, and Drug use. The third section of the ISS Clinical Form "Datos Específicos Del Evento" is where specific data from the event is recorded and includes data on both traffic injuries and violence. Only the traffic injury data or "Lesión De Transito/Transporte" will be used in this study and the following traffic injury data was recorded in Section 3: Type of transportation being used by the injured person during the event (including but not limited to pedestrian, bicycle, motorcycle, car, bus, taxi), Counterpart in the event (fixed object or another vehicle or person), Role of the injured person (pedestrian, driver, or passenger), and the Use of safety equipment.

The Traffic Accident Fatality Form or "Ficha Para Muertes En Accidentes De Transito" collects data surrounding the occurrence of the traffic fatality. The following data is collected on the form: Name, Sex, Age, and Occupation of the victim; Date, Time, and Address where the event occurred; Number of fatal victims in the same event; Type of traffic accident (including but not limited to a collision with a fixed or moving object, pedestrian struck, or a overturned vehicle); Role of the victim during the event (Including but not limited to: Driver of the vehicle, passenger, pedestrian); Use of safety equipment; Type of vehicles involved in the event for both the victim and the counterpart involved (motorized vehicles, bicycle, motorcycle, pedestrian); Type of transportation used (private, public, official); Alcohol level of the victim.

3.2 POPULATION

Two years of data, 2005-2006, were used in this study. All of the data was received from Pasto, Columbia in the form of four Microsoft Excel spread sheets. The two ISS Clinical Report Form spreadsheets were converted into SPSS version 16.0 and merged, leaving a total of 11,726 injury cases for the combined years of 2005 and 2006. All injury cases except for transport injury cases were deleted, leaving a total of 4,621. In order to ensure that there were not duplicate cases within the injury and fatality data, seven additional injury cases with a destination of morgue on the ISS Clinical Report Form were removed, bringing the final total of injury cases for the combined years 2005 and 2006 to 4,614. The same process was repeated for the fatality data, as the two Traffic Accident Fatality Form spreadsheets were converted into SPSS version 16.0 and merged, for a total of 106 cases of traffic fatalities for the years 2005 and 2006. The two data sets were merged together for a total of 4,720 cases.

3.3 STUDY VARIABLES

The primary dependant variable in this study was being the victim of a traffic fatality and was used to investigate the merged data set of traffic injuries and traffic fatalities. The secondary dependant variable in this study was being a vulnerable road user and was used to investigate the traffic injury and traffic fatality data sets separately. The independent variables used to investigate all three of the data sets include gender, age, month, day of week, time of day, safety equipment used, type of victim transport, public or other transportation, counterpart transport, and location of the traffic crash. Independent variables that were only available in the injury data set are alcohol use and site of bodily injury.

When merging the data sets of traffic injuries and traffic fatalities, differences between the data collection forms used to obtain the two types of data, required that certain variables be modified in order for them to be merged by SPSS 16.0. The variables "Type of Transport" and "User" from the ISS Clinical Report Form were combined to make them identical to the variable "Victim Characteristics" on the Traffic Accident Fatality Form. The case responses in the variable "Protective Equipment Used" from the Traffic Accident Fatality Form, were changed to "Yes", "No" or "N/A" so that it could be merged with a similar variable from the ISS Clinical Report Form. The variable for public transportation was created with the knowledge that public transportation in Pasto, Columbia consists of taxis, buses and minibuses. All other forms of transportation on the ISS Clinical Report Form were combined as "Other". The variable "Type of Service" from the Traffic Accident Fatality Form contained the data for public transportation for the fatality cases and the responses were recategorized into "Public" or "Other". The variable "Vulnerable Road Users" was created using the victim transportation variable from both data forms. The vulnerable road users group consists of pedestrians, bicycles, motorcycles, and animal or buggy users. The nonvulnerable road users includes automobiles, specifically, cars, trucks, buses, and minibuses or vans.

3.4 STATISTICAL ANALYSES

Statistical analyses were performed in this study using SPSS version 16.0. All variables in this study were converted into categorical data and percentages were calculated for each group. Univariate and multivariate logistic regression analyses were first performed on the merged injury and fatality data to determine the factors that are

associated with traffic crash mortality. The same analyses were then completed separately on the injury and fatality data to estimate the factors that are associated with being a vulnerable road user. The first, or lowest category, was always used as the reference category for each of the independent variables. In these analyses no univariate or multivariate regression models were completed on the independent variables "Victim Transport" and "Counterpart Transport" because the data from these variables was the same as that of the dependent variable of "Vulnerable Road User". Odds ratios, 95% confidence intervals, and p-values were reported for all regression analyses. Prevalence and mortality rates were also calculated using census data from Pasto, Colombia. Case-fatality rates were calculated using the total number of crashes in Pasto, Colombia.

3.5 DEFINITIONS

(Spanish word used on the ISS Clinical Report listed in parenthesis.)

Vulnerable Road Users in this study are defined as anyone using the following forms of transportation: Pedestrian (peatón), bicycle (bicicleta), motorcycle (motocicleta), animal or buggy (carreta/animal).

Nonvulnerable Road Users in this study are defined as anyone driving an automobile.

Automobiles in this study are defined as anyone using a car (automóvil), truck (camioneta), bus (camión), minibus/van (bus/microbús), or taxi (taxi).

Daytime Driving in this study is defined as driving between the hours of 0600-1759.

Nighttime Driving in this study is defined as driving between the hours of 1800-0559.

Counterpart Transport in this study refers to the type of transportation used by the opposing person that was involved in the crash with the victim.

CHAPTER IV: RESULTS

4.1 INJURY AND FATALITY DATA

The descriptive characteristics of the injury and fatality data are presented in Tables 1A and 1B. Vulnerable road users accounted for 84% of both the injury and fatality data sets. Males consisted of 69% of the overall total and 80% of the traffic fatalities. The three youngest age group categories combined to make up 84% of the injury data but just 61% of the fatality data. The months of October through December are when 21% of injuries occurred and 35% of fatalities. Thirty-four percent of injuries occurred on Saturdays and Sundays, while 52% of fatalities happened on these days. Only 7% of fatality cases used safety equipment, increasing to 32% of injury cases. Pedestrians made up 44% of fatality cases yet only 26% of injury cases. All counterpart transportation used was either an automobile or a motorcycle for the fatality cases. Ninety percent of injuries occurred in Urban Pasto, while only 70 % of fatalities occurred there.

The results of the univariate analysis of the independent variables and their relationship to traffic fatalities are presented in Tables 2A and 2B. The univariate analysis indicate that there was a 1.85 times increased odds of males being involved in a fatal traffic crash as compared to females ($p<0.001$). The three oldest age groups all have an increased odds ($p=0.001$ and $p<0.001$) of being in a fatal crash as compared to the youngest age group. Fatal traffic crashes have a 2.04 times increased odds of occurring in the months of October through December ($p=0.013$) as compared to January through March, while a traffic fatality occurring on Saturday has a 2.02 times increased odds as compared to Monday. The use of safety equipment was a protective factor against being

in a fatal crash (p=0.003). Those using bicycles or motorcycles as a mode of transport all had a decreased odds of being in a traffic fatality as compared to pedestrians while those using public transportation had a 2.61 times increased odds of being involved in a fatal traffic crash as compared to other types of transportation (p=0.008). Fatal traffic crashes had increased odds of occurring in rural Pasto as compared to urban Pasto (p<0.001).

The results of the multivariate analysis of the independent variables and their relationship to traffic fatalities are presented in Tables 3A and 3B. In the multivariate analysis males have a 2.16 times increased odds of being involved in a fatal traffic crash as females (p=0.042). As found in the univariate analysis using public transportation increased the odds of being involved in a fatal crash (p=0.039). Fatal traffic crashes also had increased odds of occurrence in rural Pasto as compared to urban Pasto (p<0.001). No other independent variables were statistically significant in the multivariate analysis.

Rates were also calculated in this study and are presented in Tables 4, 5, and 6. In 2006, the injury rate for males per 100,000 was 799.84, over twice the female injury rate of 361.87. The traffic fatality rate for males was also much higher in 2006, 17.21 as compared to 4.16. The traffic fatality rate was highest for those 60 years of age and above. The case fatality rate for 2006 was 2924.68 per 100,000.

Descriptive Characteristics of Factors Influencing Traffic Mortality in Pasto, Colombia: 2005-2006

Table 1A

	TOTAL	INJURY	FATALITY
VARIABLE	**NUMBER (%)**	**NUMBER (%)**	**NUMBER (%)**
TOTAL NUMBER	**4720 (100)**	**4614 (100)**	**106 (100)**
GENDER	**4707 (100)**	**4601 (100)**	**106 (100)**
FEMALE	1463 (31)	1442 (31)	21 (20)
MALE	3244 (69)	3159 (69)	85 (80)
AGE	**4625 (100)**	**4519 (100)**	**106 (100)**
0-14	952 (21)	939 (21)	13 (12)
15-29	1930 (42)	1901 (42)	29 (27)
30-44	985 (21)	962 (21)	23 (22)
45-59	462 (10)	442 (10)	20 (19)
60-74	208 (4)	193 (4)	15 (14)
≥75	88 (2)	82 (2)	6 (6)
MONTH	**4709 (100)**	**4603 (100)**	**106 (100)**
JAN-MARCH	1046 (22)	1027 (22)	19 (18)
APRIL-JUNE	1311 (28)	1284 (28)	27 (25)
JULY-SEPT	1333 (28)	1310 (28)	23 (22)
OCT-DEC	1019 (22)	982 (21)	37 (35)
DAY	**4702 (100)**	**4596 (100)**	**106 (100)**
MON	588 (13)	576 (13)	12 (11)
TUE	535 (11)	526 (11)	9 (8)
WED	619 (13)	616 (13)	3 (3)
THU	663 (14)	651 (14)	12 (11)
FRI	707 (15)	692 (15)	15 (14)
SAT	792 (17)	760 (17)	32 (30)
SUN	798 (17)	775 (17)	23 (22)
TIME	**4403 (100)**	**4299 (100)**	**104 (100)**
0000-0559	1317 (30)	1295 (30)	22 (21)
0600-1159	970 (21)	941 (21)	29 (28)
1200-1759	1272 (29)	1248 (29)	24 (23)
1800-2400	844 (19)	815 (19)	29 (28)

Descriptive Characteristics of Factors Influencing Traffic Mortality in Pasto, Colombia: 2005-2006

Table 1B

	TOTAL	INJURY	FATALITY
VARIABLE	**NUMBER (%)**	**NUMBER (%)**	**NUMBER (%)**
TOTAL NUMBER	**4720 (100)**	**4614 (100)**	**106 (100)**
SAFETY EQUIPMENT USED	**3339 (100)**	**3297 (100)**	**42 (100)**
NO	2285 (68)	2246 (68)	39 (93)
YES	1054 (32)	1051 (32)	3 (7)
VICTIM TRANSPORT	**4304 (100)**	**4199 (100)**	**105 (100)**
AUTO. DRIVER	199 (5)	194 (5)	5 (5)
AUTO. PASSENGER	454 (11)	441 (11)	13 (12)
MOTO. DRIVER	1180 (27)	1157 (28)	23 (22)
MOTO. PASSENGER	572 (13)	562 (13)	10 (10)
PEDESTRIAN	1140 (26)	1094 (26)	46 (44)
BICYCLE	727 (17)	719 (17)	8 (8)
OTHER	32 (1)	32 (1)	0 (0)
VICTIM TRANSPORT	**4425 (100)**	**4347 (100)**	**78 (100)**
OTHER TRANSPORT	4209 (95)	4140 (95)	69 (88)
PUBLIC TRANSPORT	216 (5)	207 (5)	9 (12)
COUNTERPART TRANSPORT	**2938 (100)**	**2850 (100)**	**88 (100)**
AUTOMOBILE	2156 (73)	2085 (73)	71 (81)
MOTORCYCLE	584 (20)	567 (20)	17 (19)
BICYCLE	79 (3)	79 (3)	0 (0)
PEDESTRIAN	119 (4)	119 (4)	0 (0)
VULNERABLE ROAD USER	**4437 (100)**	**4333 (100)**	**104 (100)**
NO	703 (16)	686 (16)	17 (16)
YES	3734 (84)	3647 (84)	87 (84)
LOCATION	**4432 (100)**	**4326 (100)**	**106 (100)**
URBAN PASTO	3948 (89)	3874 (90)	74 (70)
RURAL PASTO	484 (11)	452 (10)	32 (30)

Univariate Analysis of Factors Influencing Traffic Mortality in Pasto, Colombia: 2005-2006

Table 2A

VARIABLE	O.R.	95% C.I.	P-VALUE
GENDER			
FEMALE	Ref	Ref	Ref
MALE	1.85	1.14---2.99	<0.001
AGE			
0-14	Ref	Ref	Ref
15-29	1.10	0.57---2.13	0.770
30-44	1.73	0.87---3.43	0.119
45-59	3.27	1.61---6.63	0.001
60-74	5.61	2.63---11.99	<0.001
≥75	5.29	1.96---14.27	0.001
MONTH			
JAN-MARCH	Ref	Ref	Ref
APRIL-JUNE	1.14	0.63---2.06	0.672
JULY-SEPT	0.95	0.51---1.75	0.867
OCT-DEC	2.04	1.16---3.57	0.013
DAY			
MON	Ref	Ref	Ref
TUE	0.82	0.34---1.97	0.658
WED	0.23	0.07---0.83	0.025
THU	0.89	0.39---1.99	0.767
FRI	1.04	0.48---2.24	0.919
SAT	2.02	1.03---3.96	0.04
SUN	1.43	0.70---2.89	0.326
TIME			
0600-1759	Ref	Ref	Ref
1800-0559	0.99	0.68---1.47	0.99

Univariate Analysis of Factors Influencing Traffic Mortality in Pasto, Colombia: 2005-2006

Table 2B

VARIABLE	O.R.	95% C.I.	P-VALUE
SAFETY EQUIPMENT USED			
NO	Ref	Ref	Ref
YES	0.16	0.05---0.53	0.003
VICTIM TRANSPORT			
PEDESTRIAN	Ref	Ref	Ref
BICYCLE	0.27	0.12---0.56	0.001
MOTO. DRIVER	0.47	0.29---0.79	0.004
MOTO. PASSENGER	0.42	0.21---0.85	0.015
AUTO. DRIVER	0.61	0.24---1.56	0.305
AUTO. PASSENGER	0.7	0.38---1.31	0.266
VICTIM TRANSPORT			
OTHER TRANSPORT	Ref	Ref	Ref
PUBLIC TRANSPORT	2.61	1.28---5.30	0.008
COUNTERPART TRANSPORT			
AUTOMOBILE	Ref	Ref	Ref
MOTORCYCLE	0.88	0.51---1.51	0.642
BICYCLE	***	***	***
PEDESTRIAN	***	***	***
VULNERABLE ROAD USER			
NO	Ref	Ref	Ref
YES	0.96	0.57---1.63	0.887
LOCATION			
URBAN PASTO	Ref	Ref	Ref
RURAL PASTO	3.71	2.42---5.68	<0.001

Multivariate Analysis of Factors Influencing Traffic Mortality in Pasto, Colombia: 2005-2006

Table 3A

VARIABLE	O.R.	95% C.I.	P-VALUE
GENDER			
FEMALE	Ref	Ref	Ref
MALE	2.16	1.03---4.53	0.042
AGE			
0-14	Ref	Ref	Ref
15-29	0.84	0.32---2.20	0.719
30-44	1.00	0.37---2.75	0.994
45-59	2.02	0.72---5.69	0.182
60-74	2.02	0.61---6.65	0.248
≥75	1.28	0.27---6.09	0.755
MONTH			
JAN-MARCH	Ref	Ref	Ref
APRIL-JUNE	0.98	0.38---2.55	0.973
JULY-SEPT	0.45	0.16---1.23	0.119
OCT-DEC	1.99	0.83---4.79	0.124
DAY			
MON	Ref	Ref	Ref
TUE	0.81	0.22---3.03	0.757
WED	0.33	0.06---1.72	0.188
THU	1.24	0.41---3.79	0.706
FRI	0.96	0.32---2.93	0.945
SAT	2.22	0.83---5.95	0.112
SUN	0.94	0.31---2.83	0.905
TIME			
0600-1759	Ref	Ref	Ref
1800-0559	1.08	0.59---1.96	0.815

Multivariate Analysis of Factors Influencing Traffic Mortality in Pasto, Colombia: 2005-2006

Table 3B

VARIABLE	O.R.	95% C.I.	P-VALUE
SAFETY EQUIPMENT USED			
NO	Ref	Ref	Ref
YES	0.29	0.08---1.09	0.07
VICTIM TRANSPORT			
PEDESTRIAN	Ref	Ref	Ref
BICYCLE	0.74	0.28---1.98	0.554
MOTO. DRIVER	0.69	0.28---1.72	0.421
MOTO. PASSENGER	0.81	0.29---2.29	0.696
AUTO. DRIVER	***	***	***
AUTO. PASSENGER	***	***	***
VICTIM TRANSPORT			
OTHER TRANSPORT	Ref	Ref	Ref
PUBLIC TRANSPORT	5.39	1.09---26.78	0.039
COUNTERPART TRANSPORT			
AUTOMOBILE	Ref	Ref	Ref
MOTORCYCLE	0.97	0.46---2.04	0.926
BICYCLE	***	***	***
PEDESTRIAN	***	***	***
VULNERABLE ROAD USER			
NO	Ref	Ref	Ref
YES	***	***	***
LOCATION			
URBAN PASTO	Ref	Ref	Ref
RURAL PASTO	5.92	3.00---11.71	<0.001

Traffic Injury Rates in Pasto, Colombia per 100,000

Table 4

	YEAR 2005			YEAR 2006		
VARIABLES	**TOTAL INJURIES**	**POPULATION**	**INJURY RATE**	**TOTAL INJURIES**	**POPULATION**	**INJURY RATE**
GENDER						
FEMALE	660	212,659	310.36	782	216,099	361.87
MALE	1440	211,624	680.45	1719	215,042	799.84
TOTAL	2110	424,283	494.95	2504	431,141	580.32
AGE						
0-14	461	124,561	370.10	478	127,300	375.49
15-29	840	140,581	597.52	1061	141,199	751.42
30-44	438	84,879	516.03	524	86,746	604.06
45-59	207	46,442	445.72	235	47,464	495.11
60+	130	27,820	467.29	146	28,432	513.51
TOTAL	2076	424,283	489.30	2444	431,141	566.87

Traffic Fatality Rates in Pasto, Colombia per 100,000

Table 5

	YEAR 2005			YEAR 2006		
VARIABLES	**TOTAL FATALITIES**	**POPULATION**	**FATALITY RATE**	**TOTAL FATALITIES**	**POPULATION**	**FATALITY RATE**
GENDER						
FEMALE	12	212,659	5.64	9	216,099	4.16
MALE	48	211,624	22.68	37	215,042	17.21
TOTAL	60	424,283	14.14	46	431,141	10.67
AGE						
0-14	11	124,561	8.83	2	127,300	1.57
15-29	15	140,581	10.67	14	141,199	10.62
30-44	14	84,879	16.49	9	86,746	16.14
45-59	8	46,442	17.23	12	47,464	16.85
60+	12	27,820	43.13	9	28,432	42.21
TOTAL	60	424,283	14.14	46	431,141	10.67

Case Fatality Rates of Traffic Crashes in Pasto, Colombia per 100,000

Table 6

	TOTAL FATALITIES	TOTAL CRASHES	CASE FATALITY RATE
YEAR 2005	60	1,353	4434.59
YEAR 2006	46	1,573	2924.35
TOTAL	106	2,926	3622.69

4.2 VULNERABLE ROAD USER DATA

The descriptive characteristics of the vulnerable road user data are presented in Tables 7A through 8B. Overall, vulnerable road users made up 84% of both injuries and fatalities. Males consisted of 70% of the vulnerable road users in the injury data and 84% of vulnerable road users in the fatality data. The three youngest age groups combined to make up 86% of vulnerable road users in the injury data and 59% of vulnerable road users in the fatality data. Thirty-two percent of injuries and 51% of fatalities occurred to vulnerable road users on Saturdays and Sundays. Only 9% of vulnerable road users used safety equipment in the fatality data but 32% in the injury data did so. In regards to location, 91% of vulnerable road user injuries occurred in urban Pasto and 74% of fatalities. There was a lower percentage of alcohol use in the vulnerable road user injury group as compared to the nonvulnerable road user group, 10% and 17% respectively. There were many more head, face, and eye injuries in the vulnerable road user injury group, 45%, than in the nonvulnerable road user injury group, 13%.

The results of the univariate analysis of the independent variables and their relationship to being a vulnerable road user are presented in Tables 9A and 9B. Male gender was associated with and increased odds of being a vulnerable road user as compared to females, in both the injury and fatality data sets. All age categories from 30 to 74 within the injury data set were associated with decreased odds of being a vulnerable road user as compared 0 to 14 year olds. Those between the ages of 15 to 29 in the fatality data set had an 8.13 times increased odds ($p=0.024$) of being a vulnerable road user as compared to 0 to 14 year olds. Vulnerable road user traffic crash injuries during the months of July through December had a 1.51 times increase odds of occurrence, as

compared to the months of January through March (p=0.001). There was a decrease in odds of vulnerable road users being involved in a crash during night hours as compared to daytime hours. There was a 2.48 times increased odds (p=<0.001) of a vulnerable road user being involved in a traffic crash injury in urban Pasto as compared to rural Pasto and a decreased odds of suffering lower or upper extremity injuries as compared to head, face or eye injuries.

The results of the multivariate analysis of the independent variables and their relationship to being a vulnerable road user are presented in Tables 10A and 10B. All age groups in the injury data set showed decreased odds of a vulnerable road user being involved as compared to those between the ages of 0-14. The only group that did not reach statistical significance was the 60-74 year old group. A traffic crash injury involving a vulnerable road user had decreased odds of occurrence at night as compared to during the day. There were decreased odds of a vulnerable road user injury crash occurring in rural Pasto (p=0.001) as compared to urban Pasto. Being a vulnerable road user was shown to be protective against injuries to the lower and upper extremities as well as to the abdomen, thorax and pelvis. None of the independent variables in the multivariate analysis of the fatality data set reached any level of statistical significance.

Descriptive Characteristics of Vulnerable Road Users Involved in Traffic Crashes Resulting in Injury in Pasto, Colombia

Table 7A

	TOTAL INJURIES	VULNERABLE	NONVULNERABLE
VARIABLE	**NUMBER (%)**	**NUMBER (%)**	**NUMBER (%)**
TOTAL NUMBER	**4614 (100)**	**3647 (100)**	**686 (100)**
GENDER	**4601 (100)**	**3637 (100)**	**683 (100)**
FEMALE	1442 (31)	1096 (30)	257 (38)
MALE	3159 (69)	2541 (70)	426 (62)
AGE	**4519 (100)**	**3581 (100)**	**668 (100)**
0-14	939 (21)	780 (22)	103 (15)
15-29	1901 (42)	1560 (44)	248 (37)
30-44	962 (21)	714 (20)	178 (27)
45-59	442 (10)	312 (9)	96 (14)
60-74	193 (4)	145 (4)	34 (5)
≥75	82 (2)	70 (2)	9 (1)
MONTH	**4603 (100)**	**3640 (100)**	**684 (100)**
JAN-MARCH	1027 (22)	793 (22)	190 (28)
APRIL-JUNE	1284 (29)	988 (27)	199 (29)
JULY-SEPT	1310 (28)	1067 (29)	169 (25)
OCT-DEC	982 (21)	792 (22)	126 (18)
DAY	**4596 (100)**	**3636 (100)**	**681 (100)**
MON	576 (13)	450 (12)	95 (14)
TUE	526 (11)	439 (12)	57 (8)
WED	616 (13)	485 (13)	91 (13)
THU	651 (14)	528 (15)	91 (13)
FRI	692 (15)	553 (15)	103 (15)
SAT	760 (17)	593 (16)	111 (16)
SUN	775 (17)	588 (16)	133 (20)
TIME	**4299 (100)**	**3411 (100)**	**634 (100)**
0000-0559	1295 (30)	969 (28)	262 (41)
0600-1159	941 (21)	778 (23)	116 (18)
1200-1759	1248 (29)	1029 (30)	144 (23)
1800-2359	815 (19)	635 (19)	112 (18)

Descriptive Characteristics of Vulnerable Road Users Involved in Traffic Crashes Resulting in Injury in Pasto, Colombia

Table 7B

	TOTAL INJURIES	VULNERABLE	NONVULNERABLE
VARIABLE	**NUMBER (%)**	**NUMBER (%)**	**NUMBER (%)**
SAFETY EQUIPMENT USED	**3297 (100)**	**2801 (100)**	**479 (100)**
NO	2246 (68)	1899 (68)	336 (70)
YES	1051 (32)	902 (32)	143 (30)
VICTIM TRANSPORT	**4199 (100)**	**3556 (100)**	**636 (100)**
PEDESTRIAN	1094 (26)	1093 (31)	0 (0)
BICYCLE	719 (17)	719 (20)	0 (0)
MOTO. DRIVER	1157 (28)	1157 (33)	0 (0)
MOTO. PASSENGER	562 (13)	562 (16)	0 (0)
AUTO. DRIVER	194 (5)	0 (0)	194 (31)
AUTO. PASSENGER	441 (11)	0 (0)	441 (69)
OTHER	32 (1)	25 (1)	0 (0)
VICTIM TRANSPORT	**4347 (100)**	**3647 (100)**	**686 (100)**
PUBLIC TRANSPORT	207 (5)	0 (0)	207 (30)
OTHER TRANSPORT	4140 (95)	3647 (100)	479 (70)
COUNTERPART TRANSPORT	**3986 (100)**	**3347 (100)**	**619 (100)**
AUTOMOBILE	2085 (52)	1748 (52)	329 (53)
MOTORCYCLE	567 (14)	541 (16)	23 (4)
BICYCLE	79 (2)	70 (2)	9 (1)
PEDESTRIAN	119 (3)	88 (3)	29 (5)
FIXED OBJECT	518 (13)	396 (12)	118 (19)
NO COUNTERPART	484 (12)	408 (12)	74 (12)
OTHER	134 (3)	96 (3)	37 (6)
LOCATION	**4326 (100)**	**3459 (100)**	**612 (100)**
RURAL PASTO	452 (10)	313 (9)	121 (20)
URBAN PASTO	3874 (90)	3146 (91)	491 (80)
ALCOHOL USE	**3122 (100)**	**2448 (100)**	**459 (100)**
NO	2769 (89)	2200 (90)	381 (83)
YES	353 (11)	248 (10)	78 (17)
SITE OF BODILY INJURY	**3416 (100)**	**2963 (100)**	**245 (100)**
HEAD/FACE/EYES	1425 (42)	1321 (45)	32 (13)
LOWER/UPPER EXTREMITIES	1718 (50)	1394 (47)	206 (84)
NECK/BACK/SPINAL COLUMN	56 (2)	42 (1)	2 (1)
ABDOMEN/THORAX/ PELVIS	217 (6)	206 (7)	5 (2)

Descriptive Characteristics of Vulnerable Road Users Involved in Traffic Crashes Resulting in Fatality in Pasto, Colombia

Table 8A

	TOTAL FATALITIES	VULNERABLE	NONVULNERABLE
VARIABLE	**NUMBER (%)**	**NUMBER (%)**	**NUMBER (%)**
TOTAL NUMBER	**106 (100)**	**85 (100)**	**16 (100)**
GENDER	**106 (100)**	**85 (100)**	**16 (100)**
FEMALE	21 (20)	14 (16)	7 (44)
MALE	85 (80)	71 (84)	9 (56)
AGE	**106 (100)**	**87 (100)**	**17 (100)**
0-14	13 (12)	8 (9)	5 (29)
15-29	29 (27)	26 (30)	2 (12)
30-44	23 (22)	17 (20)	5 (29)
45-59	20 (18)	16 (18)	4 (24)
60-74	15 (14)	14 (16)	1 (6)
≥75	6 (6)	6 (7)	0 (0)
MONTH	**106 (100)**	**85 (100)**	**16 (100)**
JAN-MARCH	19 (18)	15 (18)	4 (25)
APRIL-JUNE	27 (25)	24 (28)	2 (12)
JULY-SEPT	23 (22)	18 (22)	2 (12)
OCT-DEC	37 (35)	28 (33)	8 (50)
DAY	**106 (100)**	**85 (100)**	**16 (100)**
MON	12 (11)	8 (9)	2 (13)
TUE	9 (9)	9 (11)	0 (0)
WED	3 (3)	3 (4)	0 (0)
THU	12 (11)	10 (12)	2 (13)
FRI	15 (14)	11 (13)	3 (19)
SAT	32 (30)	25 (29)	7 (44)
SUN	23 (22)	19 (22)	2 (13)
TIME	**104 (100)**	**83 (100)**	**16 (100)**
0000-0559	22 (21)	19 (23)	2 (13)
0600-1159	29 (28)	26 (31)	3 (19)
1200-1759	24 (23)	12 (14)	9 (56)
1800-2359	29 (28)	26 (31)	2 (13)

Descriptive Characteristics of Vulnerable Road Users Involved in Traffic Crashes Resulting in Fatality in Pasto, Colombia

Table 8B

	TOTAL FATALITIES	VULNERABLE	NONVULNERABLE
VARIABLE	**NUMBER (%)**	**NUMBER (%)**	**NUMBER (%)**
SAFETY EQUIPMENT USED	**42 (100)**	**35 (100)**	**7 (100)**
NO	39 (93)	32 (91)	7 (100)
YES	3 (7)	3 (9)	0 (0)
VICTIM TRANSPORT	**105 (100)**	**87 (100)**	**18 (100)**
PEDESTRIAN	46 (44)	46 (53)	0 (0)
BICYCLE	8 (8)	8 (9)	0 (0)
MOTO. DRIVER	23 (22)	23 (26)	0 (0)
MOTO. PASSENGER	10 (10)	10 (11)	0 (0)
AUTO. DRIVER	5 (5)	0 (0)	5 (28)
AUTO. PASSENGER	13 (12)	0 (0)	13 (72)
OTHER	0 (0)	0 (0)	0 (0)
VICTIM TRANSPORT	**78 (100)**	**64 (100)**	**14 (100)**
OTHER TRANSPORT	69 (88)	64 (100)	5 (36)
PUBLIC TRANSPORT	9 (12)	0 (0)	9 (64)
COUNTERPART TRANSPORT	**88 (100)**	**76 (100)**	**11 (100)**
AUTOMOBILE	71 (81)	59 (78)	0 (0)
MOTORCYCLE	17 (19)	17 (22)	11 (100)
BICYCLE	0 (0)	0 (0)	0 (0)
PEDESTRIAN	0 (0)	0 (0)	0 (0)
LOCATION	**106 (100)**	**87 (100)**	**17 (100)**
RURAL PASTO	32 (30)	23 (26)	8 (47)
URBAN PASTO	74 (70)	64 (74)	9 (53)

Univariate Analysis of Factors Influencing Traffic Crashes in Pasto, Colombia with Vulnerable Road Users as the Dependent Variable

Table 9A

	INJURY DATA			FATALITY DATA		
VARIABLE	**O.R.**	**95% C.I.**	**P-VALUE**	**O.R.**	**95% C.I.**	**P-VALUE**
GENDER						
FEMALE	Ref	Ref	Ref	Ref	Ref	Ref
MALE	1.39	1.18---1.66	<0.001	3.65	1.19---11.21	0.024
AGE						
0-14	Ref	Ref	Ref	Ref	Ref	Ref
15-29	0.83	0.65---1.06	0.138	8.13	1.32---50.21	0.024
30-44	0.53	0.41---0.69	<0.001	2.13	0.48---9.50	0.324
45-59	0.43	0.32---0.58	<0.001	2.5	0.52---11.96	0.251
60-74	0.56	0.37---0.86	0.008	8.75	0.86---88.69	0.066
≥75	1.03	0.50---2012	0.942	***	***	***
MONTH						
JAN-MAR	Ref	Ref	Ref	Ref	Ref	Ref
APR-JUN	1.19	0.96---1.48	0.121	3.2	0.52---19.67	0.209
JUL-SEP	1.51	1.21---1.90	<0.001	1.78	0.35---9.16	0.49
OCT-DEC	1.51	1.18---1.93	0.001	0.93	0.24---3.62	0.92
DAY						
MON	Ref	Ref	Ref	Ref	Ref	Ref
TUE	1.63	1.14---2.32	0.007	***	***	***
WED	1.13	0.82---1.54	0.46	***	***	***
THU	1.23	0.90---1.68	0.205	1.11	0.13---9.61	0.924
FRI	1.13	0.84---1.54	0.421	0.61	0.09---4.14	0.614
SAT	1.13	0.84---1.52	0.432	0.79	0.14---4.55	0.795
SUN	0.93	0.70---1.25	0.642	2.22	0.27---18.37	0.459
TIME						
0600-1759	Ref	Ref	Ref	Ref	Ref	Ref
1800-0559	0.62	0.52---0.73	<0.001	2.7	0.88---8.33	0.084

*** Insufficient Data or No Data Available to Perform Analysis

Univariate Analysis of Factors Influencing Traffic Crashes in Pasto, Colombia with Vulnerable Road Users as the Dependent Variable

Table 9B

	INJURY DATA			FATALITY DATA		
VARIABLE	**O.R.**	**95% C.I.**	**P-VALUE**	**O.R.**	**95% C.I.**	**P-VALUE**
SAFETY EQUIPMENT USED						
NO	Ref	Ref	Ref	Ref	Ref	Ref
YES	0.58	0.34---1.00	0.05	***	***	***
LOCATION						
URBAN PASTO	Ref	Ref	Ref	Ref	Ref	Ref
RURAL PASTO	0.39	0.22---0.69	0.001	0.54	0.12---2.56	0.44
ALCOHOL USE						
NO	Ref	Ref	Ref	***	***	***
YES	0.6	0.33---1.09	0.095	***	***	***
SITE OF BODILY INJURY						
HEAD/FACE/EYES	Ref	Ref	Ref	***	***	***
LOWER/UPPER EXTREMITIES	0.04	0.01---0.13	<0.001	***	***	***
NECK/SPINAL/ COLUMN/BACK	***	***	***	***	***	***
ABDOMEN/ THORAX/PELVIS	0.1	0.02---0.43	0.002	***	***	***

*** Insufficient Data or No Data Available to Perform Analysis

Multivariate Analysis of Factors Influencing Traffic Crashes in Pasto, Colombia with Vulnerable Road Users as the Dependent Variable

Table 10A

	INJURY DATA			FATALITY DATA		
VARIABLE	**O.R.**	**95% C.I.**	**P-VALUE**	**O.R.**	**95% C.I.**	**P-VALUE**
GENDER						
FEMALE	Ref	Ref	Ref	Ref	Ref	Ref
MALE	0.93	0.56---1.56	0.792	4.54	0.68---30.48	0.12
AGE						
0-14	Ref	Ref	Ref	Ref	Ref	Ref
15-29	0.35	0.13---0.96	0.041	6.88	0.61---77.07	0.118
30-44	0.3	0.11---0.84	0.021	1.73	0.22---13.58	0.603
45-59	0.11	0.04---0.32	<0.001	1.3	0.16---10.81	0.809
60-74	0.29	0.05---1.73	0.176	17.09	0.98---298.56	0.052
≥75	0.07	0.01---0.81	0.034	***	***	***
MONTH						
JAN-MAR	Ref	Ref	Ref	Ref	Ref	Ref
APR-JUN	0.9	0.53---1.54	0.7	4.49	0.46---43.86	0.196
JUL-SEP	1.19	0.65---2.16	0.577	1.06	0.11---10.55	0.961
OCT-DEC	1.73	0.84---3.57	0.136	0.58	0.25---11.66	0.577
DAY						
MON	Ref	Ref	Ref	Ref	Ref	Ref
TUE	2.05	0.80---5.28	0.137	***	***	***
WED	0.9	0.42---1.94	0.782	***	***	***
THU	1.55	0.67---3.57	0.303	1.8	0.09---35.28	0.7
FRI	1.21	0.55---2.68	0.641	1.34	0.09---19.91	0.832
SAT	1.22	0.56---2.65	0.611	0.82	0.09---7.91	0.863
SUN	0.82	0.38---1.81	0.626	2.46	0.19---31.18	0.489
TIME						
0600-1759	Ref	Ref	Ref	Ref	Ref	Ref
1800-0559	0.56	0.35---0.89	0.015	1.47	0.31---7.03	0.627

*** Insufficient Data or No Data Available to Perform Analysis

Multivariate Analysis of Factors Influencing Traffic Crashes in Pasto, Colombia with Vulnerable Road Users as the Dependent Variable

Table 10B

	INJURY DATA			FATALITY DATA		
VARIABLE	**O.R.**	**95% C.I.**	**P-VALUE**	**O.R.**	**95% C.I.**	**P-VALUE**
SAFETY EQUIPMENT USED						
NO	Ref	Ref	Ref	Ref	Ref	Ref
YES	0.58	0.34---1.00	0.05	***	***	***
LOCATION						
URBAN PASTO	Ref	Ref	Ref	Ref	Ref	Ref
RURAL PASTO	0.39	0.22---0.69	0.001	0.54	0.12---2.56	0.44
ALCOHOL USE						
NO	Ref	Ref	Ref	***	***	***
YES	0.6	0.33---1.09	0.095	***	***	***
SITE OF BODILY INJURY						
HEAD/FACE/EYES	Ref	Ref	Ref	***	***	***
LOWER/UPPER EXTREMITIES	0.04	0.01---0.13	<0.001	***	***	***
NECK/SPINAL/ COLUMN/BACK	***	***	***	***	***	***
ABDOMEN/ THORAX/PELVIS	0.1	0.02---0.43	0.002	***	***	***

*** Insufficient Data or No Data Available to Perform Analysis

CHAPTER V: CONCLUSION

5.1 DISCUSSION OF MORTALITY HYPOTHESES

This study examines the factors that influence fatal traffic crashes as well as those that influence the likelihood of being a vulnerable road user in both fatal and nonfatal crashes in Pasto, Colombia. The first hypothesis examined in this study was whether vulnerable road users have increased odds of involvement in a fatal traffic crash as compared to non-vulnerable road users. No statistical significance was reached in the univariate analysis and no differences were observed between the injury and fatality sample populations, as vulnerable road users made up 84% of both. Unfortunately, a multivariate analysis was not completed on this variable because of the small fatality sample size. The over representation of vulnerable road users in both the injury and fatality sample populations support what was found in the literature but further investigations into the differences between the two groups would have to be carried out with a larger fatality data set.

The multivariate analysis showed that males in this study had statistically significant higher odds of being involved in a fatal crash than women. This finding is supported by the literature and could be attributed to a reported increase in risk profile of men because of factors such as more alcohol use and less safety restraint use compared to women (Wells-Parker et al., 1996; Tsai et al., 2008). The multivariate analysis of age, and specifically the young adult group of 15-29 year olds, did not show any statistically significant increased odds of fatalities. The 15-29 year old group was the biggest single group in both the injury and fatality data set accounting for 42% and 27% respectively, which is consistent with what other studies have found. The multivariate analysis of

night time crashes did not indicate that there are higher odds of traffic fatalities at night and in fact the data collected showed there are as many fatal and nonfatal daytime traffic crashes as nighttime crashes. A plausible explanation can be obtained by taking a closer look at the data itself. There are more automobile and motorcycle crashes at night and more pedestrian and bicycle crashes during the day. Therefore, in this sample population certain types of transportation are more commonly involved in traffic crashes during the day while other types are more commonly involved in traffic crashes at night.

The next hypothesis examined was whether the use of safety equipment decreases the odds of being involved in a fatal traffic crash. The multivariate analysis showed that safety equipment decreases the odds of being involved in a fatal traffic crash at a marginal level of statistical significance ($p=0.07$). This finding is no surprise as this is what has been consistently found in other studies.

The last hypothesis that was examined was whether there were increased odds of traffic fatalities occurring in rural areas as compared to urban areas. The multivariate analysis found that traffic fatalities have an almost six times increase in odds of occurring in rural Pasto as compared to urban Pasto. This finding is consistent with studies and data from different countries in that rural traffic crashes are often times more severe (Afukaar et al., 2003; Yancy et al., 1997) and that victims are more commonly confronted with obstacles such as delays in medical care (Zwerling et al., 2005). Another finding from the multivariate analysis, although not specifically focused on in this study, was the increased odds of being in a fatal traffic crash for those using public transportation. A similar finding has been reported in a study from Kenya (Odero et al., 2003). A reason for this finding could be the fact that public transportation vehicles typically carry large

numbers of people at one time, meaning that one single traffic crash could result in many deaths at once.

5.2 DISCUSSION OF VULNERABLE ROAD USER DATA

Multivariate analysis showed that gender within both the fatality and injury data was not statistically significant. However, males dominated both study populations as they made up 70% of the vulnerable road users in the injury data set and 84% in the fatality data set. Multivariate analysis of age in the traffic injury population showed that those between the ages of 15-59 and older than 75 had decreased odds of being vulnerable road users as compared to those less than fourteen years of age. These findings are consistent with data that shows that children and young adults are the groups most impacted by vulnerable road user crashes. Multivariate analysis of the time of day variable in the injury study population showed that vulnerable road users had statistically significant decreased odds of being involved in a traffic crash during night hours as compared to day hours. As previously stated, this finding makes sense because of the fact that pedestrians and cyclists were less likely to be involved in night time crashes in this study population. Multivariate analysis of the safety equipment used variable in the injury data showed that those that responded "yes" to the use of safety equipment had a decrease in odds of being vulnerable road users. This finding could be explained by the fact that a large part of the vulnerable road user group was pedestrians, in which no safety equipment was needed. Another explanation is that less than 10% of cyclists in the injury population reported using safety equipment. Multivariate analyses of the injury data set showed that traffic crash victims in rural Pasto had decreased odds of being vulnerable road users as compared to urban Pasto. This finding coincides with the fact that being a

vulnerable road user is better suited for situations that require shorter travel, which is what is typically needed in urban areas. The multivariate and univariate analyses of alcohol use within the injured study population indicated that those that responded "yes" to the use of alcohol had decreased odds of being vulnerable road users. Only the results of the multivariate analysis were significant. These results are consistent with the fact that many vulnerable road users are children or young adults under the legal drinking age. However, it is important to note that more than one out of every ten traffic related injuries in this study was alcohol related. The multivariate analysis of the traffic injury data set showed that victims with injuries to the abdomen, thorax, pelvis, or upper or lower extremities had decreased odds of being vulnerable road users as compared to those with injuries to the head, face, or eyes. These results show how important it is for motorcyclists and cyclists to use helmets.

5.3 STUDY LIMITATIONS

The first and biggest limitation in this study was the small fatality data set population which led to the inability to complete some of the statistical models. Additional data would not only have increased the sample size but it would also have allowed for additional areas of study in this investigation. For instance, receiving four years of data instead of two would have meant that changes in the independent variables across time could have been investigated, allowing for the discovery of any areas within traffic injury that need improvement.

Other limitations became apparent when the injury and fatality data sets were merged. First, because the data used in this study was collected with two separate and different data collection forms, variables in the data sets were different, meaning that not

all variables were available for comparison or merging. One such example of this was the lack of injury site data available in the fatality data set meaning that injuries sustained to fatal and nonfatal traffic crash victims could not be compared. The second of the limitations that came from merging the datasets was the assumption that cases found in the fatality data set were not duplicated in the injury data set. Although, cases coded with a destination of morgue in the injury data set were removed, some cases were missing a code for destination. Therefore, the possibility exists that fatality cases were still present in the injury data.

5.4 PUBLIC HEALTH IMPLICATIONS AND RECOMMENDATIONS

Although the small fatality sample size may have limited this study in some ways there are still important public health implications to be obtained from this study. First, the descriptive statistics of this study population showed that certain groups such as males, young adults, and vulnerable road users predominated. These groups should be the first to be targeted for future interventions in order to make the biggest impact within traffic injury. Second, this study and many others like it have shown that the use of safety equipment can make a difference in saving lives. In this study population, less than half of those involved in automobile traffic crashes reported using safety equipment and less than one out of ten cyclists reported using safety equipment. Furthermore, three times more vulnerable road users received head, face, or eye injuries than non-vulnerable road users. Bicycle related head injuries often times endure for a lifetime, leading to expensive long term medical costs. It is estimated that a $30 dollar savings for society occurs with every dollar spent on bicycle helmets (NHTSA, 2008). Therefore, requiring the use of safety equipment and greater police enforcement of these laws is needed.

Extra analysis of vulnerable road user data was performed in this study because of the fact that this group makes up a large portion of traffic crash victims in many low and middle income countries and in fact 84% of the study population in this investigation were vulnerable road users. Those most affected by vulnerable road user crashes are typically children and young adults and 65% of vulnerable road users in this study were under thirty years of age. Vulnerable road users in this study were most often involved in traffic crashes with automobiles. As more and more people gain access to automobiles in Colombia, the problem could worsen as vulnerable road users will have to share the road with more automobiles. Therefore, infrastructure and planning, such as additional side walks and cross walks, that would act to separate vulnerable road users from automobiles are needed.

Future research should concentrate on the costs and benefits of safety restraints, as well as bicycle and motorcycle helmet use in Colombia. Such research could potentially reveal the viability of a government led program that provides helmets to those that are unable to afford them and installs seat belts in vehicles that do not have them. Additional research should also focus on the most effective and realistic prevention measures that allow pedestrians, cyclists, and motorcyclists to use the same roads as automobiles. Though there is research showing that changing the hood design of automobiles can reduce pedestrian fatalities, such a change would be cost prohibitive in Colombia. Installing side walks in high pedestrian and bicycle use areas, such as paths to public transportation, or additional installation of traffic lights, could be a less costly and more effective alternative.

One of the principal challenges that Colombia, and many countries like it, face is the lack of resources available to address many of the issues presented in this study. A combination of policy and enforcement are needed when introducing any new traffic injury prevention plan. Speed limits and laws requiring the use of motorcycle helmets and seat belts are in place in Colombia but are often ignored, indicating a need for more effective enforcement. Ultimately, country specific traffic injury and fatality problems, such as vulnerable road user injuries and deaths and the lack of safety equipment use, should first be addressed in order to receive the most return on resources used.

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APPENDICES

APPENDIX A

APPENDIX B

ALCALDIA MUNICIPAL DE PASTO - DIRECCION MUNICIPAL DE SALUD

INSTITUCION DE SALUD: _____

Notificación de Lesiones de causa externa

H.C.:

I – DATOS DE IDENTIFICACIÓN

APELLIDO 1	APELLIDO 2	NOMBRE 1	NOMBRE 2	**EDAD:** Solo una	AÑOS	MESES	DÍAS

ID / RIPS	[CC] [CE] [PA] [RC] [TI] [AS] [MS] [NU]	#:	SEXO [M] [F]	Ocupación:	Escolaridad:	Aseguradora:

Domicilio	DEPTO	MUNICIPIO	BARRIO/ VEREDA	DIRECCIÓN	TELEFONO

II - DATOS GENERALES DEL EVENTO (Marcar con X [ ]), (Para cada agrupación de datos debe marcar una sola, la mas grave)

Lugar Evento	DEPTO	MUNICIPIO	BARRIO/ VEREDA	DIRECCIÓN

EVENTO Fecha y hora

L	M	MI	J	V	S	D

DIA	MES	AÑO	HORA MILITAR

CONSULTA Fecha y hora

L	M	MI	J	V	S	D

DIA	MES	AÑO	HORA MILITAR

Remitido [Si] [No]

De qué IPS?

INTENCIONALIDAD
[1] No intencional (accidentes)
[2] Autoinfligida intencional (Suicidio)
[3] Violencia/ Agresión ó sospecha.
[8] Otro _____
[9] No sabe

LUGAR DONDE OCURRIÓ LA LESIÓN
[1] Casa / hogar
[2] Escuela/ Lugar de estudio
[3] Calle / Vía Pública
[4] Trabajo
[5] Bar, cantina o similares
[8] Otro _____
[9] No se sabe

ACTIVIDAD que realizaba cuando se lesionó
[1] Trabajo dependiente
[2] Oficio informal/ independiente
[3] Labores personales
[4] Estudiando
[5] Practicando Deporte
[6] Viajando
[7] Recreación/ descanso/ jugando
[8] Tomando licor
[98] Otra _____
[99] No se sabe

MECANISMO / OBJETO DE LA LESIÓN
(¿Cómo / Qué produjo la Lesión?)

[1] Lesión de Transporte
[2] Agresión sexual
[3] Caída Propia altura
[4] Caída por escaleras
[5] Otra Caída, altura ___ mts
[6] Golpe / fuerza contundente
[7] Corte / Puñalada
[8] Objeto Corto-Contundente
[9] Disparo de arma de fuego
[10] Fuego/ llama/ humo
[11] Líquido/ Objeto Caliente
[12] Pólvora, cual_____
[13] Estrangulado / Ahorcado
[14] Inmersión / ahogado
[15] Asfixia por cuerpo extraño
[16] Lesión por cuerpo extraño
[17] Fármacos
[18] Plaguicidas
[19] Hidrocarburos
[20] Otros Tóxicos
[21] Minas/ Munición sin explotar
[22] Otro artefacto explosivo
[23] Mordedura de Persona
[24] Animal, cual _____
[25] Electricidad
[26] Desastre natural, _____
[27] Otro _____
[28] No se sabe

Uso de Alcohol En el lesionado	**Uso de Drogas En el lesionado**	**PARA LOS QUEMADOS:**
[1] Si ha consumido	[1] Si ha consumido	Grado más grave
[2] Sospecha de uso	[2] Sospecha de uso	[1] [2] [3]
[3] No ha consumido	[3] No ha consumido	
[9] No se sabe	[9] No se sabe	Porcentaje: _____

III - DATOS ESPECÍFICOS DEL EVENTO

LESIÓN DE TRANSITO /TRANSPORTE

Tipo de transporte	**Contraparte**	**Usuario**
[1] Peatón	[1] Peatón	[1] Peatón
[2] Bicicleta	[2] Bicicleta	[2] Conductor
[3] Motocicleta	[3] Motocicleta	[3] Pasajero
[4] Automóvil	[4] Automóvil	[8] Otro _____
[5] Camioneta	[5] Camioneta	[9] No se sabe
[6] Camión	[6] Camión	
[7] Bus/ microbús	[7] Bus/ microbús	
[8] Carreta / Animal	[8] Carreta/Animal	
[9] Taxi	[9] Taxi	
[10] Otro	[10] Objeto Fijo	
[11]No se sabe	[11] Sin Contraparte	
	[12] Otro	
	[13] No se sabe	

Elementos de seguridad?
[Si] [No] [N/S/A]

-Cinturón [si] [no] [n/s/a]
-Casco Moto[si] [no] [n/s/a]
-Casco Bicicleta [si] [no] [n/s/a]
-Chaleco [si] [no] [n/s/a]
-Otro [si] [no][n/s/a]

Cuál _____

VIOLENCIA INTERPERSONAL
Antecedente previo de agresión [SI] [NO] [N/S]

RELACIÓN DEL AGRESOR CON LA VICTIMA
[1] Amigo / Conocido
[2] Desconocido
[3] Otro _____
[4] No se sabe

CONTEXTO
[1] Riña / pelea
[2] Robo
[3] Agresión sexual
[4] Pandillas
[5] Bala perdida
[6] No se sabe

SEXO DE LOS AGRESORES :
[1] Masculino [2] Femenino [3] Ambos [9] No sabe

INTENCIONAL AUTOINFLIGIDA
Intento previo?
[SI] [NO] [N/S]

Antecedente de Trastorno mental?
[SI] [NO] [N/S]

FACTORES PRECIPITANTES
[1] Conflicto con pareja o familia
[2] Enfermedad física
[3] Problemas financieros
[4] Problemas con la justicia
[5] Muerte de pareja/ familiar
[6] Abuso sexual o físico
[7] Embarazo no deseado
[8] Problemas escolares
[98] Otro _____
[99] No se sabe

IV - DATOS CLÍNICOS DEL EVENTO

APPENDIX C

OBSERVATORIO DEL DELITO - DEPARTAMENTO DE NARIÑO

SECRETARIA DE GOBIERNO DEPARTAMENTAL -
UNIVERSIDAD DE GEORGETOWN -- UNIVERSIDAD DEL VALLE INSTITUTO CISALVA

FICHA PARA MUERTES EN ACCIDENTES DE TRANSITO

1. MUNICIPIO DEL HECHO:

2. CODIGO:

3. FECHA DE LOS HECHOS — DIA | MES | AÑO

4. HORA DE LOS HECHOS — HORA MILITAR.

5. LUGAR DE OCURRENCIA DE LOS HECHOS

5.1. DIRECCION

5.2. BARRIO - CORREGIMIENTO

5.3. COMUNA

6. TIPO DE VIA EN QUE OCURREN LOS HECHOS

1 Vía Nacional ☐
2 Vía Departamental ☐
3 Vía Municipal ☐

7. CLASE DE ACCIDENTE

1. COLISION CON OBJETO MOVIL ☐
2. COLISION CON OBJETO FIJO ☐
3. VOLCAMIENTO ☐
4. CAIDA DE OCUPANTE ☐
5. PEATON ATROPELLADO ☐
6. CICLISTA ATROPELLADO ☐
7. OTRA CLASE DE ACCIDENTE ☐
8. SIN DATO ☐

8 DIA DE LA SEMANA
(Lunes, martes, etc)

9. NUMERO DE VICTIMAS FATALES EN EL MISMO HECHO ( )

10. NUMERO DE VICTIMAS NO FATALES EN EL MISMO HECHO ( )

11. NOMBRES DE LA VICTIMA

12. APELLIDOS DE LA VICTIMA

13. SEXO 1. Masculino ☐ 2. Femenino ☐ 3. No Establecido ☐

14. EDAD MEDIDA EN :

1. Años ☐ 2. Meses ☐
3. Días ☐ 4. No Establecida ☐

15. EDAD

16. OCUPACION

17. MUNICIPIO DE RESIDENCIA

18. BARRIO DE RESIDENCIA

19. TIPO DE DOCUMENTO DE IDENTIDAD

1 ☐ Cedula de Ciudadanía
2 ☐ Cedula de Extranjería
3 ☐ Pasaporte
4 ☐ Registro Civil
5. Tarjeta de Identidad ☐
6. Adulto sin Identificación ☐
7. Menor sin Identificación ☐
8. Sin dato ☐

20. NUMERO DE DOCUMENTO DE IDENTIDAD

21. CARACTERISTICAS DE LA VICTIMA

1. ☐ Conductor de Vehículo
2. ☐ Pasajero de Vehículo
3. ☐ Conductor de Moto
4. ☐ Pasajero de Moto
5. ☐ Peatón
6. ☐ Ciclista
7. ☐ Otro
8. ☐ Sin dato

22. MEDIDAS DE PROTECCION

1. ☐ **Ninguna**
2. ☐ No aplica
3. ☐ Cinturón de Seguridad
4. ☐ Casco protector Moto
5. ☐ Casco protector Ciclista
6. ☐ Otro
7. ☐ Sin dato

23. VEHICULOS INVOLUCRADOS EN EL ACCIDENTE

	VEHICULO DE VICTIMA Vehículo 1	VEHICULO CONTRAPARTE Vehículo 2	Vehículo 3	Vehículo 4
1. Vehículo	☐	☐	☐	☐
2. Motocicleta	☐	☐	☐	☐
3. Bicicleta	☐	☐	☐	☐
4. Peaton	☐	☐	☐	☐
5 Sin Dato	☐	☐	☐	☐

24. TIPO DE SERVICIO

	VEHICULO DE VICTIMA Vehículo 1	VEHICULO CONTRAPARTE Vehículo 2	Vehículo 3	Vehículo 4
1. Particular	☐	☐	☐	☐
2. Público	☐	☐	☐	☐
3. Oficial	☐	☐	☐	☐
4. Otro	☐	☐	☐	☐
5 Sin Dato	☐	☐	☐	☐

25. NARRACION CORTA DE LOS HECHOS. (

26. NIVEL DE ALCOHOL DE LA VICTIMA

1. ☐ Víctima: (mgr) Sin dato ☐ Pendiente ☐
2. ☐ Culpable: (mgr) Sin dato ☐ Pendiente ☐

Elaborado por el Grupo Técnico del Proyecto "Observatorio del delito"