Dereje Yohannis

Causes of road traffic accident and impacts on labor welfare in Gurage Zone, Ethiopia

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WOLKITE UNIVERSITY

SCHOOL OF GRADUATE STUDIES

COLLEGE OF BUSINESS AND ECONOMICS

CAUSES OF ROAD TRAFFIC ACCIDENT AND IMPACTS ON LABOR WELFARE IN GURAGE ZONE, ETHIOPIA

A THESIS SUBMITTED TO SCHOOL OF GRADUATE STUDIESIN PARTIAL FULFILLMENT OF THE REQUIRMENT FOR THE AWARD OF MASTERS DEGREE INDEVELOPMENT ECONOMICS

BY:

DEREJE YOHANNIS

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WOLKITE, ETHIOPIA

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ACRONYMS

CDMME	Center for disaster management medical emergencies
DALYs	Disability adjusted life years
LDC	Less developed country
LMO	Legal medicine organization
RSC	Road safety campaign
RTA	Road traffic accident
RTF	Road traffic fatality
RTI	Road traffic injury
UAE	United Arab Emirates
UK	United Kingdom
UN	United Nation
UNEC	United Nation Economic Commission
WHO	World health organization

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Abstract

Road traffic accident leads to global economic and health problems. Despite the prevalence of the challenge, studies on the labor welfare impacts of road traffic accident and causes of the accident are in adequate. Considering this, this study examined factors that are affecting road traffic accident and impact on labor welfare. The experimental research design was employed in which qualitative approach was used to supplement the quantitative approach. Primary data was collected from Gurage zone for both control (e.g., people in the labor force and did not faced the road traffic accident) and the treatment group (e.g., people in the labor force and faced the accident). To trace treatment group 2018/19 Ethiopian fiscal year police office report was used. The probit model result showed that drunk-driving, violating traffic rule, over loading were important causes of traffic accident. According to the propensity score matching result, facing road traffic accident significantly reduced average monthly income and average monthly working hour and increased health expenditure of a labor. To reduce the accident the traffic management department and road authority need to regulate the misbehavior of drivers including drunk-driving, violating road traffic regulations and overloading using technologies such as speed cameras and alcohol consumption detecting machine. Moreover, traffic management or road authority can reduce the accident by building traffic signs such as traffic light, zebra cross (pedestrian cross) and other community geographic related signs. Awareness creation through mass mobilization and volunteer traffic services by local community during peak hours.

Keywords: *Road Traffic accident, Labor Welfare, Propensity Score Matching*

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Road traffic accident is the cause of public health and development crisis. According to world health organization(WHO) globally, the number of people killed in road traffic crashes each year is estimated to be 1.2 million, while the number injured could be as high as 50 million, which is equal to the sum of urban population live in five of the world's large cities (WHO, 2018). The tragedy behind these figures regularly attracts less media attention than other less frequent but more unusual types of tragedy. The total number of road traffic deaths worldwide and injuries forecast to rise by some 65% between 2000 and 2020 and in low-income and middle-income countries deaths are expected to increase by as much as 80%. The majority of such deaths are currently among vulnerable road users including pedestrians, pedal cyclists and motorcyclists. In high-income countries, deaths among car occupants continue to be predominant, but the risks per capita that vulnerable road users face are high (WHO, 2018).

A number of countries that have seen success in reducing road traffic deaths over the last few years, but the progress vary significantly between the different regions and countries of the world. There continues to be a strong association between the risk of a road traffic death and the income level of countries. Road traffic injury is one of the persistent public health challenges in most regions of the world, representing substantial human and economic losses. Annually, about 1.25 million lives are lost, whereas 50 million suffer from road traffic injuries globally. It has been shown that over 60% of the reasons for traffic injuries are a risky driving behavior (Tesfaye et al., 2016).

Ethiopia is one of those rising countries with low level of income accompanied by high rate of population growth and high number of traffic accident. As part of the developing world, Ethiopia is mostly an important country with low level of urbanization. The economic performance of different sectors of the national economy is not pleased. According to the Ethiopian federal police commission report the estimated five year traffic accident the traffic accident increased from

time to time. Accident number increased by more than 1000 within the past five years (2001-2005). Similarly the number of fatality increased tremendously (Dawit, 2016)

The road traffic accident is serious problem in Ethiopia and increasing. Moreover, in Ethiopia road safety is poor and cause of increasing road accident. According to WHO data published in 2017, the road traffic accidents deaths in Ethiopia reached 27,140 or 4.27% of total deaths. The age adjusted death rate is 36.36 per 100,000 of population ranks Ethiopia 22nd in the World. Therefore, this study attempts to examine the causes and the impacts of road traffic accident on the welfare of labor.

1.2. Statement of the problem

Road Traffic accidents (RTAs) as a result of road traffic crashes (RTCs) rank as the leading cause of death, disability and property loss globally, especially in low and middle-income countries. Satar et al. (2014) estimated the costs of road transport crashes in Iran using a standard human capital approach. Costs included are medical, administrative and funeral costs, property damage, production lost and intangible costs. Data about the number of deaths and injuries resulting from RTIs between 20 March 2009 and 20 March 2010 was obtained from two national databases designed at the Center for Disaster Management and Medical Emergencies (CDMME) and the Legal Medicine Organization (LMO), respectively. The severity and medical costs of injuries were identified by reviewing 400 medical records that were selected randomly from patients who were admitted to two large trauma centers in Shariati and Sina hospitals in Tehran province. Moreover, information about production lost, property damage, rehabilitation cost, intangible costs and administration costs were collected by review of current evidence and consulting with expert opinion.

The Greg (2009) conducted study to intend to update the status, trends, causes, existing countermeasure, and issues in traffic safety, facing African countries. The purpose of this study was to inform policy makers in traffic safety policy formation. The articles are assessed for relevance and validity, although most of identified relevant articles are used, given the limited number of published studies (Greg, 2009). The study reveals that African countries are facing serious challenges in

traffic safety. The review identified a set of factors, similar to those in motorized countries, which contribute to traffic crashes and injury. Human behavior and incapacitation as a group account for more than 85% of the factors reported by police. Unlike developed countries, traffic casualties are primarily born by vulnerable road users in Africa. Pedestrians alone account for more than 40% of total fatalities in African roads. Limited countermeasures are reported in the literature. Many African countries are facing challenges in their effort to improve traffic safety. These include, but not limited to, the lack of data, research, leading agency/organization, in a culture that are somewhat fatalistic and in the economies that are, for the most part, stagnant (Greg, 2009).

According to Lanying(2012) investigated post-crash impacts on RTF victims' family members, including the adverse impacts of lost income, occupational disruption, unfavorable family dynamics, and residential relocation. Survey data from 1291 RTF family members interviewed in Taiwanin 2012 provided the evidence of impact used in this article. Twelve variables related to the family member's socio-demographic background were used to predict the scope of the adverse impact of a fatal crashing regression models developed for this analysis. RTF victims' spouses with relatively low personal incomes and strong dependence up on the crash victims were found to be most likely to experience a marked decrease in post-crash quality of life. RTF victims' family members who lived with few other adult cohabitants and had more juvenile dependents and are emotionally dependent on the victims are found to be quite likely to experience post-crash setbacks in occupational stability. RTF victims' family members who were emotionally dependent on the victims are found to be more likely to experience major family life disruptions. The younger the RTF victims' family members, and the more years since the crash, the higher the like live hood of residential relocation taking place (lanying, 2012).

A study on road traffic accident and safety evaluation in Addis Ababa Bole Sub City conducted by Dawit (2016) using GIS based black spot identification schemes. This study employed five distinct scientific principles namely: accident frequency, accident rate, empirical Bayesian, critical accident and accident prediction models. Out of the methods, empirical Bayesian proved superiority so that much of the

conclusion was based on this method. According to the study identified possible solutions include using traffic signs, user awareness campaigns, policy revisions, and permanent geometry and pavement modifications. Earlier study conducted by Feleke et al. (2015) on assessing magnitude and outcome of road traffic accidents among trauma victims at hospitals in Wolaita zone. The finding of this study indicated that 384 trauma victims were incorporated in the study of which 240 (62.5%) aredue to road traffic accidents. The majorities of patients are male 298 (77.6%) and most are within age of20 and 29 (35.42%). The principal outcome of injury is more commonly lower extremity (182 patients, 47.4%), compared to upper extremity (126 patients, 32.8%).

Fesseha and Sileshi (2012) assessed the main causes and consequences of road traffic accidents in Amhara Region. This descriptive study employed secondary data collected by Amhara National Regional State Police Commission from 2007-2011. To conduct these study the finding of this study reveals that almost half (51%) of all crashes involved freight vehicles followed by passenger vehicles which constitute one-third (34.5%) of all the accidents. Over half (54.8%) of the accidents occur on interstate highways. Passengers accounted for the largest share of road traffic deaths across the region and pedestrians were the main victims in the urban areas. Errors committed by drivers are the chief causes of the accidents, such as failure to give priority to pedestrians, speeding, failure to stay on the right side of the road, failure to maintain distance between vehicles and failure to yield the right of way for other vehicles. Overall, these factors accounted for 83.8% of all traffic accidents.

Based on the researcher knowledge there is thus an urgent need to recognize the risk condition in road deaths and injuries and to take appropriate action. Road traffic accident prevention and mitigation should be given the same attention and scale of resources that is currently paid to other prominent health issues if increasing human loss and accident on the roads, with their devastating human impact and large economic cost to society, are to be averted.

Although, there were several studies conducted in Ethiopia on traffic accident including Dawit (2016), Feleke, et al.(2015) and Fesseha and Sileshi (2012), none of these studies were conducted the impact of traffic accident on labor welfare.

However, traffic accident is expected to decrease productivity, health status and mobility of injured labor and hence reduces the welfare of labor force. To estimate the welfare impacts, this study examines welfare impact of traffic accident on labor welfare by considering labor income, labor supply, and the health expenditure of worker as indicators of labor welfare. Moreover we assume that labor welfare is function of consumption and leisure and these two arguments of welfare strongly correlated with income, health and leisure. Moreover, to estimate welfare impacts of traffic accident this study employed impact evaluation technique that has methodological contribution to the nexus between welfare of labor and traffic accident literature. Accordingly cross-sectional data was collected from randomly sampled individuals in the labor force that faced traffic accident as treatment group while the control group was a labor did not faced the accident in the study area. Thus, the specific research questions of the study are:

- What are the causes of road traffic accident?
- What is the impact of road traffic accident on labor health?
- What is the impact of road traffic accident on labor income?
- What is the impact of road traffic accident of labor working hour?

1.3. Objective of the study

The main objective of the study is to assess the labor welfare impact of road traffic accident in Gurage zone, Ethiopia.

The specific objectives of the study are:

- To examine factors that are contributing to the road traffic accident
- To investigate the impact of road traffic accident on labor health expenditure
- To examine the impact road traffic accident on labor income
- To examine the impact of road traffic accident on labor working hour

1.4. Significance of the study

This study can help in identifying the causes of the road traffic accident and impact of traffic accident on labor welfare in Ethiopia. More specifically, the study informs the level, causes and impacts of the road traffic accident in Ethiopia. This study helps to create awareness among drivers, pedestrians, passengers, policy makers,

politicians to collaborate to reduce road traffic accident in Ethiopia. The study documents causes of the road traffic accident and impacts so that decision makers can make informed decisions to reduce significantly increasing road traffic accident in the country. Finally, but not the least, the study can be used as reference for further related studies.

1.5. Scope and limitation of the study

This study examines causes and impacts of road traffic accident in Gurage Zone of southern Ethiopia. The main limitation of the study is that unwillingness to provide the right information by respondents in the process of collecting the relevant data. In addition, respondents delay in giving the required data, and a few respondents fail to respond to requests which make data collecting time longer and finalization of this study. The limitations are some targeted respondents were reluctant to share sensitive information while others misinterpret the intentions behind the research and refuse to provide accurate information for fear of disclosure besides assurances of confidentiality. However, by discussing the relevance of the study to the respondents it would help to provide the required information. The researcher has presented an introduction letter to be obtained from the university to the respective institutions and this might help to avoid suspicion and enabled the respondent to disclose much of the information sought by the study.

1.6. Organization of the Study

This study is organized in five main chapters. The first chapter contains background information of the study, statement of the problem, objectives, and significances, scope of the study, limitation of the study and organization of the study. Chapter two discusses about the related theoretical and empirical literature. The third chapter deals with research methodology which includes description of the study area, research design, population and sample size, data collection instruments and data, and methods and materials. Chapter four of this study also discuss the finding of the study and shows the result of analysis in the study and finally the fifth chapter deals with the conclusion of the study based on main finding of study and forwarding the recommendation for concerning bodies.

CHAPTER TWO

2. LITERATURE REVIEW

The literature review section of the study goes through earlier theoretical and empirical literature related to traffic accident. Particularly the review examined traffic accident globally, traffic accident levels in Ethiopia, causes for road traffic accident, theoretical framework of road traffic accident, and final the impact of road traffic accident on labor welfare.

2.1. Theoretical Review

2.1.1. Definitions and Concepts of Road Traffic Accident

Road Traffic Accident

Traffic is consists of "road users" including pedestrians, ridden or herded animals, vehicles, street cars, buses and others, either singly or together, while using the public way for purposes of travel. Traffic is often classified by type: heavy motor vehicle (e.g. car, truck) other vehicle (e.g. moped, bicycle), and pedestrian.

Road traffic accident are those accidents with following qualities: occurred or originated on a way or street open to public traffic; resulted in one or more persons being killed or injured; and at least one moving vehicle was involved(United Nations Economic Commission for Europe 2005: p. 9). Accidents involve collisions between vehicles, vehicle and pedestrians and be-tween vehicles and animals or fixed obstacles (like buildings or trees) (UNEC, 2005).The definition includes single vehicle accidents in which single vehicle alone (and no other road user) is involved. In this case the driver might be injured or die on the accident and the vehicle involved might be destroyed. Moreover, the definition excludes a pedestrian who fells while boarding or alighting from a motor vehicle. A road traffic accident can be defined as a fatal or non-fatal injury incurred as a result of a collision on a public road involving at least one moving vehicle (WHO, 2018). According to Safe Car Guide, road traffic accident can be defined as “an accident that occurs on a way or street open to public traffic, results in one or more persons being killed or injured, and at least one moving vehicle is involved. Therefore, road traffic accident is a

collision between vehicles, between vehicles and pedestrians, between vehicles and animals, or between vehicles and fixed obstacles (Guide, 2004).

2.1.2. Traffic Accident Globally

Both the World Bank and the World Health Organization, in independent studies, have calculated that, worldwide, there are around 500,000 fatalities and 15 million injuries per annum as a result of road accidents. Earlier estimates also suggest that about sixty percent of these deaths and injuries take place in those countries of Africa and Asia which are classified by the World Bank as low or middle income (World Bank, 1990). Using data from a number of detailed studies, it has been suggested that the level of under reporting of road accident fatalities in LDCS is at least twenty percent (Sayer and Hitchcock, 1984). Similar studies by James (1991) discovered that under-reporting in industrialized countries is in the order of 6 percent. The data on fatalities have been adjusted to take into account underreporting. The Greg C. (2009) conducted study to intend to update the status, trends, causes, existing countermeasure, and issues in traffic safety, facing African countries. It is the hope of the author that the finding could stimulate discussion and to inform policy makers in traffic safety policy formation. The study reviews articles published in major scientific journals, internal reports by government and institutions, as well as articles published on the Web. The journals and the internet were searched for the last 12 years, starting from 1998, dovetailing the last comprehensive literature review by Oredo (1997). Key search engines are used in the search, in addition to journal specific investigations. Journals from diverse disciplines, such as traffic safety, injury prevention, medicine, economics, public health and general social science, as well as localized journals in African countries are reviewed, recognizing the multi-disciplinary nature of the field and potential special local issues that are unique to the Continent. The articles are assessed for relevance and validity, although most of identified relevant articles are used, given the limited number of published studies (Greg, 2009). The study reveals that African countries are facing serious challenges in traffic safety. For example, recent statistics show that more than 100 people die in road traffic crashes per 10,000 vehicles in Tanzania and Ghana, compared to the 1.7 fatalities per 10,000 vehicles in the US. The fatalities will nearly double in two decades between 2000 and 2020

if major action is not undertaken. The review identified a set of factors, similar to those in motorized countries, which contribute to traffic crashes and injury. Human behavior and incapacitation as a group account for more than 85% of the factors reported by police. Not similar to developed countries, traffic casualties are primarily born by vulnerable road users in Africa. Pedestrians alone account for more than 40% of total fatalities on African roads. Limited countermeasures are reported in the literature. The evaluations of these programs are mixed and the research methods used have questionable validity. Many African countries are facing challenges in their effort to improve traffic safety. These include, but not limited to, the lack of data, research, leading agency/organization, in a culture that are somewhat fatalistic and in the economies that are, for the most part, stagnant (Greg, 2009).

2.1.3. Traffic Accident in Ethiopia

Ethiopia is one of those rising countries with low level of income accompanied by high rate of population growth and high number of traffic accident. As part of the developing world, Ethiopia is mostly an important country with low level of urbanization. The economic performance of different sectors of the national economy is not pleased. This low performance is due to a number of limitations such as low level of investment in different sectors of the national economy. According to the world health organization, the first comprehensive analysis of road traffic crashes in Ethiopia using police-reported crash data. Road traffic crashes pose a significant burden in Ethiopia, as is the case for other developing countries. Currently, developing countries contribute to over 90% of the world's road traffic fatalities (WHO, 2009) and overall road injury disability-adjusted life year (DALYs) increased by 2.5% between 1990 and 2010, with pedestrian injury DALYs increasing by 1The traffic police reports human error, road environment and vehicle factors as the main causes of road crashes. However, little documentation is available on the broader underlying factors such as deficiencies in the breviaries changes, ineffective road safety legislation and enforcement, systems for data collection and management, and in adequate medical infrastructure for post-injury management. Although a variety of road safety interventions have been successfully applied, little attempt has been made to promote and implement

them. Every year, around 300 people are killed on Addis Ababa's roads and 1500 are light and seriously injured (Federal Police Central Bureau). The governments have launched several campaigns, such as “Think” and Road Safety Campaign (RSC), to help people become aware of road safety issues and try to reduce road accident.

This study tried to analyze the traffic accidents, and develop a computer-based traffic simulation for the route selection. This thesis has two main functions. Firstly, the aim is to provide users with an understanding of the major causes of traffic accidents and present using several Statistical tools. At the second function, it will apply an innovative, hybrid statistical model for route selection based on accident prediction to traffic police office data 2.9%, more than any other category (Naghaviet al, 2012).

2.1.4. Policies to Reduce Road Traffic Accident

As the Ministry of Interior statistics show, the UAE has a poor record for road safety compared to other countries. In 2009, the road death rate was 24.8 per population of 100,000(Ministry of Interior, 2011). However, most of the other developed countries had lower rates. For example, in 2006,the UK had a road death rate of 5.4 per population of 100,000. The Office for National Statistics stated in 2008 that the United States had a road death rate of 14.3 per 100,000 population, Australia had 7.8 per 100,000 population and Japan had 5.7 per 100,000 population(Department of Transport, 2008). It can be seen that the UAE has one of the highest road death rates in the world.

The first assessment of road safety in 178 countries around the World was published by the World Health Organization in 2009 as the Global Status Report on Road Safety“ (World Health Organization, 2009), and on a global level, the United Nations (UN) decade of Action for Road Safety aims to save five million lives on the world’s roads in the next ten years. The main goal here is to ask governments to do their bit to reduce road traffic deaths and injuries(Larsonet al., 2012).The National Strategy for Traffic Safety aims to reduce deaths through RTAs from the present number of 220 to 130 and it is hoped the rate of serious

injuries will be reduced to 300 compared to a present rate of 550 injuries per year (Al-Mawlawi, 2013).

The Strategic Traffic Safety Plan aims to reduce the number of road traffic fatalities and injuries in the city of Riyadh by 30% of the expected number of road accidents for the year 2014. After applying this strategy, the number of fatalities should be reduced to 266 deaths with an average of 22 deaths per month, compared to the average of 26 deaths per month during 2013(Ar-Riyadh Development Authority, 2011). The Africa Decade Plan of Action of the African Union has the goal of reducing road traffic fatalities by 50% in 2020 and it is also aimed at preventing about one million severe injuries per year (Peden et al., 2013). To achieve this aim, there will need to be an increase in law enforcement on the roads and an improvement in the response times from emergency services after RTAs have occurred.

Furthermore, people throughout Africa will have to be encouraged to use public transportation. Nigeria and South Africa have one of the highest road traffic death rates (33.7 and 31.9/100 000, respectively) (Pedenet al., 2013; World Health Organization, 2013). According to the Kenya Roads Board (KRB), the road safety vision is: "An efficient road network for a prosperous Nation" (Kenya Roads Board, 2013). This can be achieved through increasing the funds available for road safety projects, developing the maintenance of the road network and improving the coordination between stakeholders for road safety within the Kenya Roads Board.

2.2. Empirical review

2.2.1. The Causes of Road Traffic Accident

Various studies have addressed the different aspects of RTAs, with most focusing on predicting or establishing the critical factors influencing injury severity (Chong et al. 2005). Numerous data mining-related studies have been undertaken to analyze RTA data locally and globally, with results frequently varying depending on the socio-economic conditions and infrastructure of a given location. There are numerous factors which contribute to RTAs and traffic injuries, and these factors can be classified into the following three categories: human error, unsafe vehicles and the infrastructure of roads (Cornelissen et al, 2013). Every country must

therefore work on reducing accidents and developing good data recording systems. The causes of accidents must also be identified and analyzed and it is basic to find appropriate counter measures.

2.2.1.1. Drink-Driving Traffic Accident

Leigh and Waldon (1991), for instance, hypothesized three possible effects of unemployment on fatalities. First, as aggregate unemployment increases, driving and fatalities should decrease. Second, the effect of unemployment on drinking per se is ambiguous: some unemployed may drink more due to stress, but lower incomes may lead to less drinking, making the net effect uncertain. Third, unemployment may increase aggregate levels of stress and unhappiness, perhaps leading to poorer concentration, perhaps leading to more crashes and fatalities. Using US data by state the authors found evidence in support of two of these hypotheses: holding vehicle miles constant, unemployment increased road crash fatalities (the stress hypothesis), but because unemployed people drove less, there were fewer fatalities overall. Ruhm (1995) has also examined the effects of macroeconomic conditions on alcohol consumption and found them to be pro-cyclical. Jones and Joscelyn (1978) was the first study to review the association between alcohol and traffic safety. One of their findings was that young male drivers are at high risk of driving under the influence of alcohol. Mayhew et al. (1986) focused on reviewing three groups of studies: the extent of drink-driving by youth, alcohol use among young drivers who were involved in road crashes, and the relative risk of crashing by young drink drivers. They found that young drivers under the influence of alcohol were more likely to be involved in road crashes than their sober peers. They proposed two hypotheses in connection to this observation: first, those young drivers were "inexperienced" with drink-driving; and second, that after drinking young drivers systematically engaged in more risky behavior. According to the UK Department for Transport in the latest available statistics in 2010, 250 people were killed and 9,700 were injured from drink driving. It is known that drink-driving accidents can be caused by drivers of all ages, but especially young drivers in the 20 to 24 age groups (Charlton & Starkey, 2013). Drinking alcohol reduces the ability to observe long distance objects by 25%; it also lessens the response time for the driver by 10% to 30% (Institute of Alcohol

Studies, 2010). In this regard, in France, after lowering the limit to 50mg from 80mg of alcohol in the blood, the number of fatalities was reduced by 4% (Charlton & Starkey, 2013). Therefore, it is vital to inform and educate people about the penalties of drink driving: for example, placing a story in the newspaper could reduce the number of people who drink and drive illegally (Smithers, 2013). According to the Department of traffic and patrols in Abu Dhabi between 2010 and 2012, driving under the influence of alcohol resulted in a 219 RTAs ,with 23 deaths and 36 injuries (Ministry of Interior, 2013).

2.2.1.2. Speed Drive Traffic Accident

The human operator often adapts to changing conditions in ways that do not always serve safety. A single error can have life or death consequences. Behind road-user errors, there are natural limitations. These include vision in night traffic, the detection of targets in the periphery of the eye, the estimation of speed and distance, the processing of information by the brain, and other physiological factors associated with age and sex that have a bearing on crash risk. Also influencing human error are external factors such as the design of the road, the design of the vehicle, traffic rules and the enforcement of traffic rules Dora et.al (2000). Sophisticated and quality-assured systems that combine human beings and machines, therefore, need to have an in-built tolerance of human error (Evans L, 2003).

The tolerance of the human body to the physical forces released in crashes is limited. Injury is broadly related to the kinetic energy applied to the human frame. The energy involved in a collision varies as the square of the velocity, so that small increases in speed result in major increases in the risk of injury. The relationship between impact forces in crashes and the injuries that are sustained is known for a number of parts of the body and type of injury for different categories of road user, as well as for different age groups. Bio-mechanical thresholds associated with age, sex and speed are reliable predictors of crash injury. For example, impact forces that produce a moderate injury in a robust 25-year-old male will result in a life-threatening injury if applied to a 65-year-old infirm female Bobai et.al. (2014). Using fixed speed cameras, radar and speed guns, or organizing and delivering

speed campaigns can be highly effective for raising road safety standards. The Netherlands is one of the countries using all of these technologies (Ribeiro, 2011); the Dutch government adopted a new law called Mulder law, which is appropriate for frequent risky behavior concerning traffic regulations, such as when the vehicle speed exceeds the legal speed by less than 20 mph. If, however, the speed is higher than 20 mph, this is then regarded as a criminal offence in the Netherlands. Here the numbers of police managers were increased by more than a 50%to implement the law. It was then found that the number of fines increased five times between 1995 to 2006 (a total of 8.9 million speed fines) and the breakdown included a percentage of 41 for speed in urban areas, 40% for speed on motorways and 19% for speed on rural roads (Ribeiro, 2011).

2.2.1.3. Lane Road Traffic Accident

Roads are planned according to specific criteria, such as the travel time, traffic congestion, environmental issues and travel costs. Moreover, in the period between a road being planned and a road being built, a number of circumstances can change, such as the volume of vehicles, the type of road users and the weather conditions. It is therefore crucial to focus on the black spot regions (the specific areas where most accidents take place) to reduce the number of road accidents or prevent accidents from happening in the first place. It is also vital to establish the circumstances of RTAs and to confirm where, how and why such accidents occur. Good quality data recording systems will therefore help safety engineers to understand the causes of accidents and to decide what suitable action to take for planning and designing future roads (Wang et al., 2013a). For example, France's Pedestrian Only Zones are designed to give priority to pedestrians in public spaces (Martin, 2009).

Ossenbruggen et al. (2001) used a logistic regression model to identify the prediction factors of crashes and crash-related injuries, using models to perform a risk assessment of a given region. These models included attributes describing a site by its land use activity, roadside design, use of traffic control devices, and traffic exposure. Their study illustrated that village sites were less hazardous than residential or shopping sites. Abdalla et al. (1997) also studied the relationship between casualty frequency and the distance of an accident from residential zones.

Not surprisingly, casualty frequencies were higher in accidents that occurred nearer to residential zones, possibly due to higher exposure. The casualty rates among residents from relatively deprived areas were significantly higher than those from relatively affluent areas. Mussone et al. (1999) used neural networks to analyze vehicle accidents that occurred at intersections in Milan, Italy. These authors used feed-forward multilayer perception (MLP) with BP learning. The model had 10 input nodes for eight variables: day/night, traffic flows in the intersection, number of virtual and real conflict points, intersection type, accident type, road surface condition, and weather condition. The output node ('accident index') was calculated as the ratio between the number of accidents at a given intersection and at the most dangerous intersection. Results showed that the highest accident index for the running over of pedestrians occurred at non-signalized intersections at nighttime. Sohn and Hyungwon (2001) conducted research on pattern recognition in the framework of RTA severity in Korea. They observed that an accurately estimated classification model for several RTA severity types as a function of related factors provided crucial information for accident prevention. Their research used three data mining techniques, neural network, logistic regression, and decision tree, to select a set of influential factors and to construct classification models for accident severity. Their three approaches were then compared in terms of classification accuracy. They found that accuracy did not differ significantly for each model, and that the protective device was the most important factor in the accident severity variation. To analyze the relationship between RTA severity and driving environment factors, Sohn and Lee (2002) used various algorithms to improve the accuracy of individual classifiers for two RTA severity categories.

Using neural network and decision tree individual classifiers, three different approaches were applied: classifier fusion based on the Dempster–Shafer algorithm, the Bayesian procedure, and logistic model; data ensemble fusion based on arcing and bagging; and clustering based on the k-means algorithm. Their empirical results indicated that a clustering-based classification algorithm works best for road traffic accident classification in Korea. Ng, Hung and Wong (2002) used a combination of cluster analysis, regression analysis, and geographical information system (GIS) techniques to group homogeneous accident data, estimate the number of traffic accidents, and assess RTA risk in Hong Kong. Their resulting algorithm displayed

improved accident risk estimation compared to estimates based on historical accident records alone.

The use of street narrowing is very effective when encouraging drivers to reduce their speed, especially in urban and residential areas since narrower streets are safer for pedestrians (Gorrell, 2014). A Street narrowing location depends on the traffic flow and in some locations it may pose a problem for cyclists. It may also adversely affect emergency vehicles and large vehicles in addition to reducing the visibly of drivers to see children who are playing between cars near a street(Edquist et al, 2012). However, in Ontario in Canada, narrowing the road lanes reduced the percentage of the drivers who exceeded 30 km/h from 86% to 20% (Huang &Cynecki, 2011).

2.2.2. Welfare Impacts of Traffic Accident

2.2.2.1. Costs of Road Traffic Accident

The financial impacts of RTAs are equally staggering, costing the world economy billions of dollars in medical treatment, healthcare and other consequences of human suffering (Nguyen et al., 2013). Studies indicate that six different methods have been used to evaluate the cost of road accidents: net output, the implicit public sector valuation, life insurance, court awards, the gross output or human capital method and willingness to pay(WTP) (Widyastuti, 2012). The selection of an appropriate method depends upon two main objectives: the maximization of the national output and the pursuit of social welfare objectives (Dissanayake et al., 2008). The valuation methods that concern these objectives include gross output and willingness to pay, particularly for the use in cost-benefit analyses and for social welfare maximization (Yaya& Li, 2014)When using the gross output method, problems can occur since the result is sometimes affected by people who have a low income, revealing a very low value of life (Dionne & Lanoie, 2002).The Willingness to Pay method (WTP) has been most significantly used as a valuation method since the late 1990s; it is useful for measuring non-market goods, such as pain, grief and suffering as a result of road accidents. It also allows people to take into account all the factors (for example, age, education, gender, occupation, income per month (Dissanayake et al, 2008). The WTP approach evaluates costs based on people's

preferences or how much they are willing to pay to reduce the risk of road accidents. However, the "Gross Output" method is determined by only adding a fixed amount of money to the direct cost and loss of output (Dissanayake et al, 2008). No method has been used to evaluate road casualties in the UAE and the Willingness to pay method cannot be applied to some developing countries because of the unavailability of data, incomplete data or inaccurate data (Asian Development Bank (ADB), 2005). The cost of road casualties is therefore affected by valuation techniques. There are two methods of collecting data to estimate how much people are willing to pay for a reduction in the risk of road accidents, namely Revealed Preference and Stated Preference.

The Willingness to Pay method contains two parts: a material part (consumption loss) and an immaterial part (human losses), such as the value of pain (Wijnen et al, 2009). Firstly, the Willingness to Pay method makes estimations using the Revealed Preference approach, which studies how people decide whether they would like to pay more for a safe vehicle or less for a risky vehicle. This helps to estimate the actual money people spend on safety supplies. The respondent's answers are based on real behavior and the estimate cost is designed to be similar to market data. On the other hand, the Stated Preference approach estimates costs by asking people to value non-market goods (Dionne &Lanoie, 2002). The Stated Preference method depends upon what people say rather than what they do, and it can be applied in any road safety valuation. In theory, Revealed Preference methods are more useful than Stated Preference methods. In the latter, the expenditure of income depends upon what people state they will pay. However, their actual performance may be different from what they indicate, and their expenditure of income can be shown through revealed preference methods. Hence, it is difficult to determine whether a person has chosen a particular vehicle because of its safety devices (such as airbags and seat belts) since most modern vehicles now include these features (Wijnenet al, 2009).

According to David and Zdemiroglu (2002), Stated Preference methods are more flexible than revealed preference methods because hypothetical scenarios can be used to give a good estimation of the willingness to pay for things, these being related to people's preferences (David Pet al, 2002). Using

hypothetical scenarios also means that real data does not need to be collected, so saving time and money (Wijnenet al, 2009). In addition, stated preference studies present scenarios about risk changes and these scenarios are very easy for people to understand and answer correctly. Stated preference studies can be conducted by asking people about their willingness to pay for hypothetical safety developments for themselves as individuals or for others (Navrud& Strand, 2013). The cost of RTAs in the United States is US$99 billion every year which is equal to 2.3% of GNP (Naumann et al. 2010). According to the Department of Transport in the United Kingdom in 2011, the cost of RTAs in Great Britain is £34 billion every year which is equal to 0.5% of GNP (Department for Transport, 2013b). The Transport Research Laboratory started to use the Willingness to paymethod in the UK in1988 to calculate the cost of fatal accidents. In 1993 the method was used to calculate the cost of all road injuries in the UK (Campbellet al, 2014). Meanwhile, in the UAEone fatality in a road crash case costs around 2 million US$. Severe injuries cost between 1 to 1.5 million US$ and the medium injury cost is about 300,000 US$, while minor injuries cost about 150,000 US$ (Government Accountability Office, 2008).Therefore, it is important to invest in road safety in the UAE. There is a new road network in the country with high specifications of safety but, notwithstanding this, the number of fatalities and road casualties is increasing (El-Sadiget al, 2002).

2.2.2.2. Income Impacts of Traffic Accident

As Lanying, (2012) investigated post-crash impacts on RTF victims' family members, including the adverse impacts of lost income, occupational disruption, unfavorable family dynamics, and residential relocation. Survey data from 1291 RTF family members interviewed in Taiwanin 2012 provide the evidence of impact used in this article. Twelve variables related to the family member's socio-demographic background were used to predict the scope of the adverse impact of a fatal crashing regression models developed for this analysis. RTF victims' spouses with relatively low personal incomes and strong dependence up on the crash victims were found to be most likely to experience a marked decrease in post-crash quality of life. RTF victims' family members who lived with few other adult cohabitants and had more juvenile dependents and were emotionally dependent on the victims

were found to be quite likely to experience post-crash setbacks in occupational stability. RTF victims' family members who were emotionally dependent on the victims were found to be more likely to experience major family life disruptions. The younger the RTF victims' family members, and the more years since the crash, the higher the likelihood of residential relocation taking place (lanying, 2012).

2.2.2.3. Labor Impacts of Traffic Accident

According to lanying,(2012) investigates post-crash impacts on RTF victims' family members, including the adverse impacts of lost income, occupational disruption, unfavorable family dynamics, and residential relocation. Survey data from 1291 RTF family members interviewed in Taiwanin 2012 provide the evidence of impact used in this article. Twelve variables related to the family member's socio-demographic background were used to predict the scope of the adverse impact of a fatal crashing regression models developed for this analysis. RTF victims' spouses with relatively low personal incomes and strong dependence up on the crash victims were found to be most likely to experience a marked decrease in post-crash quality of life. RTF victims' family members who lived with few other adult cohabitants and had more juvenile dependents and were emotionally dependent on the victims were found to be quite likely to experience post-crash setbacks in occupational stability. RTF victims' family members who were emotionally dependent on the victims were found to be more likely to experience major family life disruptions. The younger the RTF victims' family members, and the more years since the crash, the higher the likelihood of residential relocation taking place (lanying, 2012).

Dinesh (2002), Quality of life includes the value of pain, suffering, and quality of life loss to victims and their families. The most difficult and contentious costs to estimate are those for death, disability and quality of life. Miller (1996) suggests that pain, suffering, and lost quality of life for fatalities are best valued in dollars using an approach economist's call willingness to pay. This approach derives the value of pain and suffering by asking people what they are willing to pay (called contingent value surveys) or by studying what people actually pay for small changes in their chance of being killed or injured. In the Indian context, it is not very easy to access data which is needed to assess all costs based on above principles. It would

be very interesting to calculate the costs based on willingness to pay. Many families in India get destroyed financially in the process of obtaining treatment for road accident victims and the future education and career opportunities of family members suffer in the process(Dinesh, 2002).

2.2.2.4. Health Impacts of Traffic Accident

There are good reasons why the Government should seek to understand the nature of the relationship between transport provision and economic growth as fully and as clearly as possible. Government is committed to promoting sustainable development, embracing environmental, economic and social objectives. It is important that the economic justification for transport schemes is as robust as possible alongside consideration of their environmental and social impacts to ensure effective decision-making.

The channel of road infrastructural transmission to economic growth is manifested only through the economic growth indicators (GDP, industrial production, employment etc). The nature of transmission is determined by the role of road infrastructure capital in the production function i.e. whether it is a direct or intermediate input. As a direct input, it can either be guided by market forces; hence it is provided by the government as a public good. Where road infrastructure capital is an intermediate input in the production process, the indirect transmission channel through which road infrastructure affects growth is determined by three factors. These are productivity of physical capital which is in turn determined by reduction in adjustment costs and maintenance of existing infrastructure also derived from the facilitation of reallocation of capital. The second variable is higher labor productivity obtained from improved human capacity development. The transmission impact through human development can be realized through improving health better nutrition, education, better Roads, etc. The third factor is the externalities which transmit key technological innovations to other sectors leading to involve lower costs, and spill-over effects on other firms which are the positive externalities while the negative externalities are environmental pollution, congestion, road traffic accidents on the economy as a whole.

Similarly, in promoting economic growth, Government is often concerned about the distribution of such growth. Transport improvements, can form part of public policy packages deliberately aimed at stimulating regeneration in a particular area sometimes even at the expense of other areas. Government needs to be clear that such action is effective in meeting its goals. Government also directly and indirectly finances significant investment in transport.

Good roads are meant to facilitate improvement in the economic and business activities and translate these to making living more meaningful to the citizens, because excellent roads will cause considerable reduction in the cost of production and save time of movement of goods and persons from place to place. A serious problems that have bedeviled less developed countries especially Nigeria is that despite the colossus funds already sunk into construction, expansion, rehabilitation in the last three decades stem from faulty designs, inadequate drainage system, poor maintenance culture which most of the time leads to road traffic accidents.

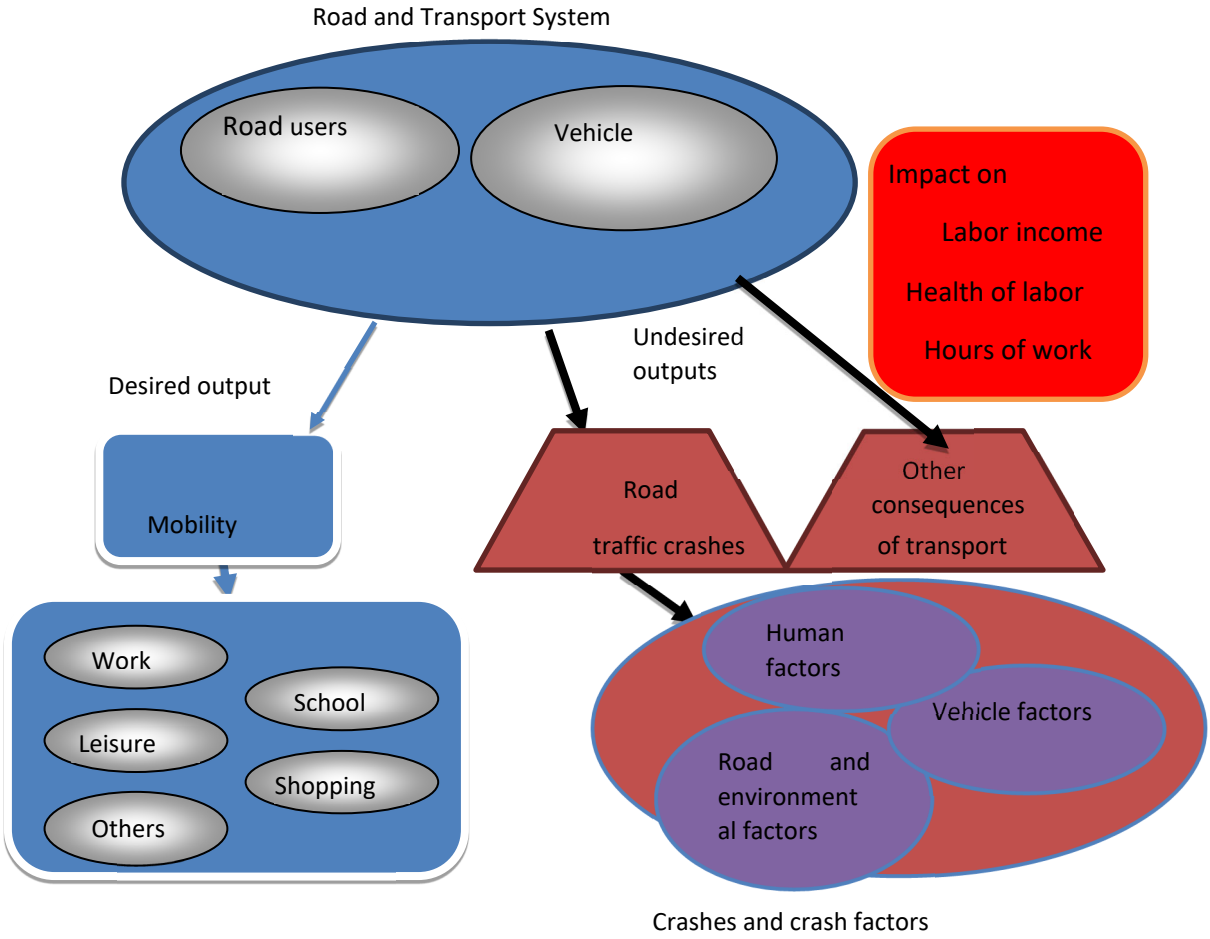
The concept of transport intensity has some problems of definition and measurement which make it inappropriate as a target in its own right, but it has usefully focused concern about the economic and environmental costs of this road traffic growth by raising the question of whether it is possible and desirable to separate the two trends, in order to obtain the benefits of economic growth while reducing the costs imposed by traffic. Recent discussion has observed that they have not been growing at the same pace, but traffic has been growing faster than the economy as a whole. The result is that the 'transport intensity' of the economy has been increasing, Roads provide virtually connectivity of countless origin and destination that are used for social, political and economic activities globally (Allen, 2003). The annual cost of road crashes is in excess of US $500 billion, and in the developing world the estimated cost is about US $65 billion each year. Due to the scarcity of costing data for African countries, it is difficult to make a precise cost of road crashes in Sub-Saharan Africa. The current estimate of costs of crashes in the continent is US$ 3.7 billion per year, of which South Africa alone accounts for 2 billion. However, the estimated costs as a percentage of the national Gross National Product (GNP) in most African countries range from about 0.8% in Ethiopia and

1% in South Africa to 2.3% in Zambia and 2.7% in Botswana to almost 5% in Kenya (Elizabeth K, and Maureen C. (2003)).

2.3. Conceptual Framework

Conceptual frame work of road traffic accident is indicated in figure 2.1. The way how, when, where and on whom it will be occurred and what are the causes and its outcome. Initially the purpose of road users and vehicle movement were for mobility but the misleading of this issue leads to undesired outcome. The main objective of the road users and vehicles is willing to desired point may be work, school, shopping, leisure or others but unexpected the human error, vehicles failure, road problem, environment conditions leads to unwanted or undesired output or road crashes and other consequences such as human health problem, property damage, effect on future life others. A traffic accident, a traffic collision or crash occurs when a vehicle collides with another vehicle, pedestrian, animal, road barriers, or any stationary obstruction such as a tree or a utility pole. Traffic collisions may result in injury, death, vehicle damage and possession damage. Motor vehicle collisions cause death and disability as well as a financial burden. Traffic accidents cause many losses especially of human life, property damages, and loss of resources. Indeed, even in strife influenced countries such as Afghanistan, Libya, Pakistan, and Yemen, road traffic remains the most common cause of fatal injuries, causing between two and eight times more fatalities than war and lawful mediation (Mohammed et al, 2019). Diagrammatical traffic accident visualized as in figure 2.1 below.

Figure 2.1: Theoretical framework of road traffic accident occurrence



Source: own work based on reviewed literature

CHAPTER THREE

3. RESEARCH METHODOLOGY

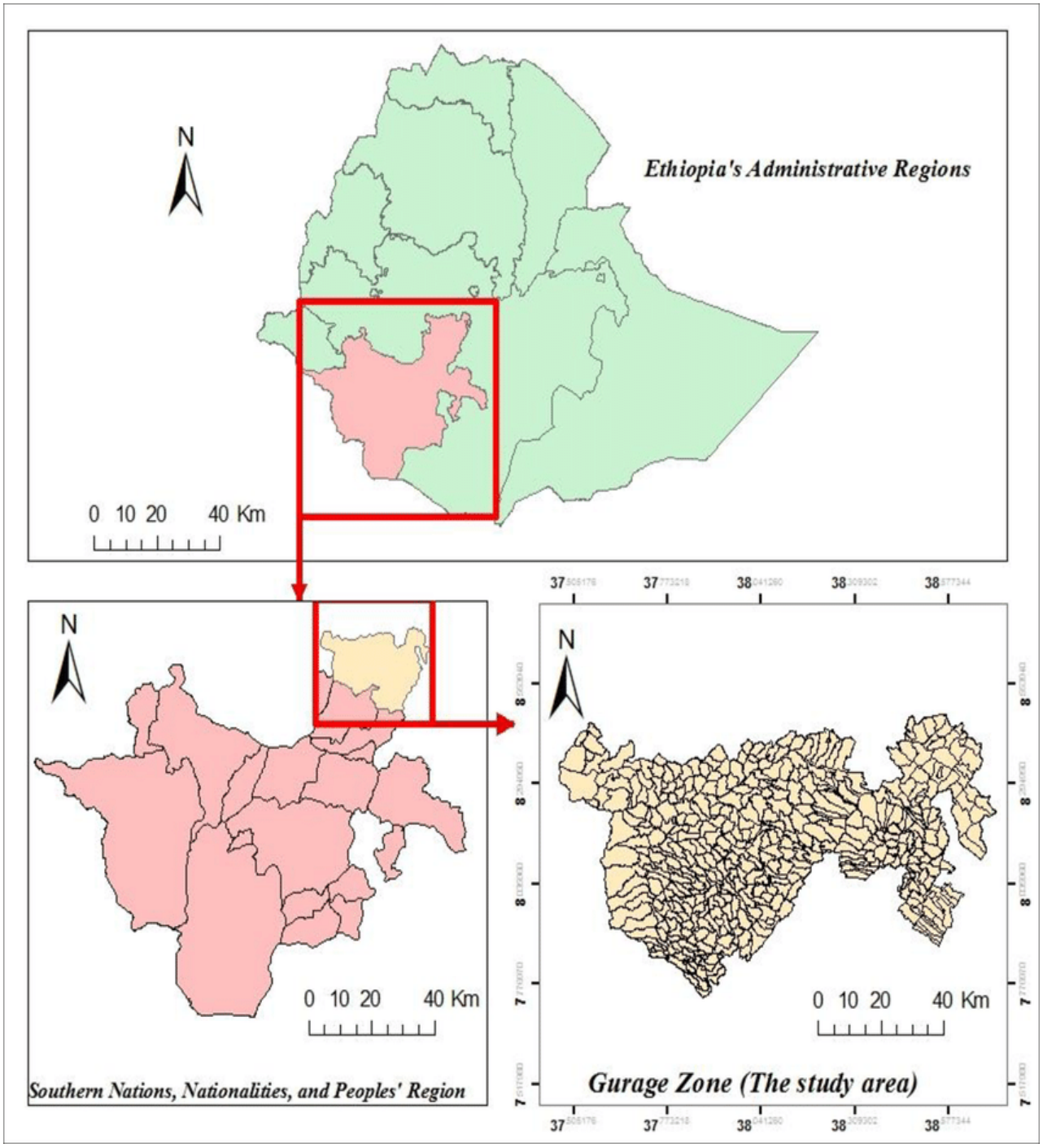
This chapter presents methods of the study constituting the study area, research design, study population, and sampling design. Moreover, this chapter describes the specification of variables of the study and empirical model.

3.1. Description of the study area

The study area is located in Gurage Zone. Gurage Zone is among zones in Southern Nations, Nationalities, and Peoples' Region (SNNPR). The zone is home for different Ethinic groups in Ethiopia and the majority of the residents are Gurage People. Gurage is bordered on the southeast by Hadiya and Yem special woreda, on the west, north and east by the Oromia Region, and on the southeast by Silt'e. Welkite is the zonal administrative center of the Zone. This Zone has 783 kilometers

of all-weather roads and 281 kilometers of dry-weather roads. On average the Gurage zone has road density of 182 kilometers per 1000 square kilometers. According to 2019 traffic police report households faced traffic accident in Gurage zone are 222 and the number of road traffic accidents in the same year reported were 88. According to 2007 census of Central Statistical Agency (CSA) of Ethiopia Gurage Zone has a total population of 1,279,646. Men population was 622,078 and women size was 657,568. The population lives in land area of 5,893.40 square kilometers. Gurage has a population density of 217.13 and 119,822. The urban population of Gurage zone was 9.36%. A household size of the Zone was 286,328 with mean household size of 4.47 persons, and 276,570 housing units Census report of 2007 (CSA, 2007).

Figure 3.1: Map of study the area



Source: GIS, Ethiopia

3.2. Research Design

The research design was experimental research that employed both quantitative and qualitative research approach. A quantitative approach was a dominantly used approach while a qualitative approach was used to supplement the quantitative

approach. A quantitative approach is involving cause and effect relationship between known variables of interest (Creswell, 2013).For instance, the quantitative design was mainly employed to measure the cause effect of road traffic accident on the welfare indicators of labor. Moreover, this study tested the theoretically established relationship between variables.

3.3. Sampling Design

The sample design for this study is the list of people faced traffic accident in Gurage Zone from early 2019 to the end of 2019. Households that did not face traffic accident in the zone were also considered in the sample frame. To make the sample size representative simple sampling technique was used while purposive sampling is used to obtain qualitative information. The total populations with incidence of traffic accident in 2019 were 233. The study population was indicated in Table 3.1.

Table 3.1: the study population

Accident type		Area				Sample total
		Gurage	Wolkite	Butajira	Emdiber	
Total accident		88	15	9	7	31
Total Death in gender	Male	67	7	5	1	13
	Female	21	2	1	5	8
Total serious injury gender	Male	47	23	7	8	38
	Female	21	2	5	5	12
Total light injury by gender	Male	41	9	13	10	32
	Female	26	12	7	4	23
Total accident by gender	Male	155	39	25	19	83
	Female	68	16	13	14	43
Total accident by person	Total	223	55	38	33	126

Source: Gurage zone road traffic accident police report, 2019.

The sample of the two population groups selected using simple random sampling technique. The randomly sampled treatment group, those faced road traffic accident were 105. Fatal accident was not considered in the study due to unavailability of respondent to get reliable information. Randomly selected control group was 120. The total sample size was 225. According to Ethiopian labor proclamation People in the labor force, age 15 to 64 years, were considered for the study in both groups.

3.3. Data Collection Instruments

Both primary data and secondary data were collected. To collect primary data structured questionnaires are used to get information from treatment and control group. Qualitative data was obtained from purposively selected individuals to complement quantitative data.

3.4. Theoretical Model

This section discusses economic models related to welfare analysis. Traffic accident may have negative impact on labor welfare; to visualize the impact on labor theoretical economic model should be employed. In this study to compare the outcome variable of (impact of traffic on labor force welfare regarding income, health expenditure and family life aspect) injured and non-injured status of labor through PSM model was employed. Matching was required because the exposure to the risk of traffic crashes is likely to depend on characteristics of individual respondents, including age, road characteristics (such as road quality and availability of sidewalks), drivers characteristics (such as under age driving, speed drive and drink drive) and other (truly random)influences. To compare economic outcomes of road traffic accident for all respondents grouping specific differences in welfare impact, researcher would estimate PSM models and probit model to identify causal factors on a dataset consisting only of matched households based on PSM. The following equation represents an outcome equation:

$$Y = \alpha + \beta RTA + \varepsilon,$$

where Y is welfare indictor variable (i.e. labor of last 12 month average monthly income, annual health expenditure and last 12 month average monthly working

hour), RTA is a labor Status of road traffic accident (RTA = 1 if a labor faces traffic accident and RTA= 0 if a labor does not face traffic accident), and ε is the error term.

3.5. Empirical Model

Under this section of the study needed to discuss first econometric model(s) to be used to achieve each planned research question. To analyze the causes of traffic accident and impacts on labor PSM was employed. Two empirical models were used. Firsts, probit model was used to determine factors contributing to road traffic accident and second Propensity Score Matching (PSM) was used to examine the impact of traffic accident on labor welfare.

i. Probit regression

In the probit model, a labor by road traffic accident rated (Y) injured is given a value 1(road traffic accidents encountered are those rated injured) while a labor road traffic accident rated un-injured is given a value of 0.

The probability p_i of having a labor injured by road traffic accident rating over an un-injured rating can be expressed as:

$$\mathrm{Pi} = \Pr(\mathrm{Yi} = 1|\mathrm{x}) = \Phi\left(x^i\beta\right)$$

Where Φ is the cumulative distribution function of a standard normal variable which ensures $0 \leq pi \leq 1$, x^i is i^{th} vector of factors that determine or explain the variation in road traffic accident outcome and β is a vector of parameters or coefficients that reflects the effect of changes in x on the probability of accident. The relationship between a specific factor and the outcome of the probability is interpreted by the means of the marginal effect which accounts for the partial change in the probability. The marginal effects provide insights into how the explanatory variables change the predicted probability of accident.

ii. Propensity Score Matching Method (PSM) for impact analysis:

Impacts are discreet (usually binary) variables. Treatments are heterogeneous in the population (Heckamn et al., 1997), developed a framework that each labor has two

potential outcomes; an outcome when accident faced (Y_1) and not faced (Y_0). If we let the road traffic accident status D, D=1 for injured and D=0, for not injured, then it is possible to write the observed outcome Y of the labor performance as a function of the two potential outcomes as:

$$Y_i = DY_1 + (1 - D)\, Y_0 = D\,(Y_1 - Y_0) + Y_0$$

The causal effect of the road traffic accident on its observed outcome Y is the difference between the two outcomes (Y_1-Y_0). But because of the realization, the potential outcomes are mutually exclusive that is only one of the two outcomes has been observed at a time (Nguezet et al, 2011). It is also impossible to measure the individual effects of road traffic accident in any labor. However, it can be possible to estimate the mean effect of road traffic accident on a population labor. Such mean parameter is called average treatment effect (ATE) (Imben and wooldridge, 2009).

$$\text{ATE} = \frac{1}{n}\sum_{i=1}^{n} \frac{Di - (p(xi)Yi}{p(xi)(1-p(xi))}$$

Where n is the sample size, n1=$\sum Di$is the number of treated variable i.e. the number of labor that injured by road traffic accident and p(xi) is a constant estimate of propensity score evaluated at x. It is possible to employee probit specification to estimate the propensity score.

Propensity score matching pursues a targeted evaluation of whether exposed to road traffic accident causes labor to impose to their welfare performance. There will be problem of avert and hidden biases and deal with the problem of noncompliance or indigenous treatment variable. In order to remove such biases Robin (1974) introduces conditional assumption which postulates, the existence of a set of covariate x, which controlled for renders the treatment outcomes (y1 and y0). The estimation using the conditional independent assumption) or they are based on a two stage estimation procedure, conditional probability of treatment called propensity score. From this we can develop two interrelated stages:

Estimating the propensity score- The first step in PSM method is to estimate the propensity scores by using either logit or probit models. Caliendo and Kopeinig (2008) noted that the logit model which has more density mass in the bounds could

be used to estimate propensity scores, P(x) using a composite characteristics of the sample households and matching will then be performed using propensity scores, p-score, of each observation. Matching algorism will be selected based on the data to be collected after undertaking matching quality test. Overlapping condition or common support condition will be identified, estimating the average treatment effects of both outcomes (ATE1 and ATE0) after estimation of the propensity scores, seeking an appropriate matching estimator is the major task.

There are various matching estimators, which include the nearest neighbor matching, caliper and radius matching, stratification and interval matching, kernel and local linear matching (Caliendo and Kopeinig, 2008).The treatment effects will be estimated based on matching estimators selected on the common support region (owusu and Awudu, 2009).The average treatment effects can be estimated using the inverse propensity weighing estimates as stated in IPSW (Nguez et al., 2011) using matching techniques of Kernel Matching (KM), Nearest Neighbor Matching (NNM) and Radius Caliper Matching (RCM).

Nearest Neighbor Matching: Caliendo and Kopeinig (2008) said that NN matching is the most straightforward and frequently used matching estimator in PSM. The individual from the control group is chosen as a matching partner for a treated individual with the least distance in terms of propensity score (Becker and Ichino, 2002). Several variants of nearest neighbor matching are proposed, e.g. NN matching 'with replacement' and 'without replacement'. In the former case, an untreated individual can be used more than once as a match, whereas in the latter case it is considered only once. Matching with replacement involves a trade-off between bias and variance. If we allow replacement, the average quality of matching will increase and the bias will decrease while increasing the variance. This is of particular interest with data where the propensity score distribution is very different in the treatment and the control group.

A problem which is related to nearest neighbor matching without replacement is that estimates depend on the order in which observations get matched. Hence, when using this approach, it should be ensured that ordering is randomly done. It is also suggested to use more than one nearest neighbor matching. Reduced variance will result from using more information to construct the counterfactual for each

participant, with increased bias that results from on average poorer matches (Caliendo and Kopeinig, 2008).

Radius Matching: To avoid the problems of bad matches resulted from the Nearest Neighbor matching; economists impose a tolerance level on the maximum propensity score distance (caliper). Imposing a caliper works in the same direction as allowing for replacement. Bad matches are avoided and hence the matching quality rises. However, if fewer matches can be performed, the variance of the estimates increases. Applying caliper matching means that an individual from the comparison group is chosen as a matching partner for a treated individual that lies within the caliper ('propensity range') and is closest in terms of propensity score (Caliendo and Kopeinig, 2008).

Dehejia and Wahba (2002) suggest a variant of caliper matching which is called radius matching. The basic idea of this variant is to use not only the nearest neighbor and limit itself within each caliper but all of the comparison members or observations within the caliper. The benefit of this approach is that it uses only as many comparison units as available within the caliper and therefore allows for usage of extra (fewer) units when good matches are (not) available.

Kernel Matching: With Kernel matching, all treated groups are matched with a weighted average of all control groups with weights that are inversely proportional to the distance between the propensity scores of treated and control (Becker and Ichino, 2002). But the matching algorithms discussed so far have in common that only a few observations from the comparison group are used to construct the counterfactual outcome of a treated individual.

Kernel matching is a non-parametric matching estimator use weighted averages of all individuals in the control group to construct the counterfactual outcome. Thus, one major advantage of this approach is the lower variance which is achieved because more information is used. Caliendo and Kopeinig (2008) concluded that like other matching algorithms, Kernel matching has also its own drawbacks that arise from the nature of the matching algorithm. The major drawback of this method is the possibility of inclusion of observations with a very low and high propensity scores and may give bad matches. Hence, the proper imposition of the common

support condition is of major importance for Kernel matching. To apply Kernel matching one has to choose the bandwidth parameter.

The choice of the bandwidth parameter is quite pertinent with the following trade-off arising: High bandwidth-values yield a smoother estimated density function, therefore leading to a better fit and a decreasing variance between the estimated and the true underlying density function. On the other hand, underlying features may be smoothed away by a large bandwidth leading to a biased estimate. The bandwidth choice is a compromise between a small variance and an unbiased estimate of the true density function and it may not be a predetermined issue (Habtamu, 2010).

The question remains on how and which method to select. Clearly there is no single answer to this question, Bryson et al. (2002) stated the choice of a given matching estimator depending on the nature of the available dataset that is it depends on the data in question, and in a particular on the degree of overlap between the treatment and comparison groups in terms of propensity score. It should be clear that there is no 'winner' for all situations and that the choice of a matching estimator crucially depends on the situation at hand. When there is a substantial overlap in distribution of propensity score between the comparison and treatment groups, most of the matching algorithms will yield similar results (Dehejia and Wahba, 2002).

Treatment effect on the treated: To estimate the effect of road traffic accident to a given outcome (working hour per labor, monthly income per labor and annual health expenditure per labor), is specified as:

$$\tau_{ATT}=Y_i\ (d_i=1) - Y_i\ (D_i=0)$$

Where τi is treatment effect (effect due to road traffic accident), Yi is the outcome on labor i, Di is whether labor i has got the treatment or not (i.e., whether a labor faced traffic accident or not). However, one should notice that Yi (Di=1) and Yi (Di=0) cannot be observed for the same labor at the same time. Depending on the position of the labor in the treatment either Yi (Di=1) or Yi (Di=0) is unobserved outcome (counterfactual outcome). Due to this fact, estimating individual treatment effect τi is not possible and one has to shift to estimate the average treatment effects of the population than the individual one. Two treatment effects are most frequently

estimated in empirical studies (Dillon, 2008). The first one is the (population) Average Treatment Effect (ATE), which is simply the difference of the expected outcomes after traffic accident faced or not:

$$\Delta Y_{ATE} = E(\Delta Y) = E(Y_1) - E(Y_0)$$

This measure answers the question what would be the effect if households in the population were randomly assigned to treatment. But this estimate might not be of importance to policy makers because it includes the effect for which the intervention was never intended (Dillon, 2008).

Therefore, the most important evaluation parameter is the so called Average Treatment Effect on the Treated (ATT), which concentrates solely on the effects on those for whom the interventions are actually introduced. In the sense that this parameter focuses directly on those labors that injured, it determines the realized impact of road traffic accident and helping to decide whether accident occurred or not. It is given by:

$$\tau_{ATT} = E(\tau/Di=1) = E(Y1/Di=1) – E(Y0/Di=0)$$

This answers the question, how much did labor injured by road traffic accident loss compared to what they would have not injured. Data on E (Y1/D=1) are available from labor injured by road traffic accident. An evaluator's classic problem is to find E (Y0/D=1). So the difference between E (Y1/D=1) - E (Y0/D=1) cannot be observed for the same labor. Due to this problem, one has to choose a proper substitute for it in order to estimate ATT. The possible solution for this is to use the mean outcome of the comparison individuals, E (Y0/D=0), as a substitute to the counterfactual mean for those being treated, E (Y0/D=1) after correcting the difference between treated and untreated labor arising from selection effect. Thus, by rearranging, and subtracting E(Y0/D=0) from both sides of equation, one can get the following specification for ATT.

$$E(Y1/D=1) = E(Y0/D=1) - E(Y0/D=0) = \tau_{ATT} + E(Y0/D=1) - E(Y0/D=0)$$

Both terms in the left hand side are observables and ATT can be identified, if and only if E(Y0/D=1)-E (Y0/D=0) =0. i.e., when there is no self-selection bias. This

condition can be ensured only in social experiments where treatments are assigned to units randomly i.e., when there is no self-selection bias (Caliendo and Kopeinig, 2008). In non-experimental studies one has to introduce some identifying assumptions to solve the selection problem. The following are two assumptions to solve the selection problem.

Assumptions:

Assumption1: Conditional Independence (Un-confoundedness): There is a set X of covariates, observable to the researcher, such that after controlling for these covariates, the potential outcomes are independent of the treatment status

$(Y1,Y0)\perp d/X$

The potential outcomes are independent of the treatment status, given X. Or, in other words after controlling for X, the treatment assignment is "as good as random." This property is also known as un-confoundedness or selection on observables. The CIA is crucial for correctly identifying the impact of participation, since it ensures that, although treated and untreated groups differ, these differences may be accounted for in order to reduce the selection bias. This allows the untreated units to be used to construct a counterfactual for the treatment group (Caliendo and Kopeinig, 2008).

Assumption 2: Common support (Overlap): This assumption rules out perfect predictability of dgiven X. That is $0 <P(d = 1/X) < 1$

This equation implies that the probability of receiving treatment for each value of X lies between 0and 1. By the rules of probability, this means that the probability of not receiving treatment liesbetween the same values. Then, a simple way of interpreting this formula is the following: theproportion of treated and untreated individuals must be greater than zero for every possible valueof X (Caliendo and Kopeinig, 2008). The second requirement is also known as overlap condition, because it ensures that there is sufficient overlap in the characteristics of thetreated and untreated units to find adequate matches (or a common support). When these two assumptions are satisfied, the treatment assignment is said to be strongly

ignorable (Rosenbaum and Rubin, 1983). Given the above two assumptions, the PSM estimator of ATT can be written as:

$$E(Y1 / d = 1) - E(Y0 / d = 0) = \tau ATT + E(Y0 / d = 1) - E(Y0 / d = 0)$$

Where P(X) is the propensity score computed on the covariates X. Equation is explained as; the PSM estimator is the mean difference in outcomes over the common support, appropriately weighted by the propensity score distribution of participants.

Data Analysis Technique: As identified in section 3.6.2 below, the study involves more than one explanatory variable, i.e., the study examines the effect of the variables on the explained variable. To develop econometric model the researcher would have used probit model to treat each individual cause of traffic accident variable and PSM model to analyze impact of traffic accident on labor force welfare. In this study both descriptive and inferential data analysis method was used by using software of STATA which is a general-purpose statistical software package that enables users to analyze, manage and produce of data collected by researcher. Present the outcomes of the result. To make all the data collected and stored meaningful and consumable appropriate analysis will be made by using tabular and percentage form of presentation accompanied by relevant explanation. Respondents selected from a range of scores/ratings/choice of answers for both traffic accident and labor variables which were arranged and coded using point numeric rating scales. In case of this study there are three types of labor welfare impact (i.e., health, income and family life) being potentially chosen by each traffic accident type, each traffic accident may zero, one, two or more labor welfare in each type.

3.6. Specification of Variables

This section presents the specification of dependent and independent variables used for analysis.

3.6.1. Dependent Variables

We considered two dependent variables. First, to determine factors contributing to traffic accident,1 for labor force faced road traffic accident and 0 otherwise. The second dependent variable involves welfare indicators. These outcome variables (welfare indicators) are monthly income of labor, average monthly hours worked by labor in the last 12 months and annual health spending. These outcome variables are explained as follows:

Annual health Spending: it is proxy of health expenditure on drugs, hospital for medical purpose and other health related spending of respondents (WHS, 2002). In such case respondents may spend money for medical and others health related issues. As the labor spend more on health related issues indicates that less welfare and less spend indicates that no health problem implies that the labor welfare is at good condition. The outcome of the health expenditure will be continues. In this case researcher would get data control group from non-injured labor or non-victim respondents.

Monthly income: It is a continuous and an outcome variable measured in ETB and it is the proxy of individual wage/salary income from labor services/self-employment income. Income of individual may be affected by RTA. To determine this in this study average monthly income of the labor during last 12 month was used average monthly income. Average monthly income is the sum of the each month for last one year divided by 12 month. As the labor income is high indicates that the labor has welfare and as income is low the labor is welfare is affected (Tom, 2017). Regarding to this study researcher was obtained before data accept as non-injured respondents with the same level of demographic characters.

Monthly Working hour: it is the proxy of working hours the labor spends on work during last 12 month and it is calculated as average monthly work hour in the given period of the year (i.e. the sum of working hour in each month during last one year divided by 12 month). Two indicators for employment status were used as an indicator for working time of the respondent and as more time the respondent spend on work an indicator for the no impact of Road Traffic Injuries welfare of labor and

the less not or insufficient time the respondent spend on work an indicator for the have impact RTA welfare of labor (Khurshid and Ajay, 2016).

3.6.2. Independent Variable

The main independent variables included passenger, environmental, vehicle, and driver characteristics.

Personal involves pedestrian factors: Road Traffic Accident result from human error, (World HealthOrganization, 2009). According to The Ministry of Interior statistics report in the UAE, the highest cause of road accidents is carelessness. The pedestrian factors that may cause road traffic accident are presented below:

Living area: 1 if he/she lives inrural area; 0 if he/she lives in urban area

Frequently traveling on foot: 1 if he/she travels on or either side of highway (main road) in rural areas; 0 if he/she travelson or either side of highway (main road) in urban areas;

Frequencyof crossingor walk highway:1 if he/she crosses highway or walks on the side of highway/street daily: 0 if he/she crosses weekly or more than weakly

Time of crossing highway:1 if cross crossing in the Day time, 0 if cross at Night time

Time takes: it is continuous variable and the proxy of time takes to arrive all weather roads from living in minutes

Status of using pedestrian crossing when you cross the street or high ways: 1 if he/she use pedestrian crossing when crosses the street or high ways, 0 if he/she not use pedestrian crossing when crosses the street or high ways

Watching the direction before crossing the street or highways: 1 if he/she watch the left and the right direction of street/ highways before crossing the street or highways; 0 otherwise

Vehicle factors included brake failure, burst tires, and overloaded cars during travel and frequently used for travel (including Pedestrian, motor car, van, bus, truck, motorcycle and commercial cars). Lack standard regulations for safety, which means that many pedestrians, motorcyclists and cyclists experience RTAs (WHO, 2009).There are also faults on vehicles that could lead to serious injuries and fatalities

Driver related factors:

Age: Age of driver. driver at early age are less matured, carless, give less value for their life are more likely affected by adult and similarly more aged(above age 64) driver are ability to drive is ineffective. Here in this study ever encountered under age 18 and above age 64 driver during travel (i.e. above driving limited age under driving limited age was used independently).

Under age 18: 1 if he/she observed driver with under age 18 during travel, 0 if he/she does not observed driver with under age 18 during travel. The study by Manner &Wünsch-Ziegler (2013)found that younger people are more exposed to traffic accident than adult workers. Therefore, in this study we expect that youth are more likely exposed to traffic accident.

Above age 64: 1 if he/she observed driver with above age 64 during travel, 0 if he/she does not observed driver with above age 64 during travel.

Drink driving: Drinking alcohol reduces the ability to observe long distance objects; it also lessens the response time for the driver (Institute of Alcohol Studies, 2010). 1 if he/she observed driver with drunk while driving, 0if he/she does not observed driver with drunk while driving during travel.

Speed driving: RTA caused by excessive speed lead to increased damage and the injuries are more serious because of the nature of kinetic energy (Manner &Wünsch-Ziegler, 2013). 1 if he/she observed speed driving driver during travel, 0 if he/she does not observed speed driving driver during travel

Violating traffic rules: the driver failure to obey traffic rule can all be prevented and the lack of these measures heavily contributes to RTA (Stanojevićet al., 2013).

1 if he/she observed driver violates traffic rules during travel, 0 if he/she does not observed driver violates traffic rules during travel.

Road related factors

Included traffic light, zebra crossing, Pedestrian path in road and road networks and they are dummy variables. The use of road quality is very effective when encouraging drivers to reduce their speed, especially in urban and residential areas since narrower streets are safer for pedestrians (Gorrell, 2014).

Traffic light: 1if the community road have enough traffic light, 0 if the community road have no traffic light.

Zebra crossing: 1 if the community roads have enough zebra crossing, 0 if the community roads have no enough zebra crossings

Pedestrian roads: 1 if the community roads good enough to Pedestrian, 0 if the community roads not good enough to Pedestrian

Roads network: 1 if the community road networks is safe for road users, 0 if the community road network is not safe for road users

CHAPTER FOUR

RESULT AND DISCUSSION

This chapter presents results and discussion of findings. It has three main subsections, the first subsection deals with the respondents' profile, the second subsection tells about exposure factors of traffic accident, the third subsection deals with impact analysis of welfare indicators.

4.1. Description of respondents

As the survey result indicates in table 4.1demographic profile of the respondent, regarding to gender of respondent 74.67% were male where as 25.33% were female. This indicates that most of survey participants were male but when we compare road traffic accident status regarding to gender most of male respondents were injured relatively the proportion of female injured labor is lower than male. Regarding to Marital status of respondents, 51.11%, 44.89%, 1.78%, 1.33% and 0.89% of the respondents were never married, married, divorced and cohabiting respectively. As the comparison of traffic accident status regarding to marital status single (never married) labor were have highest proportion of injuries relatively compared to married, divorced and cohabiting respectively.

Regarding to Current job status of respondents, 33.78%, 19.11% and 34.22% of the respondents were governmental, non-governmental and self-employee respectively while the other 12.89% of the respondents were unpaid working age workers like student who work for family as the survey result implies the road traffic accident status in-terms of current job status self-employed labor were more injured than labor who were works in Government sectors, Nongovernment employee and others in working age but unpaid workers like student, work for family and etc. Regarding to Age of labor who faced road traffic accident on average of age was 34year with standard deviation of 7.450 and road traffic accident not faced labor on average of age were 36 years with standard deviation of 9.518. This reveals that age of injured labor was less than the age of not injured labor. Regarding to education status of respondent, on average education status of injured labor was high school complete (grade 10 complete) with standard deviation

of 0.906 and average education status of labor not injured had diploma with standard deviationof0.759. This implies that education status of labor injured is lower than that of labor not injured by traffic accident.

Table 4.1: Demographic background of respondent

Background variables	Category	Total(n=225)		Road traffic accident status			
				Yes(n=105)		No(n=120)	
		N	%	N	%	n	%
Gender	male	168	74.67	77	73.33	91	75.83
	female	57	25.33	28	26.67	29	24.17
Marital status	never married	115	51.11	53	50.48	62	51.67
	married	101	44.89	49	46.67	52	43.33
	Divorced	4	1.78	1	0.95	3	2.50
	widowed	3	1.33	1	0.95	2	1.67
	cohabiting	2	0.89	1	0.95	1	0.83
current job	Government employee	76	33.78	29	27.62	47	39.17
	Nongovernment employee	43	19.11	0	0.00	43	35.83
	self-employee	77	34.22	63	60.00	14	11.67
	others	29	12.89	13	12.38	16	13.33
Age	Mean	35.138		33.990		36.141	
	Sd.	8.664		7.450		9.518	
	Min						
	Max						
Education	Mean	2.649		10.409		10.858	
	Sd.	0.859		0.906		0.759	
	Min						
	Max						

Source: own Survey result, 2020

4.1.1. Causes of Traffic Accident

4.1.1.1. Labor force related cause of traffic accidents

Labor force that faced traffic accident live in rural area was54.29% and 45.71% faced the accident live in urban area. The result indicates that the rural people were more exposed for traffic accident than urban residents. Regarding to traveling area on foot, traffic accident was more likely for people walking along road side than others. The finding indicates that from those who frequently traveling on foot on or

either side of highway (main road) in rural areas or roads not bordering highway (main road) in rural areas more exposed to traffic accident relatively compared in urban area. This means not to mean that traveller on or either side of highway (main road) or on roads not bordering highway (main road) in urban areas didn't have exposure to road traffic accident but it is to mean that it was lesser than rural.

Traffic accident status regarding to frequency of crossing highway or walk on the side of highway/street 55.24% of injured labor were daily traveller where as 44.76% of injured labor were weekly traveler. This indicates that as a labor crossing highway or walk on the side of highway/street frequently was more exposed to traffic accident than labor who crosses highway or walk on the side of highway/street weekly (with in a long time).Traffic accident status regarding to time of crossing highway or walk on side of highway/street 89.52% of injured labor were morning and day time whereas 10.48% were night time user. This result indicates that morning/day time road users were more exposed to road traffic accident compared to night time traveller. This means does not to mean nighttime road users were not injured of traffic accident all; rather it is to mean that night time road user are lesser exposed to road traffic accident than morning and day time. This implies that at travel night time is not more seen local due to these roads become free and pedestrians might not use road as day and morning time; thus, this all might reduce the road traffic accident at night time.

Traffic accident status regarding to status of using pedestrian crossing 67.62% of injured that of using pedestrian crossing when crossing the street or highways. When compared to traffic accident status for un-injured with injured labor regarding to status of using pedestrian crossing uninjured labor those uses pedestrian crossing were higher in percentage of 73.33% than that of injured labor. This indicates that of using pedestrian crossing when crossing the street or high wayswassafer from road traffic accident labor than that of not using pedestrian crossing when crossing the street or high ways. This indicates that more of injured in road traffic accident are those who are not using pedestrian crossing when crossing the street or high ways compared to non-injured. Those who are travel long time to arrive all-weather roads in minutes are relatively more likely injured in traffic accident with mean of 13.90 and 8.829 than those travel short time to arrive all weather road with mean of

13.841 and 8.679. In addition to this finding interview analysis support this regarding to personal behavior expose to road traffic accident are crossing the road at places not designed for pedestrian crossings, awareness of penalty ticket for crossing roads at an inappropriate place, using mobile phone while crossing roads and Crossing the road as a pedestrian while drunk.

Table 4.2: Road Traffic accident status by individuals' behavior related factors

Variable	Category	**Road traffic accident status**		
		Total (%)	Labor force faced accident (%)	Labor force did not faced (%)
Living area(rural=1, urban=0)	Rural	55.56	54.29	56.67
	Urban	44.44	45.71	43.33
Frequency that you cross highway or walk on the side of highway/street	Daily	72.44	55.24	87.50
	Weekly or long time	27.56	44.76	12.50
Time of crossing highway or walk on side of highway/street	Morning/day time	95.11	89.52	100.00
	Night time	4.89	10.48	0.00
Using pedestrian crossing when you cross the street or high ways	Yes	29.33	67.62	73.33
	No	70.67	32.38	26.67
Watching the left and the right direction of street/ highways before crossing the street or highways	Yes	71.11	76.19	66.67
	No	28.89	23.81	33.33
Time takes to arrive all-weather roads in minutes	Mean	13.871	13.905	13.842
	Sd.	8.730	8.829	8.679

Source: own survey result, 2020

4.1.1.2. Driver related cause of traffic accidents

Driver related traffic accidents are caused by mistakes made by driver. For example speed driving, under age driving, overloading, drunk-driving are causes of traffic accident occurred by error made by the driver. Speed drive during travel was observed by63.81% of injured labor while for did not injured labor both observed and not observed speed drive during travel by car was equal. The result based on injured group indicates that speed drive more likely to expose for road traffic accident. This finding implies that drivers drive at speed expose to high road traffic accident risk. In the similar manner of driving with speed, driving while drunk during travel more likely exposed to road traffic accident. The finding indicates that driving while drunk is risky factor to road traffic accident.

Drivers with age under 18 year driving during travel are relatively high to be encountered by road traffic accident. This indicates that drivers whose age below 18 years may lead to road traffic accident whereas drivers with age above 64 year during travel have encountered for both group was low but when compare it for both groups injured have observed was low proportion. This indicates that drivers with age above 64 year during travel may not expose to road traffic accident.

Regarding to behavior of driver violating traffic rule during travel, drivers who were violating traffic rules during travel made greater road traffic accident than those who obeyed the rule. This indicates behavior of driver violating traffic rule during travel that more likely to expose traffic road accident than those obey traffic rules. This indicates that drivers when driving while obeying traffic rule at travel saves from traffic accident. Driving with overload transport during travel observed injured group have more observed than not injured as shown in table below but the observed proportion were lower than not observed. This may indicates that driving with overload transport expose to road traffic accident. This reveals that over capacity load might lead to traffic accident. In addition to this finding interview analysis support this regarding to driver behavior factor exposes to RTA are not wearing a seat belt while driving, using mobile phone while driving, drinking alcohol and driving and no enough awareness of traffic signs and zebra crosses.

Table 4.3: Road traffic accident status by driver behavior related factors

Variable	Category	Road traffic accident status		
		Total (%)	Labor force faced accident (%)	Labor force did not faced (%)
Speed drive	Yes	56.44	63.81	50.00
	No	43.56	36.19	50.00
drunk driving	Yes	59.11	70.48	49.17
	No	40.89	29.52	50.83
Driver's age is under 18 year	Yes	48.89	52.38	49.17
	No	51.11	47.62	50.83
Drivers age is above 64 year	Yes	14.22	12.38	15.83
	No	85.78	87.62	84.17
violating traffic rules	Yes	60.44	80.00	43.33
	No	39.56	20.00	56.67
overloading	Yes	36.44	49.52	25.00
	No	63.56	50.48	75.00

Source: own survey result, 2020

Vehicle related traffic accident

In this subsection of the study vehicle related factors were analyzed, as a result labor with traffic accident and without accident frequently use commercial vehicle transport for travel. As the survey result indicates that 69.17%non-injured labor encountered vehicle failure in travel. Similarly the 59.05% injured respondent had faced vehicle failure in travel but that much not high as non-injured. This implies that all vehicle failures may not lead to road traffic accident for all road users but it may leads to property loss or other influences. This does not mean that all failure of vehicles does not cause traffic accident. Brake vehicle failure is almost equally encountered during travel by both faced and did not face accident labor.

Similar to vehicle failure non-injured labor faces more brake failure than that of injured labor. Regarding to observe burst tires vehicle failures occurred during travel non-injured faces higher than injured. Based on the survey result this all indicates that vehicle factor may not lead to road traffic accident alone but it may depend on driver behavior or road condition.

Table 4.4: Encountering vehicle related factors by injured and non-injured labor

Variable	Category	Road traffic accident status		
		Total	faced accident	did not faced accident
Vehicle related				
Encountered any vehicle failure in your travel	Yes	64.44	59.05	69.17
	No	35.56	40.95	30.83
Observed Brake vehicle failures occurred during travel	Yes	68.89	68.57	69.17
	No	31.11	31.43	30.83
Observed burst tires vehicle failures occurred during travel	Yes	63.56	57.14	69.17
	No	36.44	42.86	30.83

Source: own survey, 2020

Road condition related causes of traffic accident

Road condition related causes of traffic accident were also examined. As the survey result indicates that community roads did not have traffic light at all. Almost 56.2 % of injured labor reported that communities roads have zebra crossing while 42.5% without injure labor said community roads did not have zebra crossing. As the result implies in both groups most of respondent replies that the community road have enough zebra cross. This indicates that community road zebra cross has no that much exposure in the study area. This means that not to mean zebra cross is not necessary for community road/ not to say an exposure factor for the road traffic accident.

Regarding to community roads to pedestrian safety, the survey result indicates that 65.83% of non-injured respondent replies that community roads good enough to pedestrian and 34.17% of respondents contradicts the statement. But as the injured respondent 53.33% of respondent that community road relative to non-injured respondent replies low rate and relatively high respondent of 46.67% contradicts that community roads good enough to pedestrian. This implies that the community road pedestrian safety may have serious issue in the community regarding to traffic accident. This implies that in the community road traffic accident implies to pedestrian road is seriously affecting.

Regarding a community road network is safe for road users53.33% of respondent from injured labor replies it is safe but 45.71% contradicts the statement. When it compared to not injured group50.00% of respondent have doubt with community road and 48.33% of respondent have viewed that the community road network is not safe for users. This indicates that the community road network needs correction relatively compared for both group.

Table 4.5: Descriptive summary of road condition related factors

Variable			**Road traffic accident status**	
	Category	Total (225)	Yes(105)	No (120)
Road condition				
Community Roads have traffic light	Yes	0.00	0.00	0.00
	No	0.00	0.00	0.00
Community roads have zebra crossing	Yes	56.89	56.19	57.50
	No	43.11	43.81	42.50
Community roads good enough to Pedestrian	Yes	60.00	53.33	65.83
	No	40.00	46.67	34.17
A community road network is safe for road users	Yes	51.56	53.33	50.00
	No	47.11	45.71	48.33

Source: own survey result, 2020

Descriptive summary of labor welfare variables

In this subsection of the study researcher deals with descriptive comparison of the welfare indicators for treatment and control group. As a result the total sample of treatment group is 105 and sample of control group is 120. Welfare regarding to working hour indicates highly affected by traffic accident. The average working hour for treatment group is 101.4857during last 12 months within month with maximum and minimum of 196 and 44 were able to work working hours respectively.

The average working hour for control group is 141.53 with maximum and minimum of 196 and 72 works during last 12 months weekly working hour respectively. The finding reveals that the average working hour during last 12 month weekly working hour for treatment is lesser than control group working hour during last 12 months weekly working hour.

Welfare Regarding to the average monthly income for last 12 months influenced due to traffic accident. As shown in table 4.3 above the average monthly income for treatment group during last 12 monthly on average monthly income in average is ETB 1578.262. The finding reveals that the average monthly income during last 12 month on average for treatment group is lesser than that of control group.

Regarding to healthy expenditure during last 12 month, average health expenditure for treatment is ETB5467.81 with minimum and maximum of ETB600 and ETB23400 health expenditure during last 12 month respectively. Healthy expenditure during last 12 month, average health expenditure for treatment is ETB239.667 with maximum of ETB1800 health expenditure during last 12 month. The finding reveals that the annually healthy expenditure for treatment higher than control group.

Table 4.6: Descriptive summary of labor welfare indicator variables used

Variable	**Road traffic accident status**			
	No(120)		Yes(n=105)	
	Mean	Std. Dev.	Mean	Std. Dev.
Dependent variable				
Working hour	141.5333	35.27442	101.4857	30.29728
Income	3022.296	1652.586	1578.262	1352.505
Health expenditure	239.667	387.1419	5467.81	5376.831

Source: own survey result, 2020

4.2. Factors affecting road traffic accident

This section presents the probit model result indicated in Table 4.8 and the marginal effects of variables that affect traffic accident at less than 5% significance level were interpreted. The probit model fits the data well since the Wald test rejects the null hypothesis that states that all regression coefficients in each equation are jointly equal to zero was rejected at the 5% significance level.

Rural people in labor force were 14.5% more exposed to face traffic accident than urban labor force and the location effect is significant at 1%. The result attributed to rural people lack information about using traffic light, zebra crossing, the direction of movement, rural people may less likely obey traffic rules than urban,

in most cases speed drive is more likely in rural areas and road conditions and road signals are poor in rural areas.

People travel on foot on main roads and streets outside areas allowed for pedestrians 15.9% more probability to be faced traffic accident while in the similar manner the time traveling had become exposure causes for traffic accident as a result shown in table below the labor who travel in night time was 24.5% more probability exposed for traffic accident, the frequency of travelling also had found significant contributing factor to road traffic accident at the 5% significance level and the result indicates that weekly traveller was 19.5% more probability exposed for traffic accident.

Regarding to the driver related factors that expose to road traffic accident, the survey result reveals that drive while drunk, under 18 age drive, above 64 age drive, violates traffic rule and over load were significant exposure factor for road traffic accident at the 5% significance level. The finding consents with the finding of Mayhew et al. (1986) as focused on reviewing three groups of studies: the extent of drink-driving by youth, alcohol use among young drivers who were involved in road crashes, and the relative risk of crashing by young drink drivers and (Smithers, 2013). As the survey result indicates that, from the road condition of community zebra cross has significant exposure factor for the road traffic accident. The findings support the study conducted by (Edquist et al., 2012) and (Gorrell, 2014). As a result the factors that expose to road traffic accident were computed using average marginal effects as table4.7 shown below.

Table 4.7: Factors affecting traffic accident

Variables	marginal effect	Se	z-value	p-value
Location	0.145	0.052	2.79	**0.005**
F traveling	0.159	0.032	5.03	**0.000**
Travel time	0.245	0.046	5.30	**0.000**
Frequency time	0.196	0.051	3.84	**0.000**
Pedestrian crossing	0.085	0.051	1.68	0.094
Watching direction	0.104	0.054	1.92	0.055
Travel time length	0.001	0.002	0.34	0.734
Speed drive	0.031	0.056	0.57	0.569
Drink drive	0.181	0.059	3.02	**0.003**

Under age drive	-0.278	0.064	-4.34	**0.000**
Above age	-0.203	0.073	-2.77	**0.006**
Violates traffic rule	0.343	0.057	5.93	**0.000**
overload	0.329	0.067	4.93	**0.000**
Transport type	0.014	0.018	0.78	0.435
Vehicle failure	-0.001	0.048	-0.03	0.977
Brake vehicle failure	0.068	0.052	1.30	0.195
Burst vehicle failure	-0.111	0.053	-2.09	**0.037**
Zebra cross	-0.203	0.065	-3.11	**0.002**
Road good pedestrian	-0.035	0.053	-0.67	0.503
Road network	-0.003	0.048	-0.06	0.951
Wald statistics	LR chi2(20)			175.58
	Prob> chi2			0.0000
	Pseudo R2			0.5647
log likelihood				-67.667698
observations				225

Source: own survey result, 2020

4.3. Impact of traffic accident on labor welfare

The treated groups were densely found to the left of the graph while the control group symmetrically found in the midlines of the density estimate graph. After estimating values of traffic accident (propensity scores) of injured and not injured the second step is matching users and the control group by imposing a common support condition. The estimated propensity score has within the range of .0119 and 0.999 with a mean of 0.796 for traffic accident injured (treated groups) and in a range of 0.001and 0.961with a mean of 0.177 for not injured (control groups).

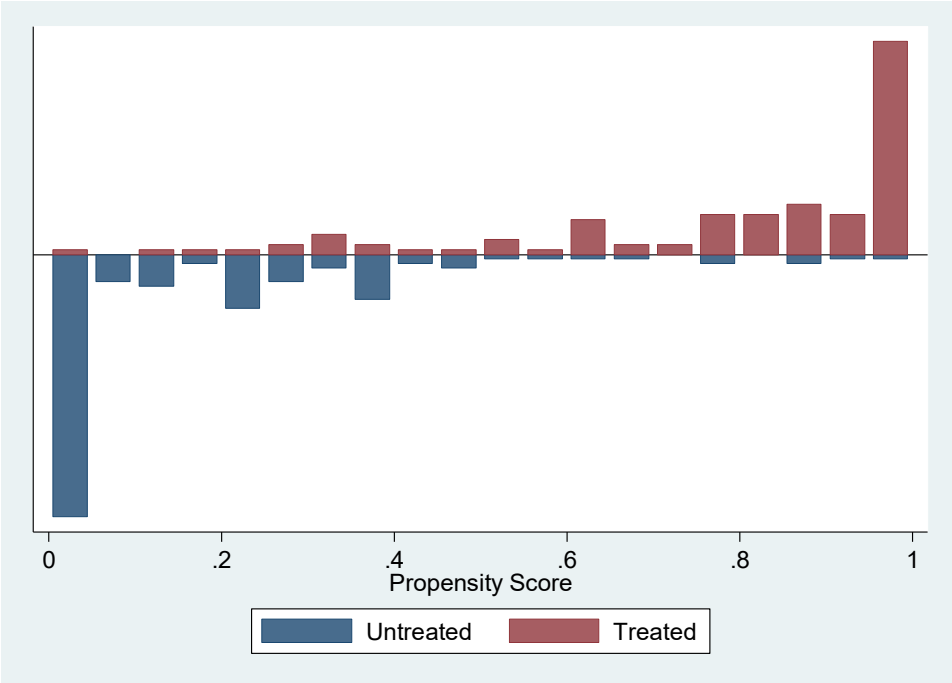
Table 4.8: Summary of estimated propensity scores

Groups	Observation	Mean	Std. Dev.	Min	Max
Total	225	0.4663326	0.3896748	1.03e-06	0.9999999
Control group	120	0.1772432	0.2308604	1.03e-06	0.96104
Treated group	105	0.7967204	0.2437925	0.011958	0.9999999

Source: own survey result, 2020

The graphical display of propensity score is shown in figure4.1 below. After creating the propensity scores, an evaluation of the distributions by treatment group checks for sizeable overlap among the groups demonstrating that the groups are comparable.

Figure 4.1: Histograms of Propensity Scores



Source: own survey result, 2020

4.3.1. Common support region

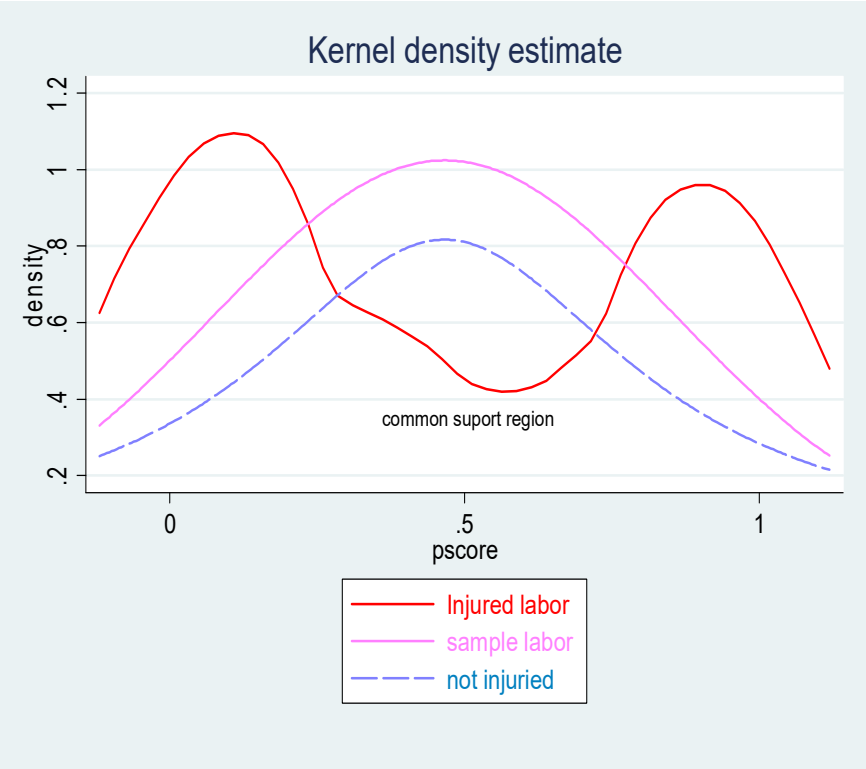
After estimating values of propensity score for injured and non-injured the next step in propensity score matching technique is the common support condition. The propensity score for each participant and non-participant groups was estimated to identify a common support region for the two groups. As indicated in the computed propensity scores vary between 0.01195804 and 0.99999989 (mean=0.7967) for injured labor and between 0.011958 and 0.99999 (mean=0.1772) for non-injured labor. Based on the minimum and maximum criterion, the common support region was lie between [0.01195804, 0.99999989]. In other words, with estimated propensity scores less than 0.01195804and greater than 0.99999989would not be taken for matching purpose.

As shown in appendix 2 table, out of the total sample households (225), 40 labors (control group labors) were discarded from the analysis. Thus, in the analysis 190 sample labors those who have common support region were included and the rest 40labors were excluded from the analysis. The appendix 2 table shows the region of

common support is [0.01195804, 0.99999989] which includes only 85 control sample matches with 105 treated samples.

The kernel density estimate in figure-1 revealed that the distribution of the total sample labors, injured, and non-injured of sample labor with respect to estimated propensity scores.

Figure 4.2: Common support region



Source: own survey result, 2020

4.4. Impact Analysis of Traffic Accident on Labor Welfare

To estimate labor welfare impact of road traffic accident propensity score Matching (PSM) impact evaluation technique was used. To estimate the average treat effect the study was used four matching technique of nearest neighbor matching, kernel matching, radius and stratification matching. The result of each impact road traffic accident on labor welfare indicator variables using four matching technique were analyzed in the following subsection.

4.4.1. Impact Analysis of Traffic Accident on Labor Work Hour

As shown in table below the result of impact of traffic accident on labor working hour the study employed the matching techniques to estimate the effect. As a result the ATT for all matching techniques was become significant. As a result ATT based on nearest neighbor of 22 controlled sample matches with 105 treated samples and kernel matching of 85 controlled sample matches with 105 treated samples analysis below road traffic accident on working hour have negative and significant almost similar result. The highest ATT results on stratification matching estimator. This indicates that traffic accident have negative and significant impact on labor working hour. The finding reveals that a labor who injured by traffic accident may waste at least about 42 working hours more without work.

Table 4.9: ATT of traffic accident on labor work hour

Welfare indicator variable	Matching algorithm	N. Treat	N. contr.	ATT	Std. Err.	T
Working hour	Nearest neighbor	105	22	-42.438	16.088	-2.638
	Radius	105	85	-41.913	7.280	-5.758
	Kernel	105	85	-42.677	15.812	-2.699
	Stratification	105	85	-48.661	14.288	-3.406

Source: - Own Survey result, 2020

4.4.2. Impact Analysis of Traffic Accident on Labor Income

As shown in table below the result of impact of traffic accident on labor income researcher employed the four techniques to estimate the effect. As a result of the matching estimator for income shown below was become insignificant for nearest neighbor, Kernel and stratification. But for only radius matching it becomes significant. As result of this ATT analysis below indicates that traffic accident have significant impact on labor income for matched group of 85 control group sample with 105 treated group sample. This implies that traffic accident at population of study have significant and negative impact on labor income and this means that a person who injured by traffic accident have losses income of ETB 957.468.

Table 4.10: ATT of traffic accident on labor Monthly Income

Welfare indicator variable	Matching algorithm	N. Treat	N. contr.	ATT	Std. Err.	T
Income	Nearest neighbor	105	22	-46.167	546.447	-0.084
	Radius	105	85	-957.468	338.382	-2.830
	Kernel	105	85	-550.519	558.733	-0.985
	Stratification	105	85	-680.410	486.215	-1.399

Source: Own Survey result, 2020

4.4.3. Impact Analysis of Traffic Accident on Labor Health Expenditure

As shown in table below the result of impact of traffic accident on labor health expenditure researcher employed the four techniques to estimate the effect. As a result all matching estimator was become significant and the average treatment effect for nearest neighbor and kernel matching estimator approximately have the same result 5258.095 and 5211.326. But the nearest neighbor considers 22 controls with 105 treatment group. When compare the result of all matching estimator of ATT the average difference was very small. The finding reveals that individual on average who faced traffic accident imposed to waste addition health expenditure. This indicates that traffic accident have significant impact on labor health expenditure and a labor who injured by road traffic accident spends at least ETB 5115.810 more for health expenditure within a year.

Table 4.11: ATT of traffic accident on labor Health expenditure

Welfare indicator variable	Matching algorithm	N. Treat	N. contr.	ATT	Std. Err.	T
Health expenditure	Nearest neighbor	105	22	5258.095	552.241	9.521
	Radius	105	85	5183.390	529.552	9.788
	Kernel	105	85	5211.326	233.462	22.322
	Stratification	105	85	5115.810	552.147	9.265

Source: own Survey result, 2020

4.5. Treatment Effect on the Treated

The estimation result presented in all welfare impact analysis report above provides a supportive evidence for the effect of the road traffic accident on working hour of labor, income of labor and health. As shown in Table below, the PSM estimation result shows that road traffic accident had a significant impact on all welfare selected indicators of labor in the study area. To see this average treatment the road traffic accident impact of labor welfare on treated (injured labor) study employed the nearest neighbor matching technique. As a result as shown in table below ATET of road traffic on working hour for accident faced labor indicates that the accident encountered labor 47.77 working hour lesser than that accident does not faced. The result is significant at 5% significance level with p-value of 0.00. Similar to working hour the ATET estimation result for income and healthy expenditure were found significant. The Income of labor that injured by traffic accident is lower by on average ETB 1356.043 than uninjured labor at 5% significance level with p-value of 0.000 and regarding to Health expenditure road traffic accident faced labor wastes on average additional ETB5172.19 at 5% significance level with p-value of 0.000. The finding on ATET estimation indicates that road traffic accident had found significant impact of labor working hour, monthly income and health expenditure. The finding supports that finding as Lanying, (2012) investigated post-crash impacts on Road traffic fatality victims' family members, including the adverse impacts of lost income, occupational disruption and unfavorable dynamics and the suggestion of Miller (1996).

Table 4.12: ATET of traffic accident on labor welfare

Variable	ATET	AI Robust Std. Err.	Z	P>z
Work hour	-47.77143	6.306995	-7.57	0.000
Income	-1356.043	291.4177	-4.65	0.000
Health expenditure	5172.19	526.6964	9.82	0.000

Source: own Survey result, 2020

4.6. Treatment Effect on the labor force

In this subsection the study reveals that welfare impact for all labor force has been analyzed. And report indicates the reverse of influence if the labor was not treated or not injured finding provides a supportive evidence for those not affected labor

effect of the road traffic accident on working hour of labor, income of labor and health as whole. As shown in Table below, the PSM estimation result shows that road traffic accident had a significant impact on all welfare selected indicators of labor in the study area. To see this average treatment impact of labor welfare on all labor force study employed the PSM. As a result as shown in table below ATE of road traffic on working hour for all sample labor indicates that the accident not faced labor spends 46.08 working hour more than that of accident faced labor. This means that if a labor force does not faced road traffic accident he/she utilize 46.08 working hour more than that of traffic accident faced labor.

The result is significant at 5% significance level with p-value of 0.00. Similar to working hour the ATET estimation result for income and healthy expenditure were found significant. The Income of labor that not injured by traffic accident is greater by on average ETB 1032.073than injured labor at 5% significance level with p-value of 0.000. This implies that if the labor was injured by traffic accident he/she might get additional ETB 1032.073. And regarding to Health expenditure road traffic accident not faced labor saves on average ETB 4785.933 or a labor force that not faced wastes ETB 4785.933 lesser than that of accident faced labor at 5% significance level with p-value of 0.002.

Table 4.13: ATE of traffic accident on labor welfare

Variable	ATE	AI Robust Std. Err.	z	P>z
Working hour	-46.08	9.599717	-4.80	0.000
Income	-1032.073	282.9087	-3.65	0.000
Health expenditure	4785.933	1551.711	3.08	0.002

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. Summary of the Study

The main objective of the study is to assess the labor welfare impact of road traffic accident in Gurage zone, Ethiopia. The researcher aimed to answer the specific research objective the causes of road traffic accident, the health impact of road traffic accident, the income impact of road traffic accident, what is the hours of work impact of traffic accident and the study employed statistical tool of STATA version 13.

The exploratory research design and both qualitative and quantitative research approach were employed for this study. Researcher would use primary data through questionnaire and according to the police office report of Gurage zone 2018/2019 fiscal year traffic data due to the RTA injured/ crashed individuals at working age population (above 15 years) around all study area. The total population for this study will be 223 injuries and as the purpose of study impact evaluation researcher will add control group or non-injured. To compare economic outcomes of road traffic accident for all respondents grouping specific differences in welfare impact, researcher would estimate PSM models and probit model to identify causal factors on a dataset consisting only of matched labors based on PSM. Based on the objective of the study researcher briefly discussed the result at the forth chapter and based on the result of the study researcher makes conclusion and forwarded recommendation in the following subsections respectively.

5.2. Conclusion

This paper evaluates the potential impact of road traffic accident for accident faced on labor welfare measured by work hour, income and health expenditure of labor. The study utilizes cross-sectional labor level data through questionnaire in from a randomly selected sample of 225 labors (105traffic accident faced and 120 control

group). Researcher estimates the casual impact of traffic accident by utilizing probit regression and propensity score matching methods to evaluate the impact of traffic accident on labor welfare. The causal factors for traffic accident were identified and based on probit regression analyzed the additional average effect of the exposure were also analyzed.

Regarding to personal/traveller factors location/living area such as it may be raised from rural area resident have no awareness about the road traffic rule and the road condition is not safe or traffic rules might not be obeyed in rural area might be weak, the way how to use, when they frequently walk in foot, the traveling time, frequency of travelling and watching the direction before crossing the way were significant factors and may expose to road traffic accident at the 5% significance level. In developing countries like Ethiopia the resource constraints, especially of lack of awareness when and how and to do use the main street may lead the unlimited consequence of road traffic accident like loss of life, un wanted spending of income or loss of income and disturbance of dependent and all family life.

Moreover, road user behavior is careless. Similar Studies show that drivers frequently ignore traffic laws (Odero et al., 2003; WHO, 2004) and pedestrians have frequently walk in the middle of streets and cross without checking for traffic. Regarding to the driver related factors that expose to road traffic accident, the survey result reveals that drive while drunk, under 18 age drive, above 64 age drive, violates traffic rule and over load were significant exposure factor for road traffic accident at the 5% significance level. As the survey result indicates that, from the road condition of community zebra cross has significant exposure factor for the road traffic accident. The result shows that personal/traveller and driver factors are the most exposure factor for the road traffic accident.

In addition to this based on the interview analysis the study has identified the causes of not wearing seat belt while driving, using mobile phone while driving, using mobile phone while crossing roads as a pedestrian, Aggressive driving behavior, the most unsafe driving behaviors are speeding, not using indicators and won't to see traffic signs. This helps us estimate the true welfare effect of road traffic accident by controlling for the role of selection problem on accident encountered.

The causal impact estimation from both the propensity score matching and probit regression suggests the road traffic accident injured have significantly lower income than non-injured even after controlling for all confounding factors. The results from average treatment effect of population statistics (ATT) also confirms that road traffic accident has significant impact on health expenditure and injured waste more health expenditure than non-injured although the result from propensity score matching is significant. Injured labor by road traffic accident, propensity score matching estimates show that road traffic accident facing has a negative and significant effect on average monthly income per injured labor although the impact on healthy expenditure is positive and significant effect on average monthly income per labor and, negative and significant effect on average monthly working hour for last 12 month per injured labor.

The results from this paper generally confirms the potential direct role of road traffic accident leads to lose of welfare through working hour, income and unwanted wastage of health spending. This all leads to labor in to losing welfare. Not only this when someone in a low income(poor) family is injured and is bed ridden at home or the hospital, the whole family gets involved in the care of the patient. These results in the disturbance of labor of all family members those on self-employed daily wage lose their income, children may not go to school and older family members may spend less time in the care of dependents. The household has to cope with the time and financial demands of the situation and this can have a permanent effect on the health of children in the family. This can be the result of loss of income, less attention, worsening hygiene at home. Since in Ethiopia a very large number of poor labor depend on daily wages and temporary jobs, the may not have health insurance, or the assistance of social welfare, a serious injury can result in permanent decrease of income.

Based on the conclusion researcher forwarded recommendation for all those concerns the risk condition of road traffic accident in the following subsection.

5.3 Recommendation

Based on the findings of the study, the following separate and specific policy interventions were proposed:

- **Government/traffic management department** need to give attentions to factors expose to road traffic accident. Here some of the next exposure factors that lead to traffic accident were identified for better attention to be given by traffic management.
- The traffic management department and road authority need to restrict or regulate pedestrians crossing a road through zones not allowed to be crossed by pedestrians.
- Traffic management department or road authority had better build sufficient traffic signs such as traffic light, zebra cross (pedestrian cross) and other community geographic related signs.
- Traffic management and awareness creating individuals or company should target to inform the pedestrian and driver about how to use that pedestrian's road and traffic signs.
- Regarding to respecting traffic rule to reduce this risky situation the traffic management should strictly implement penalties on drivers violating rules by drunken driving, speed derive and overloading.
- The government can increase detection of drivers violating rules by using technologies, such as using speed cameras, alcohol consumption detecting machine and other information system, must be applied as much as possible.
- As mentioned in the finding Road condition is risk factors of road traffic accident to overcome such accident encountered road traffic accident government and road authority should give priority to improve network, excessive dust obscuring road user view and capacity of road channel.

Pedestrian: The current road traffic accident leads all labor and human being to serious healthy and economic problem. And the personal factors serious exposure for traffic accident. Therefore

- All pedestrians should continue to be encouraged to obey the law on traffic safety.
- Every community or national road users considering the impact should stand beside of government and traffic management to eradicate road traffic accident through implementing the following suggestion:

- To overcome this risky condition all road users should respect traffic rule by obeying the law.
- Building good awareness starting from household level how to use road and what can't allowed by traffic management

Drivers: As the finding indicates the driver, vehicle and road factors leads to significant road traffic accident, therefore drivers and the road and transport authority should give priority to the following issues:

- As the finding indicates that vehicle factor is other exposure for road traffic accident. Therefore every driver should have to identify the mechanical defects on the vehicles and any vehicle feature that may contribute to an accident before starting travel or driving.
- In order to save life and reduce burden of road traffic accident drivers should carefully and responsible respect each and every traffic management rule and regulation.

Finally further researcher to get solution for the current continuous road traffic accident should have to conduct by including macroeconomic impact of country, national level healthy impact of road traffic accident and strategies to reduce road traffic accident.

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Appendix I

WOLKITE UNIVERSITY

SCHOOL OF POST GRADUATE

DEPARTMENT OF ECONOMICS

Questionnaire for labor

Dear respondent,

I am a postgraduate student at Wolkite University Department of Economics. Currently, I am undertaking a research entitled "causes of traffic accident and impacts on labor welfare of Gurage zone, Ethiopia" The data you provide will only be used for academic purpose only and respondents are assured that whatever information is provided will be highly confidential. I would like to thank you in advance for your time consideration in filling this questionnaire.

Sincerely

DerejeYohannis

Wolkite University

I. Socio-demographic information

Please kindly tick the box that clearly expresses your view about a question and write in the blank space for open-ended question.

1. Gender male □ female □
2. Age: _____ years
3. What is your current marital status?
   1. Never Married □ 2. Married □ 3. Divorced □
   4. Widowed □ 5.Cohabiting □
4. Highest Grade completed: _____ grade
5. What is your current job?
   1. Government employee □
   2. Nongovernment employee□
   3. Self - employed □
   4. Employer □

5. Other

I. **Traveller/individuals behavior related factors**

6. Where are you living?

Rural area □ urban area □

7. Where were you frequently traveling on foot?
    1) On or either side of highway (main road) in rural areas
    2) Roads not bordering highway (main road) in rural areas
    3) On or either side of highway (main road) in urban areas
    4) Roads not bordering highway (main road) in urban areas
8. What is the frequency that you cross highway or walk on the side of highway/street?

    Daily weekly monthly

9. When do you cross highway or walk on side of highway/street?

    Day time Night time both

10. How far your home is from all-weather roads _____minutes

11. Are you using pedestrian crossing when you cross the street or high ways?
    Yes, always □ Yes, sometimes □ No, I do not use □

12. Are you watching the left and the right direction of street/ highways before crossing the street or highways

    Yes, always □ Yes, sometimes □ No □

II. Driver behavior related

13. Do you see frequently drivers drive with speed behavior during travel

    Yes, always □ Yes, sometimes No□

14. Do you see frequently drivers with drink driving behavior during travel

    Yes, always □ Yes, sometimes □ No □

15. Do you see frequently drivers with age under 18 year driving behavior during travel

Yes, always □ Yes, sometimes No □

16. Do you see frequently drivers with age above 64 year during travel

Yes, always □ Yes, sometimes No □

17. Do you frequently observed drivers violating traffic rules during travel?

Yes, always □ Yes, sometimes No □

18. Do you frequently observed overloaded cars during travel?

Yes □ No □

III. Vehicle related characteristics

19. What was frequently you use for travel?

Pedestrian □ commercial vehicle □ bicycle and Motorcycle □

Automobile □ Busses □ Animal Drawn Cart □

20. Have you ever encountered any vehicle failure in your travel?

Yes, all times □ yes, sometimes No □

21. Do you frequently observed Brake vehicle failures occurred during travel?

Yes, all time □ Yes, sometimes No □

22. Do you frequently observed burst tires vehicle failures occurred during travel?

Yes □ No □

IV. Road condition

23. Does your community road have traffic light?

Yes □ No □

24. Does your community roads have zebra crossing?

Yes □ No □

25. Is your community roads good enough to Pedestrian?

Yes □ No □

26. Is your community road networks is safe for road users?

Yes □ No □

V. Information related to general labor welfare

27. Your average working hour per day during the last 1 week: _____ hours

28. Your average working hour per day during the last 12 months: _____hours

29. Average monthly income during the last 12 months: _____ birr
30. Your total work hours that have not used in the last 12 months because of illness: _____ hours
31. You're total health expenditure during the last 12 months: _____Birr
32. Have you ever faced road traffic accident? (if your answer is yes continue the next part, unless you are kindly requested to stop here)

    Yes □ No □

33. Suggest policies and strategies to reduce road traffic accident in Ethiopia? -------
    ---

    ---
34. Suggest policy or strategy revisions to reduce traffic accident problems?

    -

    _____
    _____
    _____
    _____
    _____
    _____

Focus group interview question

The main aim of the subsection of questionnaire is to gather information about causes of road traffic accident. The respondent of the following question are traffic police, Gurage zone road and transport bureau agent, and community representatives (Participants and non-participants).

1. Can you mention personal behavior expose to road traffic accident in your surrounding?
2. Can you mention vehicle related factor exposes to RTA in your community?
3. Can you mention driver behavior factor exposes to RTA in your community?
4. Can you mention road behavior exposes to RTA in your community?
5. Can you mention environmental/weather condition exposes to RTA in your community?
6. What do you think to reduce RTA?

ወልቂጤዩኒቨርሳቲ

የድህረ-ምረቃትምህርትቤት

የኢኮኖሚልማትዘርፍ

መጥይቅ

ውድ፣መልስሰጪ

በወልቂጤዩኒቨርስቲኢኮኖሚክስዲፓርትመንትየድህረ-ምረቃተማሪነኝ።በአሁኑወቅት “የትራፊክአደጋመንስኤዎችእናየጉራጌዞን፣የሠራተኛደህንነትላይየሚያሳድራዉተጽኖዎች” በሚልርዕስምርምርእያካሄድኩኝነው።የምትሰጡኝመረጃለትምህርታዊዓላማብቻየሚውልእናምላሽሰ ጪዎችየሚሰጡትማንኛውምመረጃሚስጥራዊነቱይጠበቃል።ይህንመጠይቅለመሙላትጊዜስለሰጡኝ በቅድሚያአመሰግናለሁ።

ከሠላምታጋር

ደረጀዮሐንስ

ወልቂጤዩኒቨርሲቲ

እባክዎንስለእያንደንዱጥያቄያለዎትንአመለካከት/መልስየሚገልፅሳጥንላይምልክትያድር ጉእናለክፍትጥያቄክፍትቦታለይይፃፉ።

II. **የገሶሺዮ-ሕዝባዊመረጃዎች**

1. ፆታ፤ወንድ □ ሴት □

2. ዕድሜ፤ _____ ዓመት

3. የጋብቻሁኔታ?

ፈጽሞያላገቡ □ ያገቡ □ በሞትየተለያዩ □ የተፈቱ □ ሳይጋቡአብሮመኖር □

4. ያጠናቀቁትየትምህርትደረጃ፤_____

5. በአሁንስዓትሥራዎምንድነው?

1. የመንግሥትሠራተኛ □
2. መንግስታዊያልሆነድርጅትሰራተኛ □
3. በግል - ተቀጣሪ □
4. አሰሪ □
1. ሌላ □

III. **ከተጓዥ / ግለሰብጋርየተዛመዱባህሪ**

6. አሁንየሚኖሩበትየመኖሪያአካባቢ

ገጠር □ ከተማ □

7. ብዙውንጊዜበእግርየሚጓዙትየትነበር?

1) በገጠርአካባቢዎችሀገርአቀዋራጭመክናመንገድበሁለቱምጎኖች□

2) በገጠርአካባቢዎችሀገርአቀዋራጭመክናመንገድባልሆኑመንገዶች □

3) በከተማውስጥበሀገርአቀዋራጭመክናመንገድበሁለቱምጎኖች□

4) በከተማውስጥሀገርአቀዋራጭመክናመንገድባልሆኑመንገዶች □

8. ሀገርአቀዋራጭመክናመንገድላይወይምበጎንጎንበኩልበእግርየሚያቋርጡትበ ምንያክልድግግሞሽነው?

1. በየቀኑ □ b. በየሳምንቱ □ c. በየወሩ □

9. ሀይዌይላይሲያቋርጡወይምበሀይዌይ / በጎዳናውጎንየሚራመዱትመቼነው?

1. ማለዳ □ b. ቀንሰዓት □ c. ማታማታ □

10. የሁልጊዜየመክናመንገድከቤትዎበደቂቃምንያህልይርቃል፤ _____ ደቂቃ _

11.በጎዳና (በዋናውመንገድ) ላይሲያቋርጡየእግረኛመሻገሪያያይጠቀማሉነው?

1. አዎ፣ሁልጊዜ □ b. አዎ፣አንዳንድጊዜ □ c. አይደለም፣አልጠቀምም□

12.በጎዳናውንወይምበሀይዌይላይከማቋረጥዎበፊትየግራእናየቀኝውንመንገድይ መለከተሉ

1. አዎ፣ሁልጊዜ □ b. አዎ፣አንዳንድጊዜ □ c. አይ፣አልመለከትም □

II.ከአሽከርካሪባህሪጋርየሚዛመዱመጠይቅ

13. በጉዞወቅትበተደጋጋሚበፊጥነትየመንዳትባህሪያላቸዉአሽከርካሪዎችአጋጥ ሞታል?

አዎ □ አይደለም □

14. በጉዞወቅትጠጥቶየማሽከርካሪባህሪያለውአሽከርካሪብዙጊዜአጋጥሞታል?

አዎ □ አይደለም □

15. በጉዞወቅትከ18 ዕድሜበታችየሆነአሽከርካሪበብዛትአጋጥሞታል?

አዎ □ አይደለም □

16. በጉዞወቅትከ64 ዕድሜበላይየሆነአሽከርካሪበብዛትአጋጥሞታል?

አዎ □ አይደለም □

17. በጉዞወቅትየትራፊክህጎችንሲጣሱአዘውትረውያስተውላሉ?

አዎ፣ሁልጊዜ □ አዎ፣አንዳንድጊዜ □ አይ፣አላስተዉልም □

III.ከመኪናጋርየተዛመዱባህሪዎችንበተመለከተ

18. ብዙውንጊዜለጉዞምንይጠቀማሉ?

የእግረጉዞ □ የንግድተሽከርካሪ □ ሳይክልእናሞተርብስክሌት □

የቤትመኪና □ አውቶቡስዎች □ በእንስሳትየሚሳብጋሪ □

19. እርስዎብዙጊዜበጉዞውስጥማንኛውምተሽከርካሪአለመሳካትአጋጥሞታል?

አዎ □ አይደለም □

20. በጉዞወቅትበተደጋጋሚተሽከርካሪውድቀቶች/መሰበርተከስቷል?

አዎ □ አይደለም □

21. በጉዞወቅትበተደጋጋሚጎማዎችይፈነዳሉተሽከርካሪውድቀቶችተከስቷል?

አዎ □ አይደለም □

22. በጉዞወቅትከመጠንበላይጭነቶችመኪናዎችንብዙውንጊዜያስተውላሉ?

አዎ □ አይደለም □

V. የእርስዎአካባቢየመንገድሁኔታ

23. በእርስዎማህበረሰብየመንገድየትራፊክመብራትምልክትአለ?

አዎ □ አይደለም □

24. በእርስዎማህበረሰብየእግረኛመንገድማቋረጫ(ዜብራ) አለው?

አዎ □ አይደለም □

25. የእርስዎአካባቢመንገድለእግረኛበቂናጥሩነው?

አዎ □ አይደለም □

26. የማህበረሰብዎየመንገድአውታረመረብለመንገድተጠቃሚዎችምቹነው?

አዎ □ አይደለም □

VI.የግለሰቡአጠቃላይደህንነትአመልካችመረጃዎች

27. ባለፉት 7 ቀናትውስጥየእርስዎአማካኝየሥራሰዓትበቀን_____ ሰዓትነዉ

28. ባለፉት 12 ወራትውስጥየእርስዎአማካይየሥራሰዓትበቀን _____ ሰዓትነዉ

29. በህመምምክንያትባለፉት 12 ወራትያለ-ሥራያሰለፉትአጠቃላይየሥራሰዓታት _____ ሰዓትነዉ

30. የእርስዎአማካይወርሃዊገቢባለፉት 12 ወረት_____ ብርነዉ

31. የእርስዎበጠቅላላው 12 ወሮችየጤናወጪ _____ _____ብርነዉ

32. ባለፉት 12 ወራትጊዜዉስጥየመንገድትራፊክአደጋአጋጥምዎታል? (የእርስዎመልስአዎከሆነ, ቀጣዩክፍልይቀጥሉከልሆነእባክዎእዚህያቆሙ!)

አዎ □ አይደለም □

33. በኢትዮጵያውስጥየመንገድትራፊክአደጋንለመቀነስየሚራዱፖሊሲዎችእናስትራቴጂዎችለ ይአስተያየትካልዎት

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34. የትራፊክአደጋችግርንየበለጠለመቀነስየፖሊሲወይምየስትራቴጂክለሳዎችንበተመለከተአስተያየትካልዎት

_____

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_____

የትኩረትቡድንቃለመጠይቅጥያቄ

የመጠይቁንዑስርዕስዓላማየመንገድትራፊክአደጋናመንስኤበተመለከተመረጃመሰብሰብነው።የሚ
ከተለውጥያቄመልስሰጪዋችየትራፊክፖሊስ፣የጉራጌዞንመንገድእናየትራንስፖርትቢሮተወካይእናየህ
ብረተሰብተወካዮች (ተሳታፊዎችእናተሳታፊዎችያልሆኑ) ናቸው።

1. ለመነገድትራፍክአደጋየሚያጋልጡ/
   መከሰትምክንያትየሆኑየአካባቢዎማህበረሰብባህሪያትይዘርዝሩ/ያስረዱ?
2. ለመነገድትራፍክአደጋየሚያጋልጡ /
   መከሰትምክንያትየሆኑየአካባቢዎማህበረሰብባህሪያትይዘርዝሩ?
3. ለመነገድትራፍክአደጋየሚያጋልጡ/
   መከሰትምክንያትየሆኑየተሽከሪካሪዎችባህሪያትንይዘርዝሩ/ያስረዱ?
4. ለመነገድትራፍክአደጋየሚያጋልጡ/
   መከሰትምክንያትየሆኑየአሽከሪካሪዎችባህሪያትንይዘርዝሩ?
5. ለመነገድትራፍክአደጋየሚያጋልጡ/
   መከሰትምክንያትየሆኑየእግረኞችባህሪያትንይዘርዝሩ/ያስረዱ?
6. ለመነገድትራፍክአደጋየሚያጋልጡ/
   መከሰትምክንያትየሆኑየአካባቢዎየመንገድወይምየአየርለውጥባህሪያትንያስረዱ?

የመንገድትራፊክአደጋንለመቀነስምንይስባሉ?

Appendix II

```
**************************************************
Algorithm to estimate the propensity score
**************************************************
```

The treatment is RTA

road traffic accident Encountered	Freq.	Percent	Cum.
No	120	53.33	53.33
Yes	105	46.67	100.00
Total	225	100.00	

Estimation of the propensity score

```
note: trafficlight dropped because of collinearity
Iteration 0:   log likelihood = -155.45774
Iteration 1:   log likelihood = -83.026496
Iteration 2:   log likelihood =  -70.41323
Iteration 3:   log likelihood = -67.846249
Iteration 4:   log likelihood =   -67.6688
Iteration 5:   log likelihood = -67.667698
Iteration 6:   log likelihood = -67.667698

Probit regression                                 Number of obs   =        225
                                                  LR chi2(20)     =     175.58
                                                  Prob > chi2     =     0.0000
Log likelihood = -67.667698                       Pseudo R2       =     0.5647
```

RTA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Location	.8519195	.3194081	2.67	0.008	.225891	1.477948
ftraveling	.9350705	.2152679	4.34	0.000	.5131531	1.356988
traveltime	1.442832	.3226617	4.47	0.000	.8104268	2.075238
frequencyt~l	1.154623	.3305633	3.49	0.000	.5067305	1.802515
pedestrain~g	.5017816	.3075295	1.63	0.103	-.1009651	1.104528
watchingdi~n	.6160957	.3274709	1.88	0.060	-.0257355	1.257927
Trtime	.0053888	.0158477	0.34	0.734	-.0256721	.0364497
sdrive	.1865712	.329278	0.57	0.571	-.4588018	.8319443
ddrive	1.062083	.3718743	2.86	0.004	.3332224	1.790943
uadrive	-1.634325	.4235677	-3.86	0.000	-2.464503	-.8041478
aboveage	-1.191982	.4514011	-2.64	0.008	-2.076712	-.3072526
violatestr~e	2.015162	.4202474	4.80	0.000	1.191492	2.838831
overload	1.937083	.4535092	4.27	0.000	1.048222	2.825945
futravel	.0827394	.106152	0.78	0.436	-.1253146	.2907934
evehiclefa~e	-.0083256	.2849554	-0.03	0.977	-.5668279	.5501766
Bvehiclefa~s	.400543	.3104869	1.29	0.197	-.2080002	1.009086
btvehiclef~s	-.6532677	.3219063	-2.03	0.042	-1.284193	-.0223429
zebracross	-1.194379	.4112208	-2.90	0.004	-2.000357	-.3884015
roadgoodeP~n	-.209454	.3136032	-0.67	0.504	-.8241049	.405197
rnetwork	-.0175963	.2847716	-0.06	0.951	-.5757383	.5405457
_cons	-8.225014	1.304769	-6.30	0.000	-10.78231	-5.667714

```
Note: the common support option has been selected
The region of common support is [.01195804, .99999989]
```

Description of the estimated propensity score
in region of common support

Estimated propensity score

Percentiles		Smallest		
1%	.0135431	.011958		
5%	.0203903	.0135431		
10%	.0321979	.0158276	Obs	190
25%	.221579	.016214	Sum of Wgt.	190
50%	.5896378		Mean	.5519034
		Largest	Std. Dev.	.3642027
75%	.913777	.9999948		
90%	.9972123	.9999975	Variance	.1326436
95%	.9999032	.9999997	Skewness	-.1324805
99%	.9999997	.9999999	Kurtosis	1.443525

****
Step 1: Identification of the optimal number of blocks
Use option detail if you want more detailed output
****

The final number of blocks is 5

This number of blocks ensures that the mean propensity score
is not different for treated and controls in each blocks

****
Step 2: Test of balancing property of the propensity score
Use option detail if you want more detailed output
****

The balancing property is satisfied

This table shows the inferior bound, the number of treated
and the number of controls for each block

Inferior of block of pscore	road traffic accident Encountered No	Yes	Total
.011958	39	3	42
.2	31	9	40
.4	7	6	13
.6	4	19	23
.8	4	68	72
Total	85	105	190

Note: the common support option has been selected

****
End of the algorithm to estimate the pscore
****