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SLEEP HABITS AND ROAD TRAFFIC ACCIDENT RISK AMONG LONG DISTANCE DRIVERS AT CIRCLE TRANSPORT YARD

BY

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DECLARATION

I, Boateng Ampomah Laud hereby declare that apart from references to other people's works, which have been duly acknowledged, this dissertation is a result of my own independent work. I further declare that this dissertation has not been submitted for award of any degree in this institution and other universities elsewhere.

…… ……

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(Supervisor)

DEDICATION

I dedicate this to the Almighty God who guided me through this exciting year and to my parents.

ACKNOWLEDGEMENT

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LIST OF ACRONYMS

ARES-	Apnoea Risk Evaluation System
ICSD-	International Classification Of Sleep Disorders
LMIC-	Low and Middle Income countries
NRSC -	National Road Safety Commission
PTQI-	Pittsburg Sleep Quality Index
RTAs-	Road traffic accidents

DEFINATIONS OF TERMS

Actigraphy– A non-invasive method of monitoring human rest/activity cycles using a small instrument usually around the wrist or ankle.

Polysomnography (PSG) - A type of sleep study, a multi-parametric test used in the study of sleep and as a diagnostic tool in sleep medicine.

Poor Sleep - A disruption in the sleep wake cycle, which may be introduced with restriction, interruption or fragmentation of sleep

Pulse oximetry – A non-invasive method of monitoring a subject's oxygen saturation.

ABSTRACT

Road Traffic Accidents (RTAs) are a significant public health problem with a global distribution; it disparately affects the vulnerable in society particularly in developing countries. Obstructive sleep apnea and shift worker syndrome have been widely researched as a risk factor for Road Traffic Accidents (RTAs). This study seeks to assess the association between sleep habits and Road Traffic Accident Risk.

Methods

A mixed methods approach was used to assess this association. Drivers who consented to be a part of the study self reported their accident history as well as an assessment of their obstructive sleep apnea risk. Their perceptions on sleep, drowsy driving and road traffic accidents were obtained through focus group discussions and in depth interviews with key informants.

Result

The prevalence of "high risk" for obstructive sleep apnea syndrome as assessed using the Apnea Risk Evaluation System [ARES] questionnaire was 12.8%. The prevalence of road traffic accidents due to human error was 7.9%. Sleep related accidents were reported among 1.5% of drivers. There was no association between "high risk" for OSAS and accident risk. (P=0.314). The practices to prevent drowsy driving differed between two groups of driver's stations.

Conclusion

The ARES questionnaire will be useful in clinic assessment of patients presenting with sleep related complaints. Engaging the management of driver's stations, as key stakeholders will be key in community based interventions among drivers.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Road Traffic Accidents (RTAs) are a significant public health problem with a global distribution; it disparately affects the vulnerable in society particularly in developing countries. Road Traffic Accidents (RTAs) account for 1.2 million deaths and 50 million injuries per annum-representing about 6% of the population of sub Saharan Africa and a global cost of $518 billion. (Peden et al., 2004a)

This growing problem aptly described by Vinand M Nantulya & Reich, (2003) as the "*NEGLECTED EPIDEMIC"* is projected to increase by 65% between 2000 and 2020. The greatest percentage increase-80% is expected to occur in low and middle-income countries (LMIC). (Murray & Lopez, 1997)

Sleep disorders and shift worker syndrome have been widely researched as a risk factor for Road Traffic Accidents (RTAs). This is because of its impact on concentration, performance and safety. In the USA 10-50% of accidents is attributed to sleepiness, with Obstructive Sleep Apnea Syndrome (OSAS) having 3-7 fold increase risk of industrial and RTAs.(Stoohs, Guilleminault, Itoi, & Dement, 1994) Surveys among commercial drivers in developing countries- Ghana and Kenya showed that drivers worked exhausted, for long hours in an effort to achieve profit margins set by owners of the vehicles. (Mock, Amegashie, & Darteh, 1999)(Vinand M Nantulya & Muli-Musiime, 2001)

On 7th April 2004, the World Health Organization (WHO) and the World Bank launched their first report on Road Traffic Injuries advocating for a multi-sectorial preventive approach at dealing with this growing problem.

Poor sleep habits is assessed clinically using a variety of tools: questionnaire

based methods assist in subjective assessment whilst objective measures may be done through polysomnography, actigraphy or pulse oximetry. (ICSD, 2001) The challenge with objective measures is their reliance on sleep experts, over night clinic stays or expensive equipment. This makes objective methods difficult to deploy on a population scale in low resource countries where sleep medicine is scarcely practiced.

This study seeks to assess how best questionnaire based methods describe the distribution of poor sleep habits and will estimate the association between poor sleep habits and road traffic accident risk among a high risk group in Ghana.

1.2 Statement of Problem

1.2.1 Global Impact of Road Traffic Accidents (RTAs)

Africa is experiencing an epidemiological transition; non-communicable disease is a current burden along with existing communicable diseases. Road Traffic Injuries failed to gain the attention communicable diseases and recently some non-communicable diseases gained. Pedan et al noted that the traditional belief that Road Traffic Injuries are random events and unavoidable fueled the neglect.(Peden, McGee, & Krug, 2002)

The sustained neglect of interventions would result in injuries being the third leading cause of global burden of disease and injury in 2020.(Murray & Lopez, 1997)

Table 1.1: Leading causes of Global burden of disease

Change in rank of DALYs for the 10 leading causes of global burden of disease			
1990		**2020**	
Rank	**Disease And Injury**	**Rank**	**Disease And Injury**
1	Lower respiratory tract infections	1	Ischemic heart disease
2	Diarrhoeal diseases	2	Depression
3	Perinatal conditions	3	Road Traffic Accidents (RTAs)
4	Unipolar major depression	4	Cerebrovascular disease
5	Ischemic heart disease	5	Chronic obstructive pulmonary disease
6	Cerebrovascular disease	6	Lower respiratory tract infections
7	Tuberculosis	7	Tuberculosis
8	Measles	8	War
9	Road Traffic Accidents (RTAs)	9	Diarrhoeal disease
10	Congenital abnormalities	10	HIV

Source: (Murray & Lopez, 1997) ; DALYs-Disability Adjusted Life Years

1.2.2 Population at Risk

Though all road users are at risk of injury, some road users are more vulnerable. Pedestrians and two-wheeler users are at greater risk compared to occupants. A widely accepted explanation is ascribed to the "variety and intensity of traffic as well as the failed separation of various road users compared to industrialized countries." (Peden et al., 2004a)

The second group of road users with high fatality is passengers, accounting for about 38%-51%. In Africa, pedestrians and passengers using mass public transport are

a major affected group. (Peden et al., 2004a)

With respect to age, 50% of Road Traffic Accidents (RTAs) occur among the age group 15-44 years, with the proportion higher in LMIC. Amongst developed countries the ages 15-29 years account for the highest proportion whilst ages greater than 60 years are highest in developing countries. Increased exposure and high risk seeking behavior among men, accounts for a higher occurrence among them. (Mathers et al., 2002)

Individuals in poorer areas with low economic development are also at higher risk of road traffic injuries in both developed and developing countries. The choice of transport in many developing countries is often dependent on level of income. Safer more confortable vehicles are relatively more expensive with cheaper alternatives available for same destinations. (Laflamme & Diderichsen, 2000)

1.2.3 Road Traffic Injuries

Twenty percent of patients admitted for Road Traffic Accidents (RTAs) have traumatic brain injuries with 20% having fractures in the lower limb. (Peden et al, 2002) Two thirds (62.3%) of a total of 2913 trauma admissions to a Nigerian teaching hospital over a 15-month period were related to Road Traffic Accidents (RTAs).(Solagberu et al., 2002)

1.2.4 Economic Cost

A worldwide estimate of the economic cost of RTAs for low-income countries is 1%, middle-income countries-1.5% and developed countries 2%. (Jacobs, Aeron-Thomas, Astrop, & Britain, 2000) The National Road Safety Commission (NRSC) of

Ghana reports that there were 19 fatalities per 10,000 vehicles in 2010 in Ghana. (Ghana NRSC Report, 2010). The cost to Ghana represents 1.6% of our Gross Domestic Product (GDP). The figures for LMIC are probably underestimated because of data quality issues. (Peden et al., 2002) While LMIC countries strive with less advanced emergency health services they are besotted with 36-80% of trauma admissions ascribed to road traffic injuries.(Odero, Garner, & Zwi, 1997)

1.2.5 Sleep Disorders

The International Classification Of Sleep Disorders (ICSD, 2001) identifies over 80 different types of sleep disorders. These assist clinicians and epidemiologist diagnose sleep disorders based on the three common sleep symptoms, insomnia, excessive sleepiness and abnormal event during sleep.

In clinical settings clinicians assess sleep complaints using questionnaires, which classify sleep disorders by quality, daytime sleepiness score or apnea risk score. An assessment of sleep habits can be made using the questionnaires with high-risk patients referred for specialist attention.

1.2.6 Public Health Intervention-Ghana

In 2013, there were 2249 deaths by Road Traffic Accidents (RTAs) with males constituting 1,158(69%). During the same year, 14,181 people were injured with 2,642 (18.6%) being pedestrians. Out of the 22,208 vehicles involved 10279 (46%) were commercial vehicles with motorcycles contributing 2570(11.6%).

System based approaches at tackling this problem have explored four areas for targeted campaigns in Ghana. (Ghana NRSC Report, 2010) These are

- Excessive speeding
- Driving under influence of alcohol or drugs

- Driving tired/ fatigued
- Campaign to promote significant use of seatbelt and crash helmet use

1.2.7 Research Gap

Various papers, in USA, Europe, Argentina and Turkey have assessed the distribution of sleep disorders among drivers. Obstructive sleep Apnoea syndrome is the main disorder common in the bus/truck driver population. The gold standard-polysomnography, which requires overnight sleep study, is used to confirm the diagnosis. Due to the expertise needed, time and financial cost, researchers have assessed the validity and reliability of various sleep questionnaires as a population-screening tool. The sleep questionnaires commonly used are the Pittsburg Sleep Quality Index (PSQI), the Apnea Risk Evaluation System Questionnaire (ARES), Berlin sleep questionnaire and the Epworth Sleepiness Scale (ESS).

Despite positive findings very few papers have explored the use of questionnaires among the driver population in low resource countries. Routine screening for sleep disorders, a cost effective method is not common practice in Ghana.(Levendowski et al., 2007) (Perez-Chada et al., 2005) (Akkoyunlu et al., 2013)

1.3 Justification

The major risk factors of sleep disorders have been well described in literature and its association with Road Traffic Accidents (RTAs) has been estimated using objective measures. Studies have also shown the validity and reliability of questionnaires and compared them to polysomnography. These studies have advocated the use of sleep questionnaires for population level screening.(Levendowski et al., 2007) ((Lauderdale, Knutson, Yan, Liu, & Rathouz, 2008).

This study seeks to assess the distribution of sleep habits assessed by questionnaire methods and the relationship between poor sleep defined by a questionnaire and accident risk. This would bring to fore nuances to reflect on when using questionnaires as a screening tool in this population. This is essential because of the relative high cost of using objective measures to evaluate poor sleep in large populations, particularly in LMIC.

Driver fatigue is one of four educational campaigns currently being used by the NRSC, Ghana. This research hopes to begin a scientific exploration of the context and estimate burden of the problem among a high-risk group in the largest transport yard in the country's capital.

Additionally, there have been few studies on sleep in Ghana; notable among them is the WHO study on Global Ageing and Adult Health. This multicenter crosses sectional study involving adult's 50yrs and above in northern Ghana estimated a 6% prevalence of sleep problems among the study population. The highest among the centers was 40%, Bangladesh) and lowest 3.9% (Puwerojo, Kenya).

Limitations highlighted by researchers were an inability to collect information on chronic morbidities and lifestyle behaviors. The sleep questionnaire used was also not ideal as only two questions were asked. (Stranges, Tigbe, Gómez-Olivé, Thorogood, & Kandala, 2012).

Routine surveillance of Road Traffic Accidents (RTAs) though improved in recent times is still unreliable with cases often under reported; this has impaired the deductions we make from the data. It is hoped that the findings would also make a case for continuous surveillance of Road Traffic Accidents (RTAs).(Odero et al., 1997)

1.4 Conceptual Framework

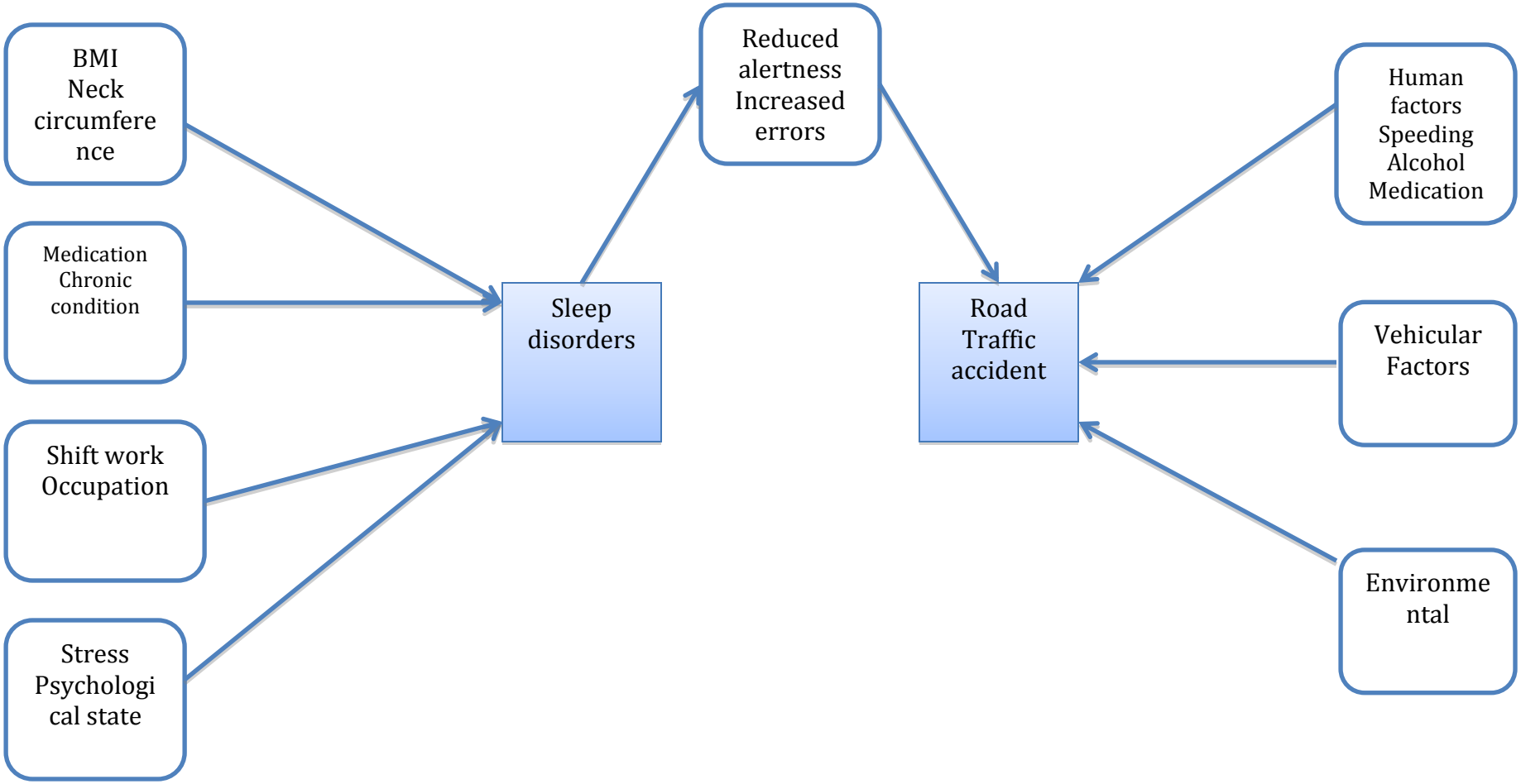

Figure 1.1: Conceptual Framework

1.5 Objectives of the Study

1.5.1 General Objective

To explore the association between sleep habits and road traffic accident risk.

1.5.2 Specific Objectives

1. To assess the prevalence of poor sleep habits assessed by questionnaire-based methods among long distance drivers?
2. To assess the association between sleep habits assessed by ARES questionnaire and road traffic accident risk?
3. To assess the perceptions, attitudes and practices on sleep and accident risk among drivers

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Public Health Approach

The success of a public health intervention calls for a multidisciplinary approach. This should tap expertise from, medical, epidemiological, behavioral science, social science, economics, engineering and policy experts to name a few.

The epidemiological study of Road Traffic Accidents (RTAs) took on a widely accepted systems approach with the development of the Haddon Matrix in 1990s. Three phases of time sequence of crash event: pre-crash, crash and post crash were proposed as well as the epidemiological triad of human, machine and environment.(Haddon Jr, 1968) The resulting interaction produced the nine –cell Haddon Matrix model that has guided public health interventions.

Whilst significant progress and learning has been made in developed countries, developing countries have showed little progress in road traffic injury intervention.

Table 2.1: Haddon's Matrix

Factors Phase		Human	Vehicles and equipment	Environment
Pre- crash	Crash prevention	Information Attitudes Impairment Police enforcement	Roadworthiness Lightening Braking Handling Speed management	Road design and road layout Speed limits Pedestrian facilities
Crash	Injury prevention during the crash	Use of restraints Impairment	Occupant restraints Other safety devices Crash protective devices	Crash protective road side objects
Post-crash	Life sustaining	First aid skill Assess to medics	Ease of access Fire risk	Rescue facilities Congestion

Source: W.H.O Report on Road Traffic Injuries, 2004

2.2 Risk Factors

Four contributing factors have been identified as the risk factors for Road Traffic Accidents (RTAs). The aggregate of movement by a community within a transport system constitute *"Exposure"*- the first of the risk. The *"likelihood of a crash"* given an exposure is the second whilst the *"likelihood of injury"* given a crash is the third. The fourth risk factor relates to the "outcome of the crash". (Peden et al., 2004b)

The precursors of the risk are human error, the kinetic energy at impact, tolerance of the individual and the availability of emergency services. (Tingvall et al, 1995) As many countries develop, LMIC in particular there is an increased desire to travel, which leads to an increase in motorized, transport. Mass movement in search of jobs, better health services and opportunities expose many to the risk of Road Traffic Accidents (RTAs).

Some factors leading to crash involvement are speed, alcohol use, medicinal and recreational drug use, driver fatigue and in recent times the use of mobile phones. (Peden et al., 2004b)

2.3 Excessive Speeding

Excessive speeding has been implicated in many road traffic injuries with the rise in modern cars with high acceleration speeds. The probability of a crash involving an injury is proportional to the square of the speed whilst a fatal crash is related to the fourth power of the speed.(Andersson & Nilsson, 1997) Between 1998 and 2000, speed was identified as a main contributory factor in 50% of road crashes in Ghana (Afukaar, Antwi, & Ofosu-Amaah, 2003) whilst a similar study showed 44% in Kenya (Odero et al., 1997).

Speed is also implicated in RTAs involving commercial road transport and public passenger vehicles as well.(Odero et al., 1997) Globally, young drivers have a higher risk compared to older drivers.(Mayhew, Simpson, & Pak, 2003) Among young drivers, late night driving is a predictive factor for serious crashes especially among ages 20-44 years.(Williams, 2003)

2.4 Alcohol and Driving

Driving under the influence of alcohol, which impairs cognition, is also responsible for Road Traffic Accidents (RTAs). A study in Ghana revealed 7% of drivers with a random alcohol breath test above a legal limit of 0.08g/dl. (Mock, Asiamah, & AMEGASHIE, 2001)

Though sleep and alcohol are distinct causes of Road Traffic Accidents (RTAs), sleep has been long shown to worsen the sedative effects of alcohol. (Roehrs, Beare, Zorick, & Roth, 1994)(Arnedt, Wilde, Munt, & MacLean, 2001)

2.5 Sleepiness

Driver fatigue or sleepiness is commonly related to long distance driving; sleep deprivation and disruption of circadian rhythm. Three high-risk groups have been identified (NCSDR/NHTSA Expert Panel On Driver Fatigue And Sleepiness, 1996)

1. Young men 16-29yrs
2. Shift workers who work particularly night, long working hours or irregular hours
3. People with untreated sleep apnoea

Figure 2.1: Factors that predispose to fatigue

Factors that predispose a driver to fatigue

Drivers at risk of fatigue	Temporal factors causing fatigue	Environmental factors in fatigue	Sleep-related factors
Young drivers (up to 25 years)	Driving between 02.00 and 05.00	Driving in remote areas with featureless terrain	Driving with sleep debt
Drivers over 50 years	More than 16 hours of wakefulness before trip	Monotonous roads	Driving with a sleep-related condition
Males	Long work period before trip	Main arterial roads	Driving when normally asleep
Shift workers	Long time since start of trip	Long-haul driving	Drivers disposed to nodding off
Those for whom driving is part of job	Irregular shift work before trip	Unexpected demands, breakdowns, etc.	Driving after poor-quality sleep
Those with medical conditions (such as narcolepsy)	Driving after successive nights of shift work	Extreme climatic conditions	
After consuming alcohol	Driving under time pressure	Driving an unfamiliar route	
Driving after inadequate rest and sleep	Some drivers are drowsy in the afternoon		

Source: WHO Report on Road Traffic Injuries, 2004

In low-income countries buses and trucks are often involved in RTAs. Their incidence is higher on non-urban roads compared to urban roads. Night shift workers have been shown to have high performance errors. Multiple researches done in developed countries have shown an increased risk of Road Traffic Accidents (RTAs) as well as work/ home accidents among people with sleep problems or disturbance. This risk ranges from 2-6x compared to those without sleep disorders. (Findley, Smith, Hooper, Dineen, & Suratt, 2000)(Radun & Summala, 2004)

2.6 Sleep Habits

Sleep is both physiological and behavioral with predictable patterns of this neurobiological need well researched. Poor sleep is therefore as a result of a disruption in the sleep wake cycle, which may be introduced with restriction, interruption or fragmentation of sleep. The cure for sleepiness is sleep yet it still eludes us. The international classification of sleep disorders identifies over 80 different types of sleep disorders.

The ICSD groups sleep disorders into four categories

1. Dyssomnias- disorders of initiating and maintaining sleep +excessive sleepiness
2. Parasomnias- disorders of arousal or sleep stage transition
3. Sleep disorders associated with mental, neurologic or other medical disorders
4. Sleep disorders with insufficient information to confirm as definitive sleep

2.7 Obstructive Sleep Apnea Syndrome (OSAS)

Obstructive sleep apnea syndrome is described by the ICSD as a disorder characterized by repeated episodes of upper airway obstruction that occur during sleep, usually associated with a reduction in blood oxygen levels. The snoring pattern consists of loud snores or brief gasps that alternate with episodes of silence that usually last 20 to 30 seconds. The loud snoring typically has been present for many years, often since childhood, and may have increased in loudness before the patient's presentation. The snoring often disturbs the sleep of bed partner. The snoring may be exacerbated by alcohol ingestion before bedtime or by weight gain. (ICSD, 2001)

2.8 Shift Work Sleep Disorder (SWSD)

The International Classification of Sleep Disorders (ICSD) describes shift work sleep disorder as consisting of insomnia and excessive sleepiness that occurs as a result of work schedule. They are usually transient and associated with reduced alertness and performance. Some reports have noted increased irritability and conflict among subjects with SWSD. (ICSD, 2001)

2.9 Sleep Research in Ghana

A study on the socio determinants of rest deprivation among Ghanaian women based on the 2008 demographic and health survey revealed placed national prevalence of sleep deprivation at 0.13%, with Greater Accra, the capital having a prevalence of 14.5%. Education, wealth and religion were the national correlates of rest deprivation in this study. (Mittelmark & Bull, 2010)

The WHO study on global ageing and adult health is the largest population based study on sleep in Ghana. This multicenter cross sectional study involved adults' 50yrs and above in northern Ghana estimated a 6% prevalence of sleep problems among the study population. Researchers noted the limitation on the use of two questions to assess sleep. Another study assessed sleep quality and maternal and fetal outcomes, the findings revealed that maternal sleep played a significant role in pre-ecclampsia, low birth weight and stillbirth among Ghanaian women attending a teaching hospital. (Owusu et al., 2013)

2.10 Sleep and Accident Risk

It is difficult to assess objectively the level of sleepiness of drivers involved in crashes unlike alcohol levels. However inferential evidence describes the characteristics of sleep related crashes as (NCSDR/NHTSA Expert Panel On Driver Fatigue And Sleepiness, 1996)

- They occur late at night, early morning or mid afternoon
- The crash is likely to be serious
- A single vehicle leaves the motorway
- The crash occurs on a high speed road
- The driver does not attempt to avoid the crash
- The driver is alone in the vehicle

In the early 1990s, various papers showed the influence of disturbed sleep on mental health through laboratory and in vehicle studies.

Table 2.2: Sleepiness and cognitive function

Effect of sleepiness on driving	Researcher
Slower reaction time	(Dinges, 1995)
Reduced vigilance	(Kribbs & Dinges, 1994)(Haraldsson, Carenfelt, Laurell, & Tornros, 1990)
Deficits in information processing	(Dinges, 1995)

Individuals with disordered respiratory breathing have a higher risk of sleep disorders and a higher risk of automobile accidents. (Teran-Santos, Jimenez-Gomez, & Cordero-

Guevara, 1999)(Howard et al., 2004) An extensively researched sleep disorder is obstructive sleep apnea. In a systematic review and meta analysis, Tregear, Reston, Schoelles, & Phillips, (2009) showed that individuals with obstructive sleep apnea were at significant risk for a crash. The mean crash rate ratio of such drivers was likely to fall within the range of 1.21 to 4.89. The study went on to outline predictors of Road Traffic Accidents (RTAs) in drivers with OSAS; the predictors were Body Mass Index (BMI), apnea plus hypopnea index, oxygen saturation and possibly daytime sleepiness.

2.10.1 Assessing Reduced Cognitive Performance in OSAS

Proctor et al. [1996] investigated 248 United Auto Workers working day and evening shifts. The aim of the study was to assess cognitive function decline as a result of shift work. The tools they used included Trail-Making Test, Wisconsin Card Sort Task, Symbol Digit Substitution Task, Visual Reproduction, Pattern Memory and Vocabulary Task. The autoworkers reported poorer cognitive performances for individuals who worked overtime compared to those who did not.

In a systematic review of executive functions in OSAS, Saunamäki & Jehkonen, (2007) noted that executive function are the most defected cognitive domain in OSAS. They suggested that executive function should be assessed using a battery of test in order to capture different cognitive changes. The draw back with this was the inclusion of a high number of false positives.

Over half of the papers reviewed used two tests in assessing cognitive functions. It was also noted that cognitive decline showed little decline in individuals with high general intelligence.

The battery of tests recommended include Digit Span Backwards And Forwards,

Wisconsin Card Scoring Test, Stroop Test, Mazes Test, Double Encoding Test And Corsi Block Tapping Test. (Décary, Rouleau, & Montplaisir, 2000)

This study assessed cognitive function using simple easy and quick to administer tools, namely the Trail Making Test, The Stroops Test and Serial Sevens.

2.10.2 Trail Making Test

The Trail Making test by R. M. Reitan, (1955) is another quick way of assessing speed, attention and mental flexibility. It also assesses spatial organization, visual tracking and recognition. Part A of the test involves a subject connecting encircled numbers distributed on a page sequentially. Part B of the test involves alternating numbers and letters sequentially. It is scored on amount of time spent on the task. No training is required for the test and its free and easy to obtain. The test can be administered orally if patient is unable to do written version. (Reitan, 1979)

2.10.3 The Stroops Test

The Stroop test assesses selective attention, cognitive flexibility and processing speed. Its been used in clinical setting since its description in the early twentieth century. (Reitan, 1979) The Stroop test involves of colours that are written in words but in wrong color ink. The challenge for the test taker is to correctly identify the right colour whilst ignoring whatever the actual word is. It is freely available on Apple ios EncephalAPP- The Stroop test (2013) by Jasmojan Bajaj.

2.10.4 Serial Sevens

This involves subjects serially subtracting or adding a number e.g. 7 or 3 from e.g. 100. This is commonly used for mental state exams where patients are asked to subtract 7

from 100. It is a quick way of assessing memory and concentration and it is not diagnostic of a disorder. (Smith, 1967)

2.10.5 Sleep Questionnaire

Self reported perceptions of sleep are routinely assessed in primary care settings in developed countries using questionnaires e.g. Pittsburg sleep quality index, Epworth sleepiness scale and Berlin sleep questionnaire. Objective assessment is done using polysomnography, actigraphy and EEG. Studies have shown a stronger agreement between subjective and objective measures among women compared to males.

2.10.6 Pittsburg Sleep Quality Index Questionnaire

This questionnaire developed by Buysse at al, (1988) assesses sleep quality over the previous month. It consists of 19 self-rated questions and 5 questions rated by the bed partner or roommate. It estimates sleep duration, latency, sleep disturbances, use of medications and some specific sleep related problems. Its applications are most useful in clinical settings to classify subjects as “good” or “poor” sleepers. It is not designed to identify OSAS, which is a significant medical condition in this population. This limitation is addressed by specific questions in the questionnaire, which will point the clinician to explore further some specific sleep disorders. For the purposes of this study the PTSI will not be used.

2.10.7 ARES and Berlin Questionnaire

The ARES questionnaire and the berlin questionnaire have been used to assess OSAS in the general population. They both catalogue demographic and anthropologic data. The Berlin questionnaire enquires about high blood pressure but the ARES expands to include

heart disease, diabetes, stroke and prior diagnosis of OSAS. The Berlin questionnaire further adds nine questions whilst the ARES has the Epworth Sleep Score embedded in it plus 3 additional questions.(Levendowski et al., 2007)

A study among truck drivers using the ARES questionnaire provided a sensitivity and specificity of 94% and 79%, respectively.(Levendowski et al., 2007) The Berlin questionnaire reported a sensitivity and specificity of 86% and 77%, respectively. (Netzer, Stoohs, Netzer, Clark, & Strohl, 1999)

Sensitivity is an essential criteria for screening tools, however employers will want to know the specificity to assess the cost effectiveness. (Levendowski et al., 2007)

The sensitivity of the two questionnaires in assessing OSAS was carried out among dental patients. All 85 subjects answered both questionnaires and subgroup differences were compared.(Enciso & Clark, 2011) Fifty-three subjects had severe OSAS whilst 31 were controls. This smaller sample study also showed a preference for the ARES questionnaire.

The ARES questionnaire in the Enciso & Clark, (2011) study revealed sensitivity of 87.7%, specificity of 57.9%, a positive predictive value of 87.7%, and negative predictive value of 57.9% compared to 67.7%, 68.4%, 88%, and 38.2%, respectively, for the Berlin questionnaire.

The ARES questionnaire is recommended for use in populations with high pre-test probability and high sleep apnea risk.(Levendowski et al., 2007)(Demede et al., 2011)

The ARES sleep questionnaire is one page in length and can be easily filled by respondents. It has been translated into Spanish and French among other languages. The ARES questionnaire is the index questionnaire used in this study.

2.10.8 Estimating Road Traffic Accident Risk

Two approaches of assessing accident risk in the literature were.

1. Accident risk as assessed as a ratio of the number of accidents one has had over the number of years as a licensed driver.
2. Accident risk as also assessed as a dichotomous outcome to the question

- ❖ Have you ever had a sleep related accident
- ❖ Have you ever had a near sleep related accident

The first assessment has interpretation limitations, as the outcome is expressed as a ratio. RTAs may be underreported and may be a rare outcome. This leads to smaller tallies (number of accidents) expressed over the denominator, total number of driving years. The second may be assessed as a leading question with possible influences on the answer from the interview process. In their land mark paper (Nisbett and Wilson, 1977) wrote

"Subjects are sometimes (a) unaware of the existence of a stimulus that importantly influenced a response, (b) Unaware of the existence of the response, and (c) unaware that the stimulus has affected the response. It is proposed that when people attempt to report on their cognitive processes, that is, they do not do so on the basis of any true introspection. Instead, their reports are based on a priori, implicit causal theories, or judgments about the extent to which a particular stimulus is a plausible cause of a given response."

For this study the following questions will be asked in an effort to improve the response

1. Have you ever been involved in an accident attributable to another driver or pedestrian?
2. Have you been involved in an accident that was due to your human error?
3. Have you ever had a sleep/near sleep related accident?

Estimating Alcohol use

The quantitative section also assessed self-reported alcohol use, using the CAGE questionnaire. This CAGE questionnaire, an internationally used questionnaire developed by Dr John Ewing (1984). It has been translated into several languages and popular among primary care givers. The CAGE is an acronym for four questions asked as part of history taking. (Ewing, 1984)

These are

1. Have you ever felt you should **C**ut down on your drinking?
2. Have people **A**nnoyed you by criticizing your drinking?
3. Have you ever-felt bad or **G**uilty about your drinking?
4. Have you ever had a drink first thing in the Morin in to steady your nerves or to get rid of a hangover (**E**ye Opener)

Item responses on the cage are scored 0 or 1, with a higher score an indication of alcohol problems. A total score of 2 or greater is considered clinically significant.

CHAPTER THREE

3.0 METHODS

In order to meet the study objectives a mixed methods approach was used. This was to obtain as much breadth and depth in the relationship between the variables of interest- poor sleep habit and road traffic accident risk. Mixed method approaches will further expand the interplay between actors (drivers) and transport system. Participation in the study was voluntary and anonymity was ensured.

3.1 Study Setting

The circle transport yard, a key hub of transport services is located at the Kwame Nkrumah Interchange in Ghana. There are about 84000 cars using this route per day. It is conveniently located in central Accra, the capital of the country. There are multiple sub-stations, which coordinate transport to various parts of Ghana and even beyond. The services available include cargo/goods transport by truck drivers and mass transport services using vans and buses. The cost of transport for mass public transport range from high end, popularly called “VIP” buses and lower end services popularly called “207” buses. For the purpose of the study these transport services have be grouped into two, the commercial drivers who provide “VIP” services and the commercial drivers who do not, known as the Neoplan station. The rationale was to capture the socioeconomic context influencing the research question.

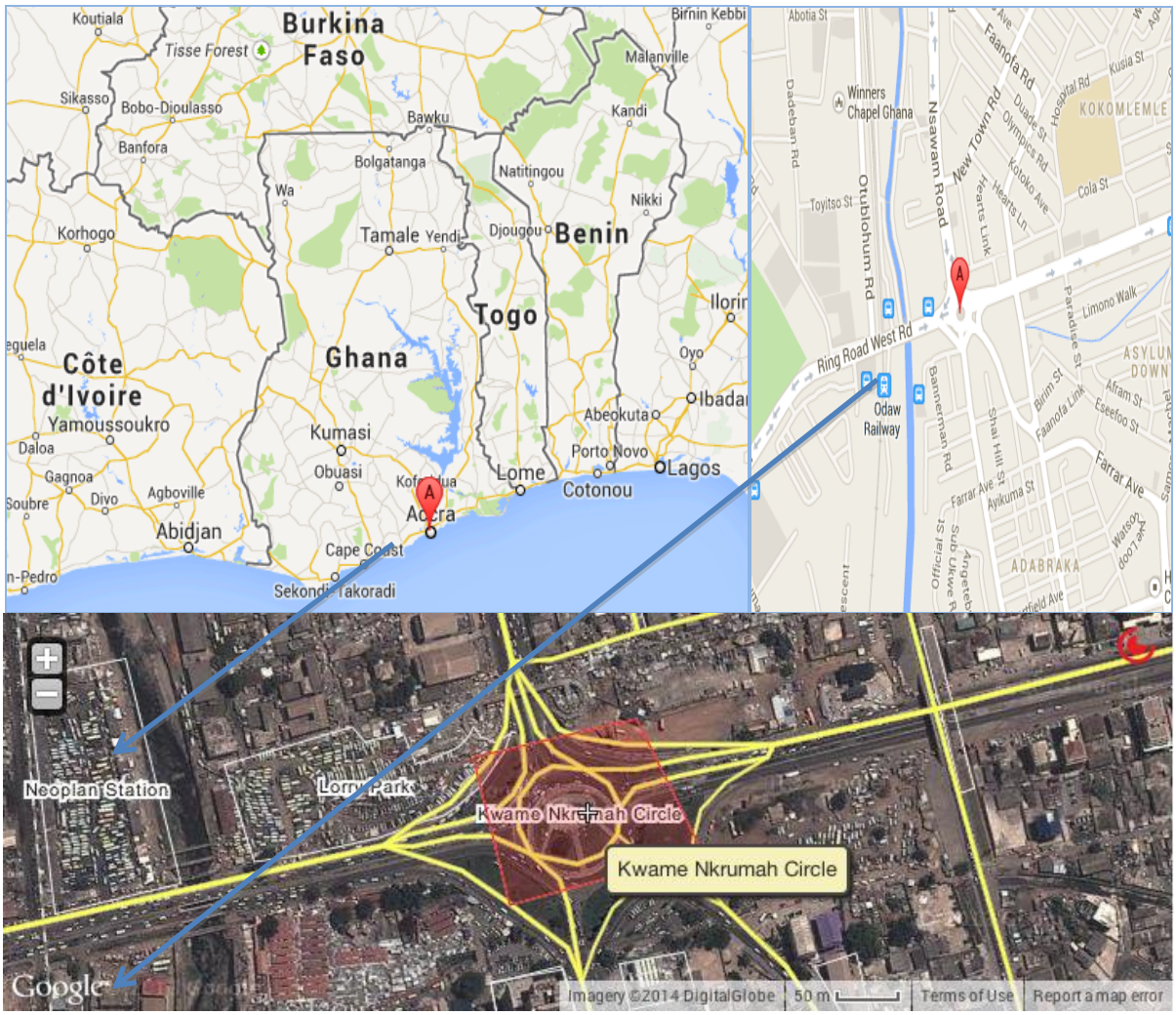

Figure 3.1: Map of study area-source Google Maps

3.2 Study population

All survey respondents were aged at least 18 years who were registered drivers and driver's assistants.

3.3 Study Design

3.3.1 Quantitative

The quantitative section was a cross sectional study to assess the prevalence of poor sleep habits and its relationship with road traffic accident risk. The outcome of interest-road

traffic accident risk was assessed by the following questions 1. Have you ever been involved in an accident due to your human error? 2. Have you ever had a sleep related accident? The question “have you been involved in an accident due to your human error?” will be used as the main outcome of interest in the statistical analysis.

The exposure of interest was poor sleep habit evaluated by the ARES sleep questionnaire. The quantitative section was conducted among a calculated sample size 220 drivers. Sample size was estimated using the prevalence of obstructive sleep apnea, a severe sleep disorder common among this risk group. Assuming a prevalence of 15% (Howard ME et al, 2004) and a significance level of 5 % at 95 % confidence interval an estimate of 195 was made; a total of 203 participants were enrolled.

Drivers were recruited at the station using convenient sampling. The drivers present during data collection were approached for consent. This was due to the nature of their work and similar in approach to studies done by (Akkoyunlu et al., 2013) and (Perez-Chada et al., 2005). These were studies done in Turkey and Argentina.

3.4 Sample Size Calculation

The sample size was determined using the formula

$N=(Z^2 \times P \times Q) / d2$

Where N is the sample size

P= the assumed the prevalence of obstructive sleep apnea

Howard ME, 2004 - 15.8%

[Prevalence: Yosoff M et al, 2010 - 44% (6.6% for severe OSAS), Akonyullu et al, 2013 - 11.6%]

Q= 1-P

d-the significance level at 95% confidence interval

$=(1.96^2 \times .15 \times .85) / 0.05^2$

=196

A total sample size of 216 was estimated assuming 10% of questionnaires were not completed

3.5 Variables

3.5.1 Dependent Variables

1. Road traffic accident risk
2. Sleep habit as assessed by the ARES sleep questionnaire

3.5.2 Independent Variables

3.5.3 Demographic information

Anthropometric measures

Medical history

Alcohol intake

Shift schedule

ARES sleep questionnaire

Driving history

Cognitive function using (Trail making Test, Stroop test, Serial 7 subtraction)

3.6 Data Analysis Plan

Continuous measurements were presented as mean ± SD, or medians. Categorical variables were presented as percentages and 95% confidence intervals (CI). For comparisons of proportions and categorical data, $\chi 2$ was used. A logistic regression model was employed to assess the association between accident risk and poor sleep habits.

3.7 Qualitative

The qualitative approach is premised on the theory of planned behavior (Ajzen, 1975). The drivers attitude toward sleep, their subjective norms and perceived behavioral control, together shape their individual intentions and actions. The qualitative arm used focus group discussions and key informant interviews to elicit responses. The focus group discussion will seek divergent views on lived experiences of drivers in relation to sleep disorders, shift work and road traffic accident. Two FGDs comprising of 6 drivers each were conducted. The groupings were

1. Drivers of the "VIP" buses
2. Drivers of the "207" Benz buses

The discussions were conducted in a quiet comfortable place conducive for participants to air the views freely and confidentially.

The structured questionnaire covered the following themes

- Perception on work related fatigue
- Beliefs on sleep and sleep disorders
- Knowledge on sleep disorders and Road Traffic Accidents (RTAs)
- Knowledge on role of shift schedule on health

- Attitude and practices related to sleep management
    - At work
    - Outside work
    - Rest practices of drivers

The meeting was moderated to ensure a varied, representative view from each individual was captured. All discussions were digitally recorded as well as notes taken by trained research assistants.

The key informant interview interviewed three supervisors, a welfare officer and

The key informant session probed further using structured questionnaires on work habits of drivers, sleep habits at work, scheduling of shifts, sleep related accidents, awareness of shift worker disorders, recruitment and management of drivers and training programs organized at the stations.

The data was summarized based on common themes in the key areas in interview guide. The information was transcribed using Microsoft word and analyzed using Nvivo.

3.8 Quality Control

The study was conducted in accordance with the procedures specified and the study manual will guide research assistants. The training of field assistants and supervisors covered the following key areas: good clinical practice, objectives and importance of the study, probing techniques, data collection procedures, and filling of questionnaires. The Principal Investigator supervised the fieldwork.

All data was entered legibly, in English and explanation given for missing data. Data was reviewed on an going basis through out the study.

Personnel of the study team

I was the sole investigator and conducted the study with trained assistants.

3.9 Ethical consideration

Ethical consideration was sought from Ghana Health Service Ethic Review Committee on Research on Human Subjects. Site approval was obtained from the GPRTU station office and the drivers association at the circle transport yard

There are no known risks of the study. There will be individual and community benefits from the study. The study was conducted at the transport yard with minimal interference on day-to-day activity of the drivers. Subjects had their blood pressure and OSAS risk assessed. Participants were informed that interviews would be recorded with information gathered stored in secure cabinets and data protected by password.

Drivers were counseled and referred for specialist attention where necessary. The consenting process was done in a place with adequate privacy in a language understood by subject in the presence of a witness. Subjects were not coerced to partake in the study. Participants who were unable to write consented by thumbprint. The consent form included emergency contact numbers of principal investigator, the administrator of GHS ethic review committee and institution of study.

Data collected would be stored for five years following from end of study. This will comprise questionnaires, transcribed interviews and taped recordings. These will be only accessible by the principal investigator. All records will be destroyed in an environmentally friendly manner with witnesses and photographic evidence. Confidentiality and Privacy of respondent will be assured in accordance with provisions in Data Protection Legislations under the Laws of Ghana such that their identities are adequately protected.

Subjects who voluntarily accepted to be in the study were given chance to withdraw at any stage of the study. There was no compensation for participants in the quantitative session however participants in the focus group discussion were refreshed with water.

CHAPTER FOUR

RESULTS

4.1 Quantitative Section

During the period of the study, commercial long distance drivers at the Circle Transport yard were invited to participate in the study, the major transport center in the capital city Accra, Ghana. Subjects were approached whilst waiting to be assigned passengers. The prevalence of "high risk" for obstructive sleep apnea syndrome as assessed using the Apnea Risk Evaluation System [ARES] questionnaire was 12.8%. The prevalence of road traffic accidents due to human error was 7.9%. Sleep related accidents were reported among 1.5% of drivers. There was no association between "high risk" for OSAS and accident risk. (P=0.314) Table 5.2. There was no significant association between age and a "high" risk for OSAS. (P=0.261). Table 5.1.

Table 4.1: Characteristics of Drivers by the ARES risk score

Characteristic Of Drivers	No of Drivers Total No=203	ARES Risk score Low Risk 187(92.1%)	High Risk 16(7.9%)	Pearson's Chi Square test P-value
Age group (yrs)				0.261
<30	10(4.9)	10(5.7)	0(0.00)	
30-50	162(79.8)	142(80.2)	20(76.9)	
>50	31(15.3)	25(14.1)	6(23.1)	
Mean Age	42.33 ± 8.03			
BMI mean	24.67 ± 4.44			0.021
Overweight	59(29.1)	52(29.4)	7(26.9)	
Obese	26(12.8)	18(10.2)	8(30.8)	
High Blood Pressure	70(34.5)	55(31.1)	15(57.7)	0.008
Snoring	91(44.8)	67(37.9)	24(92.3)	0.0001
Educational Level				0.649
None	48(23.7)	40(22.6)	8(30.8)	
Primary/JHS	145(71.4)	128(72.3)	17(65.4)	
Sec/vocational	10(4.9)	9(5.1)	13.9)	
Medical History				
Alcohol	59(29.1)	47(26.6)	12(46.2)	0.040
CAGE(2+)	25(12.3)	21(11.9)	4(15.4)	0.610
Hypertension	16(7.9)	10(5.7)	6(23.1)	0.002
Smoking	3(1.5)	2(1.1)	1(3.9)	0.284
Diabetes mellitus	8(3.9)	7(4.0)	1(3.9)	0.979
History of sleep problems	6(3.0)	4(2.3)	2(7.7)	0.127
Chronic drug use	23(11.3)	20(11.3)	3(11.5)	0.971
Serial seven (15+)	36(17.7)	32(18.1)	4(15.4)	0.737
Two or more psychological test (+)	31(15.3)	27(15.2)	4(15.4)	0.986

Driving History				
Shift schedule				0.153
Day	169(83.3)	149(84.2)	20(76.9)	
Night	15(7.4)	14(7.9)	1(3.9)	
Mixed	19(9.4)	14(7.9)	5(19.2)	
Trained on the job	155(76.4)	136(76.8)	19(73.1)	0.561
Driver vehicle ownership				0.003
None	146(71.9)	134(75.7)	12(46.2)	
Private vehicle	27(13.3)	22(12.4)	5(19.2)	
Commercial vehicle	30(14.8)	21(11.9)	9(34.6)	
Payment mode				0.153
Monthly	169(83.3)	149(84.2)	20(76.9)	
Weekly	15(7.4)	14(7.9)	1(3.9)	
Daily	19(9.4)	14(7.9)	5(19.2)	
Accident history				
History of RTAs attributable to another driver/pedestrian	67(33.0)	60(33.9)	7(26.9)	0.480
History of RTAs due to personal human error	16(7.9)	13(7.3)	3(11.5)	0.459
History of sleep related accident?	3(1.5)	2(1.1)	1(3.9)	0.284
Night	26(12.8)	24(13.6)	2(7.7)	0.403
TOTAL	203	117(87.2)	26(12.8)	

4.2 Driving History

The mean age of drivers was 42.33 ± 8.03 years. The majority 169 (83.3%) of drivers reported having a day shift. However, it is important to note that individuals with day shift often had shifts that continued into the night. Twenty-seven percent (27.0%) of the drivers owned vehicles with nearly half of this number also engaging in commercial transport business. The commonest mode of payment among drivers was a monthly payment schedule; this was reported among 169(83.3%) drivers. Learning to drive on the job was reported among 155(76.4%) of drivers, with 14(6.0%) having had formal driving school training. The rest of the drivers self learnt driving, 34 (16.8%).

4.3 Accident History

Thirty-three percent (33.0%) of drivers reported having a history of an accident attributable to a pedestrian or another driver compared to 16(7.9%) who admitted to personal human error as a cause of a past accident. Sleep related accidents were reported among 3(1.5%) drivers. A history of RTAs occurring at night was reported among 26 (12.8%) drivers. Table 5.1. A higher proportion of drivers reported a history of a vehicular related accident 30(14.9%) compared to 16(7.9%) who reported a history of an environmental related accident.

Table 4.2: Bivariate analysis of Human error related RTAs by characteristic of drivers

Characteristic of Drivers	Number (%) of drivers=203	Self reported RTAs due to Human error		Unadjusted odds ratio	Pearson'sChi Square test P-value
		NO	YES		
Age group (yrs)					0.926
30-50	162(79.8)	149(79.7)	13(81.3)	1	
<30	9(4.8)	1(6.3)	10(4.9)	1.27(0.15-10.85)	
>50	31(15.3)	29(15.5)	2(12.5)	0.79(0.18-3.69)	
BMI					0.134
Normal	107(52.7)	100(53.5)	7(43.8)	1	
Underweight	11(5.4)	8(4.3)	3(18.8)	5.36(1.16-24.80)	
Overweight	59(29.1)	53(28.3)	6(37.5)	1.62(0.52-5.06)	
High blood pressure	70(34.5)	65(34.8)	5(31.3)	0.85(0.28-2.56)	0.775
Medical History					
Alcohol	59(29.1)	54(28.9)	5(31.3)	1.12(0.37-3.38)	0.842
Hypertension	16(7.9)	10(5.7)	6(23.1)	0.85(0.28-2.56)	0.775
“High risk” for OSAS	26(12.8)	23(12.3)	3(18.6)	3.50(0.31-40.03)	0.314
Two or more psychological test (+)	31(15.3)	29(15.5)	2(12.5)	0.78(0.17-3.67)	0.748
Driving History					
Shift schedule					0.001
Day	14(6.9)	12(6.4)	2(12.5)	1	
Night	7(3.5)	4(2.1)	3(18.8)	4.50(0.54-37.38)	
Mixed	182(89.7)	171(91.4)	11(68.8)	0.39(0.08-1.94)	
Driver vehicle ownership					0.100

None	146(71.9)	134(75.7)	12(46.2)	1	
Private vehicle	27(13.3)	22(12.4)	5(19.2)	3.93(1.18-13.08)	
Commercial vehicle	30(14.8)	21(11.9)	9(34.6)	1.92(0.48-7.69)	
Payment mode					0.067
Monthly	169(83.3)	149(84.2)	20(76.9)	1	
Weekly	15(7.4)	14(7.9)	1(3.9)	5.22(1.43-19.12)	
Daily	19(9.4)	14(7.9)	5(19.2)	0.80(0.10-6.55)	
Accident history					
History of RTAs attributable to another driver/pedestrian	67(33.0)	60(33.9)	7(26.9)	10.67(2.92-38.95)	0.0001
History of fatal accident	10(4.9)	5(2.7)	5(31.3)	16.5454(4.16-65.83)	0.0001
History of RTAs due to Vehicular factor	30(14.8)	26(13.9)	4(25.0)	2.06(0.62-6.89)	0.230
History of RTAs at Night	26(12.8)	20(10.7)	6(37.5)	5.01(1.65-15.25)	0.002
History of RTAs due to environmental factor	16(7.9)	15(7.4)	1(0.5)	2.43(0.27-22.14)	0.432

4.4 Health Status

The prevalence of alcohol use among drivers was about thirty percent 59(29.1%).. Hypertension was reported among 16(7.9%) of the drivers whilst self reported diabetes mellitus was 3.9%. However blood pressure measured on site revealed a prevalence of 34.5%. Almost half 107(52.7%) of drivers had a normal BMI. The prevalence of overweight and obesity were 29.1% and 12.8% respectively. Only three percent of the drivers reported a history of sleep problems. A quarter of drivers regularly used Herbal medication. Snoring was reported among 44.8% of drivers. OR-3.97, CI=(2.48-6.38). Table 4.2. Although hypertension (P=0.002), snoring (P=0.0001) and alcohol use (P=0.040) were significantly related to a high risk for OSAS they were not significantly related to accident risk. (P>0.05)

The Serial Seven test score for maximum of two correct answers was reported in 36(17.73%) of drivers. A Stroop Test time score of <110sec was reported among 82 (48.81%) of drivers, a cumulative percentage of 70.0% completed the test <150 seconds. Thirty-nine (19.21%) drivers were unable to complete the Stroop Test because they were unable to read. Fifteen percent (15.27%) of drivers had at least two unsatisfactory results in the three psychological tests done.

Table 4.3: Multivariate analysis of Human error related RTAs by characteristics of drivers

Characteristic	Number (%) of drivers	Unadjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Shift schedule		1.09(0.12-1.18)	0.053		
Day	14(6.9)				
Night	7(3.5)				
Mixed	182(89.7)				
History of RTAs attributable to another driver/pedestrian	67(33.0)	10.67(2.92-38.95)	0.0001	16.30(3.37-78.91)	0.001
History of a fatal accident	30(14.8)	16.55(4.16-65.83)	0.0001	32.59(5.06- 210.04)	0.0001
History of an Accident at night.	26(12.8)	5.01(1.65-15.25)	0.0020		
TOTAL	165				

4.5 Accident History

Self reported RTAs due to personal human error was used to assess sleep/fatigue related accidents to improve accuracy of self-reported accident history. There was no significant association between age and a history of human error related accident (P=0.261) and a "high" risk for OSAS. Alcohol use measured with the CAGE score did not play a significant role in human related errors. (P=0.414).

The driving shift schedule played a significant role in accident risk (P=0.001) during bivariate analysis only. Drivers with a mixed day and night schedule were less likely OR-0.38, CI=(0.08-1.94) to be involved in an accident compared to Day shift drivers. Drivers with a history of a fatal accident OR-16.54, CI=(4.16-65.83) or reporting an "accident

attributable to pedestrians/another driver" OR-10.67, CI=(2.92-38.95) had a significant association with being involved an accident due to personal error (P<0.0001). Vehicular factors do to play a significant factor in human error related accidents. (P=0.23)

Factors associated with human related accidents after Bivariate analysis were shift schedule of drivers (P=0.001), History of an "accident attributable to another road user" (P=0.0001), history of a fatal accident (P=0.0001) and history of an accident at night (P=0.002). The exposure of interest, a "high" risk of OSAS was not significantly associated with human related accidents. (P=0. 314)

Qualitative Results

a. Knowledge on causes of RTAs

The results showed that informants had an extensive knowledge of the causes of RTAs. Informants reported several reasons as the causes of RTAs in the country. The causes covered environmental, human and vehicular related factors.

The major cause reported by the majority of drivers was poor road network and infrastructure. Repeated mention was made of the Suhum section of the road linking Accra and Kumasi. Deplorable roads weakened and loosened ballpoints and springs of vehicles.

The consequences of driving on these bad roads were damage to the vehicle and fatigue of the driver, which increases the risk of road accidents.

> *"Our major challenge has been the road condition, particularly the Accra Kumasi road. The road is not good. Ever since 2008, we started buying brand new buses. The road has spoilt all the new cars."* ***Key informant, Management, age- (30-50), Neoplan station***

"We know the highway authority builds roads. The contractors in charge of the roads have stopped constructing. We need the authorities to repair roads. A vehicle almost fell on mine yesterday…The cars that bring charcoal are not balanced and will fall whilst on bad roads. The roads are the main cause of accidents. ***Focus group discussion, Age- (30-50), Neoplan Station***

"Over speeding…Over loading and wrong over taking…Careless driving… Our roads are very bad and cars break down along the same roads, which are abandoned for days. The NRSC should try and tow these cars to prevent RTAs…There are no signs to prompt cars of such broken down cars in the middle of the road. Also there are speed ramps on the roads without any road signs prompting drivers that they are approaching a speed ramp." ***Key Informant, age- (30-50) VIP station***

"They are Alcohol, Fatigue and the bad nature of road because it can cause a bolt to loose from the car. This may lead to removal of a part and you cannot do anything about it. When you look at the roads in northern region and the roads in southern. The roads in south especially [Suhum- Nsawam] road are bad. This increases fatigue. The day it is repaired I will kill a chicken and eat it. When you get there from northern region to Accra, the fatigue intensifies." ***Key informant, management- Sprinter buses, age - (>50), Neoplan station***

"The roads are bad. This weakens the car and affects the tire, ball joint and springs." ***Key informant, Management- Welfare, age-(>50), Neoplan station***

"So many things could cause RTAs. The bad nature of the roads, careless driving and unnecessary overtaking of other cars could cause RTAs." ***Key informant, management-Trustee, age- (>50), Neoplan station***

Another key cause of road accidents mentioned by majority of drivers was fatigue or tiredness. They cited that drivers and passengers are often in a haste to get to their destinations. Drivers who request to rest during a trip face objection from passengers who are eager to arrive at their final destinations.

The drivers further added that on some occasions, they were forced to embark on another trip upon arrival at a destination due to the large numbers of passengers waiting. They explained that the consequence of lack of adequate rest is drowsy driving.

Conversely they did not consider fatigue from shift schedule and long driving hours as an important contributory factor in recent times. There has been a significant increase in vehicles with over 600 vehicles available for passengers. As a result in between trips drivers have a rest period of 2-3days.

> *"When you are tired and you want to rest for 30 min the passengers will not agree. He will insist on you driving him. They don't see us as humans like them who need rest. So we have to force and send them and if an accident occurs it kills us all. Just imagine when the passenger sits in car he estimates the travel distance e.g. 6 hours Accra- Kumasi. But the road condition may extend the time. He may not understand.* ***Focus group discussion, Age- (30-50), Neoplan Station***

> *"Fatigue from drivers, instead of the driver resting, he continues to drive, could cause RTAs"* ***Key informant, Management, age - (30-50), VIP station***

> *"Most of the time it is due to fatigue, after a driver returns from a trip, he may not rest and will force to get a second load of passengers…this can also cause RTAs."* ***Key informant, Management, age- (30-50), Neoplan station***

> *"It results from people who are not careful, observant and also tiredness. It may also be hastiness, or a faulty car."* ***Key informant, Management-Welfare, age-(>50), Neoplan station***

> *"So many things could cause RTA. Also, sleep driving could cause accident. The driver maybe tired and instead of taking time to sleep, he will continue driving with the intention of reaching his destination on time and if care is not taken, he may end up in an accident.* ***Key informant, management-Trustee, age-(>50yrs), Neoplan station***

Another major cause for road accidents that was common in the responses was the poor maintenance of vehicles. Some respondents indicated that some vehicles had worn out parts, which increased RTA risk.

The reported faulty trucks and vehicles by the roadside in it self posed a safety risk. They added that they were aware the government had procured some toll trucks but they were expensive to use.

> *"When faulty some vehicles can be parked on the roads for a long period of time. This is unsafe. Cars are no longer being towed when spoilt. The price for towing can be high -1,000 Ghana cedis. So drivers leave the car in the road when it is spoilt. There is one currently on the Nkawkaw road it has killed a driver needlessly."* ***Focus group discussion, Age- (30-50), Neoplan Station***

> *"Mostly when the long vehicles break down on the road, they do not use any road signs to prompt other drivers of such break downs. If a driver during an overtaking fails to recognize the broken down car on the road, it then runs into it and causes accident."* ***Key informant, Chief driver, age - (>50), Neoplan station***

> *"Also when we did our research we found that old tires, expired tires and worn out tires are causes of accidents. When the front tires "blasts" it is of more risk than the back tire. This can also cause RTAs****." Key informant, Management, age- (30-50), Neoplan station***

The human related factors they identified were over speeding, wrongful overtaking, careless driving, driving under the influence and drowsy driving. They reported that many drivers are frequently impatient to get to their destinations, and are encouraged by passengers to over speed. The disregard of regulations further increased the risk of RTAs occurring. They added that some drivers do not observe for obstacles on the road such as broken down vehicles, potholes and ramps. This could lead to lose of control of the vehicle when they encountered these obstacles.

> *"Impatience by drivers causes RTAs. They don't take extra care before overtaking other cars. They don't check and re-check before overtaking other cars and if not careful, it results in accidents. We talk to our drivers to be careful and drive patiently. In addition, passengers are also factors to road traffic accidents. They complain to*

drivers to over-speed in order to reach their destination early. ***Key informant, Chief driver, age- (>50), Neoplan station***

A few drivers mentioned that drinking and driving could cause road accidents. They reported that due to the nature of their job and tiredness, they sometimes take in alcohol to energize them.

"In addition driving and drinking is a cause of RTAs. After a trip a driver goes to a chop bar and drinks alcohol because he wants energy to drive." ***Key informant, Management, age- (30-50), Neoplan station***

Some few respondents indicated that some of the causes of road accidents emanate from some actions of the highway authority. They cited the example of road accidents caused by inappropriately cited police checkpoints. They also complained of other causes such as illegally acquired driving licenses.

"The police also build checkpoints in curves and it is not safe… Sometimes they put a stone in the middle of the road and it can cause RTAs…Speed rumps… Where there are signboards it is too close to the road…when building speed rumps they need technical people to correctly site it. The road signs also need to be reflective to be seen at night. Lastly there are many potholes in the road.

The causes of RTAs are police related and GPRTU related. People pay 5 million for license- its not right." ***Focus group discussion, Age- (30-50), Neoplan Station***

b. Accident Risk Reduction Measures

Respondents revealed that there are several actions that they under take collectively and as individuals to reduce accident risks. They added that drivers were tested with alcohol breath analyzers sometime in the past and drivers above legal limit were barred from driving. They also reported that with the assistance of the Motor Traffic and Transport Unit-MTTU, checkpoints have been mounted along the Accra-Kumasi road where drivers' alcohol levels

are checked periodically. Passengers also reported drivers reeking of alcohol to relevant authorities for immediate action.

> *"The clients we work with do not like alcohol so when they sense the smell of alcohol on you, they will not board your vehicle. Over here we have someone who checks alcohol among drivers. From here to Suhum there is an official who checks"* ***Key informant, management-Sprinter buses, age-(>50), Neoplan station***

> *"We therefore mounted checkpoints with MTTU where we checked the alcohol levels while on the journey… We often talk to the drivers about fatigue; we encourage them to park and stretch their legs. Sometimes the drivers pretend to have dropped something on the way and he runs for it. This helps fight of sleepiness. Drivers are also advised on the effect of drink driving, fatigue and over speeding."* ***Key informant, Management, age- (30-50), Neoplan station***

> *"We have rules to check alcohol intake and driving and when a driver is caught with smell of alcohol, he is sacked and fined. We don't allow drivers to take alcohol and drive our cars."* ***Key informant, Chief driver, age-(>50), Neoplan station***

c. Trainings and Workshops

Another major measure that is taken to reduce road accidents was regular training and sensitization workshops. They explained that although these are organized periodically, sometimes once a year, they enable drivers to be taught about best practices in driving. These workshops and refresher trainings are reportedly sometimes, organized in collaboration with the NRSC. They however indicated that although these sessions were organized some drivers do not partake.

> *"Every year we organize road safety training here for the drivers where we teach them best practices of driving on the road, driving within the right speed limits and avoidance of unnecessary overtaking of other cars. Some drivers are floating drivers without a station and such drivers do not receive such education and directions so they drive anyhow on the roads."* ***Key informant, management-Trustee, age -(>50yrs), Neoplan station***

> *"We do organize refresher training. We can have almost hundred drivers for such trainings."* ***Key Informant, Age - (30-50), VIP station***

d. Managing driving and shift schedule

The majority of respondents from the Neoplan station indicated that drivers were on call 24 hours, seven days a week. They reported that drivers generally do not have days of rest or vacations. Drivers took breaks during the waiting period for passengers. They explained that currently, due to the increased number of buses and low demand in the business, drivers have to wait for two to four days for passengers. They added that the number of drivers per bus depends heavily on the distance of travel. In general each car had a driver and a "Mate". [Boarding assistant]

The focus of management in the Neoplan station was the management of vehicles and getting the maximum possible returns. Drivers were a secondary focus and were hired and fired by owners and management. Neoplan Drivers complained of the absence of rest rooms compared to their colleagues at the VIP station. The VIP station had a structured well-organized management with a safety officer, functional welfare, rest rooms and well-organized drivers in uniforms. About 75% of Neoplan station drivers slept in their vehicles in between trips compared to 55% at the VIP station. About 10% of the Neoplan drivers reported sleeping in rest rooms whilst 43% of VIP drivers slept in formal rest rooms. Some VIP drivers, cited disturbance from phone calls as reasons they avoided the formal rest room provided by management.

> *"It depends on distance. One driver for short distances… It depends on distance…maximum driving hours, after fours you should rest, park stretch your legs."* ***Key informant, Management, age- (30-50), Neoplan station***

> *"For now there business is low. It may take you three to four days to load your vehicle. At least 8hours then you rest. But we don't get that always because of the nature of the job. We have "off days" because it may take 2-3 days for car to load."* ***Key informant, management-Sprinter buses, age-(>50), Neoplan station***

"We assign one driver to a bus with his mate. That why we ensure they have some rest in the course of the journey. At least to rest after every 20 kilometers travelled… We work seven days in the week…We have a lot of cars here and we book them accordingly. When it's not the turn of a driver to travel, he is made to have some day to rest before travelling again to reduce the tiredness. We ensure they have enough rest. ***Key informant, management-Trustee, age - (>50), Neoplan station***

"We work throughout the week. Seven days in the week. Drivers don't have holidays…we do have time to rest. I came last night. I have slept since then." ***Focus group discussion, Age- (30-50), Neoplan Station***

"Every station has station masters or porters who check this. Many who work at night cannot work day and vice versa. Also the passengers have reduced in number primarily due to many more cars available now." ***Key informant, Management-Welfare, age-(>50), Neoplan station***

Management of drivers and their shift schedule at the VIP station had some similarities with management at the Neoplan station although with few marked differences. A major difference reported by respondents at the VIP station was the use of spare drivers at marked intervals during a long distance trip. The system was well organized and used by most drivers. They reported that about forty spare drivers are available to be paired with other primary drivers.

Drivers were required to drive up to a scheduled point, after which the spare driver took over driving. They also reported a maximum of three days in between trips. Management had prior arrangements with notable rest stops along the route where drivers are mandated to stop for a minimum of fifteen minutes to rest. They also had a "time roaster" where the time of departure and arrival were recorded for objective tracking of total journey time. This is to track over speeding among drivers.

"There are so many buses here at VIP station therefore the drivers don't get that tired to be running several trips at a time. Also, there are spare drivers here to assist.

A bus could spend like three days here in Accra before being arranged to travel to Kumasi. In that case the drivers don't get tired. They get enough time to rest. There are few old drivers here. We have many buses so sleepiness in driving is not an issue here.

The drivers rest a little at Linda Dor restaurant for 15 minutes where passengers also use the washrooms and buy food. The issue of tiredness is not an issue here at VIP station… Every driver is assigned to a bus and we have about forty spare drivers." ***Key Informant, Age - (30-50), VIP station***

e. Perception on sleep and RTAs

Nearly all respondents held the view that inadequate sleep was a major contributory factor to road accidents. They reported that sleep is a necessary requirement for a healthy mind and body. The adverse effect of inadequate sleep was drowsy driving and poor concentration.

They explained that the human body needs a minimum of eight hours sleep. They insisted that they had not received any reports concerning drowsy driving but should they receive any such reports, the driver will be cautioned on the need for adequate rest before embarking on any trip. About 80% of Drivers in the Neoplan station had not taken a formal vacation compared to 43% of drivers in the VIP station.

*"Sleep can really result in accidents especially long-distance journeys. You need to rest during the journey. If physically and mentally you cannot drive long journey, you need a spare driver to ensure safety. When an accident happens, it's the passengers we are concerned about not the car.****" Key informant, Management-Welfare, age-(>50yrs), Neoplan station***

"This is one factor. Before we go for long distance journeys, we sleep from morning to afternoon. I will sleep from morning to 12 noon before waking. This is because one

will drive the whole night so you have to rest. You have to rest well. Sleep well. ***Key informant, management-Sprinter buses, age-(>50yrs), Neoplan station***

" If he does not get enough sleep, he will be feeling sleepy when driving and that could result in accidents. Because of the bad nature of the road, when a driver is sleeping whiles driving and he pumps into a pothole, it could redirect the car running into the buses and there will be more damage. He may even not notice the road signs and if there is an emergency on the road, he may end up running into more troubles." ***Key informant, management-Trustee, age -(>50), Neoplan station***

"We have to get 8 hours sleep as humans. RTAs can result from inadequate sleep. You owe nature if you don't sleep well. You can't cheat nature." ***Key informant, Management, age- (30-50), Neoplan station***

Figure 4.1: Drivers at VIP sleeping underneath their cars (cargo section)

Figure 4.2: VIP station official restroom

f. Drug and stimulant use

Management and some drivers reported the use of some medications to prevent sleep. They reported the use of "asra" [finely ground tobacco], which they snorted as a stimulant to stay awake. Others drank coffee or alcohol to avoid sleep driving. They insisted that the body needed rest and taking these medications could result in adverse events in the long term.

> *"Some people sniff "asra" which is very bad we have stopped them because you cannot cheat nature. Some people use coffee but they are deceiving themselves. It's like drug addiction. If you are tired you have to rest before continuing."* ***Key informant, Management, age- (30-50), Neoplan station***

> *"You have to rest well. Sleep well. Medicine will have adverse effects on you later. So the goal is to sleep well."* ***Key informant, management-Sprinter buses, age -(>50yrs), Neoplan station***

> *"We don't give any medicine to keep drivers awake. When a driver is sick, he is allowed to stay home for two weeks and be fit before coming to work to drive again.*

Even the laborers here are also allowed to be well before coming to work." ***Key Informant, Age - (30-50), VIP station***

g. The role of welfare in the stations

The drivers reported the presence of welfare unions amongst both Neoplan and VIP drivers. Whilst the evidence regarding the role of welfare association is more noticeable amongst drivers of VIP buses, it was lacking among Neoplan drivers.

Many indicated that due to the little or no benefits that they receive from the union; they did not consider the welfare as a union for supporting drivers. They explained that the union was beneficial to car owners with drivers having limited roles and power. Some respondents reported that welfare leaders had not organized formal meetings in a while.

They cited the inability of the union to provide social security, rest rooms and financial assistance to the sick or retired drivers. They compared the benefits of their union with those of the VIP and indicated that drivers at VIP enjoy more benefits from their union or associations. About 60% of drivers in the Neoplan station did not have a valid health insurance card, whilst a lesser proportion of drivers in VIP also did not have a valid health insurance card, 42%.

"We have a welfare committee but I don't benefit from it." ***Key informant, management-Sprinter buses, age -(>50yrs), Neoplan station***

"There are several issues with this welfare association. There are no meetings for the welfare association. It's really a problem here." ***Key informant, Chief driver, age - (>50), Neoplan station***

"We don't have a welfare association but they collect welfare dues. When a driver has an issue nobody talks for him. If you are sick nobody cares. The owner of the car is the one we collect money for not the driver…I have been working here for 20 years

but I am not a union member. It is not a drivers union but a car owners association, when a driver is old; it is difficult to come here for money. We don't have social security. The owners have cheated us for a long time. It is compulsory for the owner to pay our social security. Even if you change owners the new owner should continue paying but this is not done.

*VIP drivers are not different, we are brothers but because the owners of VIP formed a union. They have built a room to rest for them. We don't have that here. They once bought mattresses but it didn't work. Go and look at the VIP station, the managers have made the environment nice. Our managers here haven't helped us. By now drivers should have a hospital and school for our children and wives to attend. There is no rest room for us.***" Focus group discussion, Age- (30-50), Neoplan Station**

*"We don't have a welfare association for only drivers. One can apply to become a member of the union. If you have a problem you come to them and they settle it for you. When something is beyond the local union we step in.***" Key informant, Management, age- (30-50), Neoplan station**

Drivers from the VIP recounted that their station is considered a company and hence issues of welfare are imbedded into the company regulations. Key informants reported the existence of a welfare association, which had a constitution that guided the activities of the association

"It's a company and we are part so it is all inclusive. We don't officially have a welfare association but when someone needs help or support he is taken care of." **Key Informant, Age - (30-50), VIP station**

"We have welfare association. The members have their own constitution that guides their activities. They have outlined support packages they give to members who might be sick, been involved in an accident or bereaved. Those are the support members enjoy in the welfare association." **Key Informant, Age - (30-50), VIP station**

h. The maintenance of cars

All respondents indicated that the maintenance of vehicles was high priority in vehicle management. Many reported that although car owners are responsible for the cost of repairs and maintenance, drivers are required to know when their vehicles are due for servicing and to send their vehicles for maintenance after a minimum of eight trips and or after each 5000km that the vehicle covers. Others indicated that maintenance should be daily and after each trip. Some respondents indicated that some vehicles owners had contracted mechanics that serviced all their vehicles.

The stationmaster or the chief driver is responsible for supervising vehicle management. When a vehicle is found not to be road worthy, the vehicle was barred from journeys. Notable differences in the stations were; in the VIP station servicing was well structured and supervised strictly by safety officers and station mangers. However in the Neoplan Station despite similar control measures it largely was controlled by the release of funds by vehicle owners. About 30% of drivers in the Neoplan station had vehicles with non-functional seat belts for drivers compared to 3% of vehicles in the VIP station with non-functional seat belts for passengers. Table 4

> *"As a road safety officer, I ensure that the car tyres are always checked, I asked the drivers to listen to the sound of the car and ensure its constant servicing. But you know when the drivers go onto the streets; you don't know what happens there. Here at the station, once your headlights are not working, I ensure you don't move the car and assign passengers to a new car because there are more buses here…all the drivers ensure they undertake their car servicing regularly. There are also car electricians and mechanics around who attend to minor issues."* ***Key informant, Management, Age – (30-50), VIP station***

"We have transport officers. We don't joke with maintenance. If there is a problem you call them to come over or you send car to them. Servicing is done after 8 trips, but if you see car has a problem you send it for servicing." ***Focus group discussion, Age- (30-50), Neoplan Station***

"Every two weeks, we undertake general bus maintenance. We change the oil every two weeks. Drivers comply with the maintenance protocol else they lose their jobs. Though the engine has an eleven-year guarantee, there is the need to constantly change the engine oil to keep it working well always. We have mechanics, electricians, sprayers and all." ***Key Informant, Age - (30-50), VIP station***

"We have our car maintenance regularly. It's the driver who handles the car so if he hears any unusual sound under the car he has to take it for servicing. The stationmaster manages the cars and drivers. Everyone has their individual workshops where they take their cars for servicing." ***Key informant, Chief driver, age- (>50yrs), Neoplan station***

"The station master checks on the vehicle and the driver… if you run 5000km you have to go for servicing. We abide by it. If you don't go you are spoiling your own car. The managers are in charge of managing the cars and driver." ***Key informant, management-Sprinter buses, age- (>50), Neoplan station***

"We have our own workshop in Kumasi where we maintain our buses. Because of the bad nature of the road, we service the buses every two weeks. So every two weeks buses need to be serviced. Every director has their chief driver who are responsible for managing the drivers." ***Key Informant, Age - (30-50), VIP station***

i. The recruitment of drivers

Regarding the issue of recruiting drivers, respondent reported two main ways of recruitment. Many respondents indicated that they started off as a driver's mate [assistant]. They were taught to drive on the job after which they were assisted to obtain a license.

New drivers were assigned to experienced drivers for a period of observation. When the supervising driver has approved of his driving abilities he is given full membership status. In the VIP station it was policy to recruit drivers with License F, which is the highest for long distance drivers. This ensured that drivers had a lot of experience before coming on board as a driver. In the Neoplan station vehicle owners would introduce their drivers to the station for a vetting process. The type of driving license was not a prerequisite. However station managers had a significant say in the selection of the driver. A minimum of four years experience is required for eligibility as a driver.

The added advantage of a supervising driver arrangement was to familiarize incoming drivers with the route from the perspective of an experienced driver.

> *"To become a driver we go through a lot, we first start with a master, who teaches us to drive. When your master is satisfied with your driving he leads you to get a license. You should not send us to a board to test us…If you bring a car to the station with a driver, we check his license and check to see if he has worked with us before. If not, we assign him to a driver to work with for two weeks to see his driving. Here at Neoplan if they don't know you it is difficult to work here. Usually for your first trip we will not let you load at night. You have to work during daytime. When you are familiar with road we let you drive at night."* ***Focus group discussion, Age- (30-50), Neoplan Station***

> *"Here in VIP station, our drivers hardly have accidents. The secret is that most of our drivers learnt how to drive here in the station. Some were driver's mates who*

have worked for ten years and then drive for five years. In that case they know the roads so well and can travel to all destinations. They have been trained well also from here. Over 70% of the drivers here were trained by the old and experienced drivers here." ***Key Informant, Age - (30-50), VIP station***

"We count on experience; highway drivers don't go through driving school. We do employ them like you are employing technical personnel, e.g. carpenter. We send him to a master for training. He will then be taught driving on the job with master. In a couple of years he picks up if he is smart. The driver recommends that he becomes a mate to a driver. Here we do register cars but not drivers, but we employ drivers who know and can ply the road." ***Key informant, Management, age- (30-50), Neoplan station***

"When the bus is given to you, you are solely made in charge of it. You are given the opportunity to select a competent person to drive the bus. We then vet the person to ensure he is competent for the job. The driver is then attached to an old driver and learns from the person. We don't assign buses straight to new drivers. You are then later assigned an old bus to drive when the one you are attached to is given a new bus. That's our method of recruitment." ***Key Informant, Age - (30-50), VIP station***

"For qualification, we check the class of license the person has (Class F) and should have driven the bus not less than five years." ***Key Informant, Age-(30-50) VIP station***

"We cross check your driver's license, then check your recommendation from others and we test you. We assess your driving before accepting you." ***Key informant, management-Trustee, age- (>50yrs), Neoplan station***

j. Training of drivers

Many respondents reported that drivers periodically receive some training from government agencies responsible for ensuring the safety of the roads. The National Road Safety Commission (NRSC) was frequently reported as the government institution that

provides the bulk of these trainings, which mostly deal with issues of awareness on road safety.

The Motor Traffic and Transport Union (MTTU) were also reported as institutions that provide some of these trainings. These trainings were cited to include best practices, careless or reckless driving, road regulations, over speeding and overtaking as well as addressing any other concerns posed by drivers. Station managers have the responsibility of ensuring that drivers attend these training sessions. Some respondents indicated that these trainings were interactive, as drivers do not have the opportunity to contribute their challenges.

> *"Every year we organize road safety training here for the drivers where we teach them best practices of driving on the road, driving within the right speed limits and avoidance of unnecessary overtaking of other cars. Most of the others drivers are floating drivers without a station and such drivers do not receive such education and directions so they drive anyhow on the roads. "***Key informant, management-Trustee, age -(>50yrs), Neoplan station**

> *"Recently the MTTU were around to educate us."* **Key Informant, Age - (30-50), VIP station**

> *"NRSC/MTTU come and organizes such trainings for our drivers. We ask questions and they educate us."* **Key informant, Chief driver, age -(>50yrs), Neoplan station**

> *"The NRSC do come here but they don't take our input, they only say what is in their books."* **Focus group discussion, Age- (30-50), Neoplan Station**

> *"It is mandatory for all drivers to go and listen for the training but some of the drivers might not be available (might be on a trip) so they might not participate."* **Key Informant, Age - (30-50), VIP station**

"We pull them to the meetings. We don't have any schedule but once in a week the station masters talk to drivers" ***Key informant, Management, age- (30-50), Neoplan station***

k. Salaries of drivers

Regarding the issue of salaries, the majority of respondents reported that their vehicle owners determine the salaries of drivers. They reported that due to this, salaries for drivers are not sufficient or satisfactory although the majority of them could not provide an estimate of the salary of a driver. A few respondents indicated that many of the drivers do not receive a regular salary and often compete amongst themselves thus facilitating transport owners to conspire to pay low salaries. About 73% of Neoplan drivers were paid on a monthly basis compared to 95% among VIP drivers. The alternative to monthly payment was weekly and daily payment. Only 4% of drivers at the VIP station reported being paid based on the number of trips per week or month however 24.8% of drivers at the Neoplan station were paid based on the number of trips per week or month. Salaries at the VIP station were largely fixed.

"As you can see for every ten drivers, only 3 receive salary, the drivers are not united. When there is a problem with the car owner, the car may be seized and parked. My fellow driver can approach the car owner and say he can do more trips than I usually do. When the car owner believes this the car is given to him. Meanwhile he cannot do that. This leads to the car owners treating us cheaply." Focus group discussion, Age- (30-50), Neoplan Station

"The bus owners pay them. The driver gets some money also from the charges they take from passengers for their luggage and goods." ***Key Informant, Age - (30-50), VIP station***

"The car owners determine the salary of drivers." ***Key Informant, Age - (30-50), VIP station***

"Its individual cars so those who bring their cars here pay their drivers." Key informant, Chief driver, age -(>50), Neoplan station

l. Communication in times of emergency

The majority of respondents recounted that in times of emergency, drivers often provide support for each other. They reported that drivers often communicate via phone to each other not only in times of emergency or to inform each other about obstacles/dangers on the road. Some drivers called fellow drivers during trips as a measure to address drowsy driving. Other respondents indicated that some drivers often use their headlights to provide warnings to other road users. The VIP drivers were required to have hands free earpieces to reduce phone distractions.

*"We do that a lot. The drivers are united though we don't have a union. I have the numbers I call the driver behind me if I see something on the road. We have been told not to use the mobile phone. It doesn't help us because you have to communicate in times of danger. When you drive for long distance and passengers are asleep you can call a fellow driver and chat. This helps you stay awake. This can go on for an hour and we continue.***" Focus group discussion, Age- (30-50), Neoplan Station**

"We use mobile phone to communicate. We use Bluetooth devise so we don't use our hand on our phones" ***Key Informant, Age - (30-50), VIP station***

"Drivers use mobile calls and signals with their headlights" ***Key informant, Management, age- (30-50), Neoplan station***

"Now mobile phones are common and everyone has one. We have earpiece that drivers wear in order to communicate to other drivers in case there are armed robbers on the way. They also inform other drivers in case there are broken down

vehicles on the road that might be situated at accident prone locations." ***Key Informant, Age - (30-50), VIP station***

"Every driver knows which car is ahead and behind so they call the drivers and inform them of any events." ***Key Informant, Age - (30-50), VIP station***

"We have all the numbers we may call to inform them that there is a car spoilt in the curve. Hence slow down at that bend" ***Key informant, management-Sprinter buses, age- (>50), Neoplan station***

m. Handling disciplinary issues among drivers

Many respondents indicated that disciplinary issues were handled by the chief drivers and stationmasters. Some respondents also reported the existence of disciplinary committees made up of station managers and drivers tasked with handling cases of driver indiscipline. Transport owners handled cases that failed to reach a resolution. Disciplinary measures included suspension for some defined period, usually between two weeks and two months depending on offence. Their mandate included complaints received from passengers.

"It depends on the person involved…you could be suspended for awhile…you could be dismissed." ***Key Informant, Age - (30-50), VIP station***

"You will bring him before the management, if he is guilty, the managers will sit with him, explain and sack him. Our managers are the disciplinary committee who check on drivers. The managers are in charge of managing the cars and drivers" ***Key informant, management-Sprinter buses, age-(>50yrs), Neoplan station***

"We don't readily sack drivers because it is a professional job .We get information from passengers because the see the driver driving left and right or sleep driving. We give them strict warning. We caution you when you are reported and can suspend you

for two weeks. In the past we used to sack people but now unless the offence is serious." ***Key informant, Management-Welfare, age-(>50), Neoplan station***

"We sack those who go against the laws and rules of the station and safety regulations. We suspend the driver for three months and he is made to apologize to the person he fought with. This will serve as a deterrent to others to put up best behaviors. The welfare association ensures the discipline of committee members and drivers. When a member misbehaves, they are referred to the association and the appropriate sanction is applied." ***Key Informant, Age - (30-50), VIP station***

"If it is minor we suspend you for some time e.g. two weeks. If it is major we can say, "we have nothing doing with you but we can work with car" Your car can work here but not the driver. The car owner must look for another driver." ***Key informant, Management, age- (30-50), Neoplan station***

"When a driver drinks alcohol and drives, it causes accidents so once a driver engages in that; we sack the driver from driving here. We don't support driving and alcohol intake. The committee handles indiscipline and the person is dealt with. We have passengers in the car and some of them report of the bad driving nature of drivers and we call and ask the driver involved. He tells his side of the story and if found at fault, he is then dealt with." ***Key informant, Chief driver, age- (>50), Neoplan station***

"Any problem is handled with chief drivers before it goes to the car owner." ***Focus group discussion, Age- (30-50), Neoplan Station***

n. Recommendations

Respondents gave several recommendations on reducing the RTA risk. The most prominent recommendation was the need for the government and relevant authorities to work on construction and maintenance of the road networks. They called for the expansion and

maintenance of the roads and stressed on the need for public awareness and education on road regulations. Respondents also requested assistance in the importation of vehicular parts by government to reduce cost. Drivers also advocated assistance in the prompt towing of faulty vehicles from roadsides to prevent them posing an accident risk.

They also recommended that drivers should be tested for licensing using practical and culturally appropriate measures. Drivers noted that whilst many drivers were minimally educated the licensing process was heavy on theory and an ability to read. An emphasis of practical knowledge of vehicular management and road safety was suggested. They reiterated that the system of training drivers through years of apprenticeship was more rigorous and effective compared to formal driving schools.

> *" We need the authorities to repair road. For me the license is important to me. It is not the license that drives, it is people who drive! We train our youth to drive and they gain experience from going on the road with us. When you train someone, he is given a license B that is not needed for commercial driving.*
>
> *We drivers we didn't go to school, everybody knows we are illiterates and didn't go to school, so when testing for license why do you give us a test that involves reading of the alphabet?*
>
> *They should be asking questions relating to the car. We want a change in the rules. If a master trains his student with a bus, he should be tested with the master's bus to see his competence."* ***Focus group discussion, Age- (30-50), Neoplan Station***
>
> *"A little patience on the road could help reduce RTAs. As a driver, you should have patience on the road and avoid wrong over takings.*
> *The NRSC should try and tow broken cars to prevent RTAs. There are no signs to prompt cars of such broken down cars in the middle of the road. Also there are speed ramps on the roads without any road signs prompting drivers that they are approaching a speed ramps.*
>
> *The government should work on our bad roads for us. Some places have potholes and when you decide to avoid the potholes, you later end up running into another car and causing RTAs.*

Pedestrians don't obey road signs. They cross the road anyhow… the road safety commission should expand their education programs to the roads and in the buses…they could mount platforms around the toll boots and educate people.

The NRSC should check the poor lighting of some cars. Both front and back lighting of cars are so bad. They should check that for us. They should also check on arm robbery on our road for us… ***Road safety officer, Key Informant, Age - (30-50), VIP station***

"The Accra-Kumasi road is in a very bad state. The government should try and construct the road for us…The government should support the GPRTU to import spare parts to help maintain our cars. Now there are increases in the costs of spare parts so the government should help us. ***Key informant, management-Trustee, age-(>50yrs), Neoplan station***

"The Accra-Kumasi road is in a very bad state. Because of the bad nature of our roads, drivers decide to avoid the big potholes and end up running into other cars and results in accidents. Once the road is in good shape, I believe it could reduce the road traffic accidents." ***Key informant, Chief driver, age - (>50yrs), Neoplan station***

CHAPTER FIVE

DISCUSSION

The aim of the study was to assess the association between OSAS assessed by questionnaire and road traffic accident risk. The prevalence of OSAS by the ARES questionnaire was 12.8% whilst the prevalence of self reported human error related accidents was 7.9%. This study surveyed relatively large sample size of drivers on sleep habits and driver characteristics. Predominantly middle age men were surveyed who were largely Bus drivers. Obesity had a prevalence of 12.8%. Normal BMI was recorded among 51.7% of drivers. They were informed of the nature of the study, participation was voluntary and anonymous. The study recruited 203 drivers belonging to two main transport stations in the transport yard. These were a. The "VIP" station which had higher fares and attracted majority of the middle class and b. the "Neoplan" station, which had comparatively lower fares and common with lower economic class. The study group was entirely male. There were 90(44.3%) drivers from the VIP station and 113(55.7%) form the Neoplan station. Of these drivers, 191(94.1%) were bus drivers and 12(6.0%) were cargo truck drivers. Majority of respondents, 145(71.4%) had primary education as highest educational level

The WHO SAGE study, (Stranges et al., 2012) showed a prevalence of poor sleep quality of 8.3% of Ghanaians men age >50years. Though our sample was relatively younger they were also a high-risk group of long distance drivers explaining the high risk for OSAS. The prevalence of smoking was low 1.48%, the national prevalence of smoking is generally low, (Owusu-Dabo, Lewis, McNeill, Gilmore, & Britton, 2009) reported a national prevalence of 3.8% and among men prevalence was 8.9%. A W.H.O nationwide survey showed an obesity prevalence of 2.8% (Biritwum, Gyapong, & Mensah, 2005), this study

showed a much higher prevalence of 12.81% with about 29.0% being overweight. This was expected because eating habits among long distance drivers are poor. Drivers tend to overcompensate for long hours of not eating with purchased meals at their destinations, which are often unhealthy. They are also a demographic with decreased physical activity due to the nature of their occupation. A systematic review of hypertension put hypertension prevalence between 19%-48%, (Bosu, 2010). Self reported hypertension was reported among 7.9% whilst high blood pressure was measured in 34.5% of drivers. This suggests that at least 26% of the drivers are not on treatment for hypertension. This finding is consistent with (Cappuccio, Kerry, Forbes, & Donald, 2004) finding of the prevalence of awareness, treatment and control of hypertension in semi urban areas in Ghana as 22%, 11.3% and 2.8% respectively.

Self reported RTAs due to personal human error was used to assess sleep/fatigue related accidents to improve accuracy of self-reported accident history. The reasoning behind this was; 1. Drivers may underreport their history of sleep related accidents because of fear of consequences of loosing a license (Smolensky, Di Milia, Ohayon, & Philip, 2011). 2. Driver fatigue has been linked to decreased performance and alertness. This effect may be the primary driver of other human sources of error such as over speeding, wrongful overtaking, or driving under the influence of alcohol. The expectation was; drivers were likely to admit of a personal contribution to an accident without being probed to give the specific reason

There are no published data on the prevalence of OSAS among Africans (Young, Peppard, & Gottlieb, 2002). The validation of the ARES questionnaire using transportation workers in USA revealed a “high risk” prevalence of 52%, out of which 77% were confirmed as having severe OSA by objective assessment [polysomnography].(Levendowski et al.,

2007) The sampled population had a higher mean BMI of 30.5 ± 5.3 kg/m2 but a lower mean age of 37.7±10.4 yrs. Snoring which was significantly associated with a high risk of OSAS was prevalent in 44.8% of drivers compared to 56% among drivers in the study in Turkey, (Akkoyunlu et al., 2013) and 71% in a study in Brazil (Perez-Chada et al., 2005). The OR for "high risk" OSAS among drivers who snore in this study was 19.70 CI=(4.51-86.04).

Driving shift schedule increased the risk of human error related accidents. Drivers who had a mostly night shift had a higher risk, which was expected. A likely explanation would be due to fatigue and poor visibility. Drivers with a mixed were less likely to have a human error related accident OR-0.39 (0.08-1.94) compared with those on a day schedule. Driving shift was not associated with an increased risk for OSAS because majority of the extended work hours was spent on waiting for passengers and not driving. This is consistent with groundbreaking studies on sleep and performance, which showed decrease reaction time, and performance among drivers and drowsy sleeping.(Dinges, 1995) During this period drivers had a chance to rest but had to stay alert on activities in station. They likely had shorter sleeps but adequate time to rest since they were not engaged in formal strenuous activity. Most drivers reporting a history of fatal accident and attributing blame to passengers and other road users are more likely to make driving errors leading to RTAs. (P-0.001). It is possible that some drivers underestimated their personal contribution to the cause of accidents. Drivers for legal and financial reasons are more likely to blame another road user for a road accident. This may mask a higher association between human errors and sleep related accidents. Only three drivers in the study confirmed having ever had an accident due to fatigue. A possible reason for this would be the fear of adverse consequences. Vehicular factors did not correlate with human related error, as these independently were sufficient to

cause accidents Multivariate analysis showed that two key predictors of Human error related RTAs were a history of a fatal accident and attributing RTAs to pedestrians and other road users. ($P<0.001$) The odds ratio was 32 and 16 respectively.

The Drivers in general had a very good understanding of the causes of accidents; their responses captured all the system-based classification of causes of road traffic accidents. These were human related, vehicular related and environmental related factors. The drivers and key informants identified satisfactory risk reduction strategies. The differences in terms of risk reduction differed depending on the management practice in place. The VIP section was much organized in the area of checks and balances to reduce accidents. Though alcohol was not significantly related to OSAS or accident risk, about 12% of drivers who drunk alcohol had a clinically significant screen for alcoholism assessed by the CAGE questionnaire. In the absence of stringent measures to identify alcohol use at work, such drivers may pose a risk to society and their personal health. Two studies done among Ghanaian drivers in the capital city, which employed the use of alcohol breath analyzers, reported a high drunk driving prevalence. Out 0f 2736 drivers randomly stopped for the examination 5.5% exceeded the legal limit for alcohol with 8.7% having detectable alcohol in the breath examination. (Damsere-Derry, Afukaar, Agyemeng, & Ackaah, 2012) Regrettably a similar study done a decade earlier among a driver cohort of 149 drivers revealed a prevalence of 7.3%. It further reported that drunk driving was more common among private, uneducated middle age drivers. Commercial drivers in the study had a prevalence of 6.4% compared to 9.8% among private drivers. (Mock et al., 2001)

Of major concern to drivers were environmental factors. The state on the road and faulty vehicles on the road were two common environmental factors. Over speeding, drunk

driving and fatigue mentioned human related factors. The NRSC has anchored its campaign theme around four points; 1 “Over speeding”, 2 “Drunk driving” 3 “Fatigue driving” and 4 “Safety belt use”. This is the subject of quarterly toolbox discussions among drivers and all actors interviewed showed very good knowledge in the causes and risk reduction measures. Although there were regular training for drivers, the attendance was not compulsory. Drivers were encouraged to be there but were not mandated to be there. This appreciable knowledge in causes of Road Traffic Accidents has been reported in other studies among Ghanaian drivers. A focus group discussion among commercial drivers reported good general attitude on road safety, use of seat belts, vision examination and drunk driving. However the same study revealed this did not necessarily translate to behavioral change as many of the drivers had not examined their vision and seat belts was used only on long journeys.

There was a robust training system for drivers, which included years of shadowing an experienced driver. This system exposed drivers to the conditions of the job and the potential routes they would ply in future. Drivers believed that this system was superior compared to a formal driving school. They sought incorporation of a more practical and relevant system of training mirroring their system.

Sleep, Shift schedule and driving history

Shift schedule was grouped as day, night and mixed schedule. The majority of drivers were of mixed schedule and this was confirmed in the qualitative. There are no fixed arrival and departure times in the transport yard. Drivers operated on a continuous cycle; hence drivers could arrive in daytime and depart at night two to three days after. The culture of permanent day or night shift is nonexistent.

Drivers had sufficient time in between trips to rest. This period was reported by drivers to range from 2-3 days. Provided they were not doing personal errands in between they were free to rest. However the absence of a place to rest meant that drivers had to sleep in their vehicles and other uncomfortable places. The sleep is often interrupted because drivers had to simultaneously keep a watch on the departure board. Occasionally when there was a spike in passenger numbers, drivers had to do back to back driving which was potentially dangerous because of inadequate rest. Self reported total driving time on the job was not recorded on the quantitative section because it did not reflect actual driving time. Some drivers drove private commercial vehicles during the rest period, which prevented them from resting. A study conducted in Finland which assessed fatal traffic accidents among trailer truck drivers and accident revealed that only 2% of 251 long haul drivers were estimated to have fallen asleep while driving just prior to an accident, with 4% being tired prior to the accident. However the same study revealed that 13% of drivers had exceeded the legal limit of continuous driving prior to the accident. (Häkkänen & Summala, 2001) This compared to our study showed a driver population that reported low prevalence of sleep related accidents but with a high proportion of drivers exceeding accepted industry standards for driving. Sleep driving is most often under reported because of the fear of adverse consequences.

Sleep was generally accepted as a major ingredient for good health. Drivers were able to link poor sleep to poor concentration and an increased risk of accidents. Some drivers noted that they use of stimulants such as coffee, whilst others drank alcohol and snorted "asra"[finely ground tobacco] to keep awake. Drivers and managers were unanimous in concluding that fatigue is not related to long hours of driving because drivers had enough time to rest.

With respect to control measures there were both formal and informal ways of ensuring drivers and vehicles were ready for a trip. Station managers had significant powers to bar drivers from driving if drivers or vehicles were not fit for a journey. In the Neoplan station a lot of powers rested in vehicle owners in the hiring and facilitation of servicing of vehicles. This contrasted to practices at the VIP station where a safety officer present and station manager ensured servicing was regular and timely.

Drivers were paid a fixed salary in the VIP station whilst owners in the Neoplan station determined salaries. This coupled with weak welfare support for drivers in the Neoplan station may impact on general mental well being. Drivers complained of a lack support for emergencies such as health and educational support. The results showed the link between driver salary and performance. In Santiago, Chile a study was conducted to compare two systems of bus driver compensations, fixed wage and " being paid per passenger". The findings revealed drivers paid per passenger drove noticeably more aggressively, causing more accidents per kilometer driven.(Johnson, Reiley, & Muñoz, 2005)

Whilst management styles varied there were functional disciplinary committees with significant powers in all stations. They had powers to hire and fire, and sat on cases brought before them.

Drivers in the Neoplan station complained that the welfare union unsatisfactorily represented them. They felt neglected especially in the area of salaries and social security payment. Drivers were able to communicate to each other effectively during journey to warn fellow drivers and the main station of dangers in the street such as obstacles and armed robberies. The natural experiment of two different organizational cultures existing next to each other afforded deeper insight into the role organizational culture played on safety.

Differences could be seen in hiring and recruitment, worker participation, communication and feedback, rewards, training and supervision. A study among 62 different hospitals studying managerial practices and injuries among staff revealed that management practices reliably predicted injury. The most important finding reported by the investigators was that proactive measures, which are akin to the culture seen in the VIP station reliably, predicted injury rates. (Vredenburgh, 2002)

Limitations/Strengths

The study attempts to estimate fatigue among drivers, it probes the question more than existing population based studies on sleep. The qualitative section explains further the context of the observation in the quantitative section. Self reported measures are subjective and may be underreported. The study did include the input of external regulators such as the NRSC and highway authority. Their perspective would be helpful in understanding some of the issues raised.

The subjects were selected using non-random sampling, drivers volunteered willingly. It is possible those unwell or significantly fatigued would decline to participate. Accidents as reviewed in LMIC are severe with poor outcomes because of weak emergency medical systems. Drivers with severe OSAS may retire early or be absent due to earlier accidents or poor health. The sample would largely consist of drivers who are fit because of the harsh conditions surrounding their work.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATION

6.1 Obstructive sleep apnea

Subjective methods of sleep apnea assessment yielded a high prevalence of "high risk" for OSAS despite a low complaint of sleep problems. A relative lesser knowledge of sleep apnea in the population was reported, this may due a lower awareness of sleep problems among clinicians. Shift schedule does not play a significant contributory in our sample population for OSAS risk. Though drivers spent a lot of time at their workplaces, a proportion of this time was available for resting. Cognitive function appears to be minimally affected by the risk of OSAS. The use of an IPAD delivered Stroops test to assess cognitive function is satisfactory among respondents who can read, but with longer time to finish. The awareness of hypertension among subjects was low, objective measures of blood pressure revealed a higher prevalence of high blood pressure.

6.2 Human related accident Risk

In the absence of data, it is difficult to assess sleep related accidents by self-report. Drivers are more likely to report of RTA history involving personal human error without being probed on specifics. Mixed shift schedule appeared to be associated with a reduced accident risk. Drivers with history of fatal accidents, night vehicular accidents and accidents attributable to other road users should be engaged in road safety training as it was associated with Human related errors. Human related errors may have a bidirectional effect on each other. A driver may over speed following drowsy driving and may result in an accident. A

fatigued driver may take alcohol as a stimulant and have the attendant effect of decreased alertness.

6.3 Management styles

Individual and group risk reduction measures can be significantly improved if management skills are improved. The monitoring and support for drivers can be improved significantly to make business both cost effective and safe. The social concerns of drivers deserved serious attention as it impacted on the general well being of the driver. The state of vehicles should not be decided by vehicle owners but by station managers who are constantly present at the station. Convenient places of rest and structured driving schedule could help drivers have a regular planned rest period. The current system potentially results in frequent interrupted sleep.

6.4 Recommendations

1. The level of knowledge among drivers on causes of accidents was adequate and education among drivers should be encouraged.
2. Whilst knowledge among drivers on causes of accidents was high there is a need to ensure more driver participation in workplace training regularly.
3. Driver managements and vehicle owners are two key stakeholders that should be targeted in improving safety culture by regulators such as the National Road Safety Commission.
4. Key stakeholders such as management teams should ensure that their mandated officials and not vehicle owners supervise driver and vehicular management.

5. Shift management should be keenly managed by driver management to ensure there are measures to identify drivers fatigued.
6. The education of passengers is an important control measure to identify a high-risk behavior among drivers during a journey.
7. Further research should seek to improve management safety cultures among drivers as well as improving their oversight responsibilities among drivers and passengers.
8. Passenger seat belts were absent in the older buses, this is a worrying health risk

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APPENDICES

Appendix 1: Consent Form

Project Title: SLEEP HABITS AND ROAD TRAFFIC ACCIDENT RISK AMONG LONG DISTANCE DRIVERS AT CIRCLE TRANSPORT YARD

Institution affiliated

School of Public Health, University of Ghana, Legon, Accra

Background of interviewer

My name is ……from……., helping a student to collect data purely for academic work for Masters in Public Health

Procedure

Information to be included in this study includes background characteristics e.g. Age, sex, medical history, driving history, accident history, knowledge about sleep habits. Data collection is purely interviews.

Risks and benefits

You may feel uncomfortable with some of the questions I will be asking you; however, they will be helpful to me, other researchers, other drivers and the general public as well.

Right to refuse

Your consent to participate in this study is voluntary, you are not under any obligation to do so, and you are at liberty to withdraw from this study. However, I will appreciate if you can complete it.

Anonymity and confidentiality

Be assured that any information given will be used purely for the purpose of research. Any information given will be treated with utmost confidentiality.

If you have any questions about the project or your participation feel free to ask or you can contact …….

Before taking consent

Do you have any questions to ask me…(if yes, note questions below)?

……

……

……

……

Consent

I…….have understood the study, after having the explained to me thoroughly in English/Twi/Ga language do hereby agree to take part in the study

Signature/Thumbprint…….

Interviewer statement

I……..the undersigned, have explained to the subject in the language he/she understand and the subject has agreed to take part in the study.

Signature of interviewer……

SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA, LEGON

Appendix 2: Questionnaire

Project Title: SLEEP HABITS AND ROAD TRAFFIC ACCIDENT RISK AMONG LONG DISTANCE DRIVERS AT CIRCLE TRANSPORT YARD

This questionnaire is designed for a dissertation for masters of public health program. Please answer the questions with all honesty. All information form the interview will be kept confidential.

Questionnaire ID	Name of Research Assistants
Study Site	Vehicle Number

Thank you for your cooperation. Do you have any question to ask?

Appendix 3: Interview guide Focus Group Discussions/Key informants

Drivers

General causes of RTAs

1. What are the causes of road traffic accidents?
2. How do you minimize your risk of road traffic accidents?
3. What challenges do you face as per driving schedule?
4. What measures do you take to increase your revenue from transport?
5. How does vehicle ownership affect your salary at the end of week, month?
6. Do you need 8 hours of sleep to feel refreshed for days work?
7. How much sleep do you need to feel refreshed?
8. What prevents you from getting your preferred amount of sleep?
9. When you don't get enough sleep how do you make up for it?
10. As you get older you require less sleep, do you agree?
11. How does a poor night sleep impact your day?
12. How do you prepare your self for a good sleep?
13. How does poor sleep impact your driving?
14. How do you address sleepiness whilst driving?
15. Where do you rest during long journeys?
16. How often do you rest? At Home? At work?
17. What prevents you from resting on long journeys?
18. Have you ever had a sleep related accident/near accident?
19. Do you need drugs or medications to help you sleep?
20. How many people are currently having poor sleep and how does it manifest?

21. How does your work impact your health?
22. How soon after arriving at your destination do you embark on another journey?
23. How many trips can you do in a 24hour period on a good day?
24. How does poor sleep impact on your health?
25. Have you ever reported to hospital with sleep problem complaint?
26. What was the outcome?
27. What are your places of rest at work?
28. How many people have history of snoring in their sleep?
29. How serious is it? What is reaction of your partner?
30. How does the drivers association, stationmaster identify drivers unfit for duties each morning? Is there a mechanism to do so?
31. What qualifies an individual to be a driver in your association?
32. Do you have any disciplinary procedures for drivers who are cautioned for misconduct?
33. Is it mandatory for all drivers involved in an RTA or cautioned by the police to report to station management team?
34. What communication channels are in place for drivers to communicate with other drivers in times of emergencies?
35. What awareness have been created by NRSC/MMTU concerning fatigue, sleep and driving?
36. What is the maximum number of driving hours allowed for commercial drivers?
37. How many drivers per vehicle does law for commercial vehicles prescribe? Trucks, Buses etc.

38. How many days in a week do you work? When are your off days? Who uses your car on your off days?
39. Do you have a welfare association? What support does the welfare association provide to members?
40. How factors make you suspect sleepy driving related accidents?
41. What is maximum driving distance/hours for motorist?
42. Where are some of the odd places you have slept during a journey?

Indepth Interviews

1. What are the causes of road traffic accidents?
2. How do you minimize your risk of road traffic accidents?
3. What challenges do drivers face as per their driving schedule?
4. What measures do drivers take to increase their daily trips at work?
5. How does vehicle ownership affect your salary at the end of week, month?
6. How does a poor night sleep impact a driver's day?
7. How does poor sleep impact your driving?
8. How do you address sleepiness whilst driving?
9. Where do drivers rest during long journeys?
10. What prevents drivers from resting on long journeys?
11. How common is sleep/fatigue related accidents?
12. Are medications, drinks helpful for drivers to stay awake at work?
13. What are your places of rest at work?
14. How does the drivers association, stationmaster identify drivers unfit for duties

each morning? Is there a mechanism to do so?

15. What qualifies an individual to be a driver in your association?
16. Do you have any disciplinary procedures for drivers who are cautioned for misconduct?
17. Is it mandatory for all drivers involved in an RTA or cautioned by the police to report to station management team?
18. What communication channels are in place for drivers to communicate with other drivers in times of emergencies?
19. What awareness have been created by NRSC/MMTU concerning fatigue, sleep and driving?
20. How does fatigue and sleep impact on driver safety?
21. How do you identify the sleepy driver?
22. What policy is in place to prevent fatigue driving? Educational? Monitoring?
23. What is the maximum number of driving hours allowed for commercial drivers?
24. How many drivers per vehicle does law for commercial vehicles prescribe? Trucks, Buses etc.
25. How many days in a week do you work? When are your off days? Who uses your car on your off days?
26. Do you have a welfare association? What support does the welfare association provide to members?
27. How factors make you suspect sleepy driving related accidents?
28. What is maximum driving distance/hours for motorist?
29. Where are some of the odd places you have slept during a journey?

ARES Sleep Questionnaire

THE BUS DRIVER STUDY ID NO. = [_____ _____ _____]

Project Title: SLEEP HABITS AND ROAD TRAFFIC ACCIDENT RISK AMONG LONG DISTANCE DRIVERS AT CIRCLE TRANSPORT YARD

This questionnaire is designed for a dissertation for masters of public health program. Please answer the questions with all honesty. All information form the interview will be kept confidential.

Questionnaire ID	Name of Research Assistants
Study Site	Vehicle Number

Question	Response	code	Comment /Skip
1. Highest educational level	**Tertiary** **Sec/Voc** **Primary/JHS** **None**	**0** **1** **2** **3**	
2. Religion	**Christian** **Muslim** **Traditionalist** **Other**	**0** **1** **2** **3**	
3. Current Marital status	**Married** **Single** **Divorced** **Cohabiting** **Widow**	**0** **1** **2** **3** **4**	
4. Ethnic status	**Akan** **Ga/ Adangbe** **Ewe** **Northern ethnic groups**	**1** **2** **3** **4**	
Driving History			
5. Year of certification as a driver **5a Years of driving experience**	**……..** **<5yrs** **5-10yrs** **11-15yrs** **16-20yrs** **20-25yrs** **30+yrs**	 **5** **4** **3** **2** **1** **0**	

THE BUS DRIVER STUDY ID NO. = [_____ _____ _____]

6. How long have you been a commercial driver?	**…… [yrs]** **<5yrs 5** **5-10yrs 4** **11-15yrs 3** **16-20yrs 2** **20-25yrs 1** **30+yrs 0**	
7. What vehicle do you drive?	**Neoplan /OA bus 3** **Cargo truck 2** **"207"/Ford 1** **"VIP" 0**	
8. Working safety belt availability for passengers?	**Yes 0** **No 1**	
9. What training did you have for driving? 9a. **Type of drivers license**	**Formal (driving sch) 0** **Informal** **Mate-driver 1** **Self taught 2** **……**	Visual confirmation Yes No
10. What is your common destination of travel as per region?	**Central region 1** **Ashanti region 2** **Volta 3** **Brong Ahafo 4** **Northern 5** **Upper east 6** **Upper west 7** **Western 8** **Eastern 9** **Outside Ghana 10**	

THE BUS DRIVER STUDY ID NO. = [_____ _____ _____]

11. How many hours on the road to you spend ---in a day? 11a. How many hours do you spend at work?	**……hrs** **……hrs**	
12. What is your usual driving shift?	**Day 0** **Night 1** **Mixed 2**	> 70%= day/night
13. How many work official leave have you taken in last two years?	**Three+ 3** **Two 2** **One 1** **None 0**	
13a Duration of leave	**6 weeks 0** **5weeks 1** **4 weeks 2** **3 weeks 3** **2weeks 4** **1 week or less 5**	
13a. Do you own a vehicle at home?	**Yes (commercial) 2** **Yes (private) 1** **No 0**	Taxi , Trotro
14. How are you paid?	**Daily 2** **Weekly 1** **Monthly 0**	

THE BUS DRIVER STUDY ID NO. = [_____ _____ _____]

14a How are you paid?	**Rate per trip** **Fixed monthly fee**	**1** **0**	
15. Number of dependents	……		
Accident History			
16. Has an insurance company ever denied you insurance claims for a RTA?	**Yes** **No**	**1** **0**	
17. Have you ever filled a police report form for a RTA?	**Yes** **No**	**1** **0**	
18. Have you ever been involved in an accident attributable to another driver or pedestrian?	**Yes** **No**	**1** **0**	
19.Have you been involved in an accident that was due to your human error?	**Yes** **No**	**1** **0**	Over speeding Fatigue Alcohol Phone distraction
20. Have you ever had a sleep/fatigue related accident?	**Yes** **No**	**1** **0**	
21. Have you ever been involved in a fatal accident as a driver?	**Yes** **No**	**1** **0**	Death of someone

THE BUS DRIVER STUDY ID NO. = [_____ _____ _____]

22. How many Road traffic accidents have you been involved in?	……	
23. Have you been involved in an accident due to vehicular factor	**Yes** **1** **No** **0**	Burst tyre Failed brakes Engine failure etc
24. Have you ever been involved in accident due to environmental factors?	**Yes** **1** **No** **0**	Fog Bad road Rain Slippery surface
25. How do you address sleepiness whilst driving?	**Take coffee** **1** **Take alcohol** **2** **Take a drug/stimulant** **3** **Park and rest** **4** **Speed up** **5** **Play loud music** **6** **Engage in conversation** **7** **Other ……** **8**	
26. Have you ever reported to hospital/ Health care provider with sleep problem complaint?	**Yes** **1** **No** **0**	
27. Have you ever had an accident at night?	**Yes** **1** **No** **0**	

THE BUS DRIVER STUDY ID NO. = [_____ _____ _____]

Sleep Habits		
28. During the last month when do you usually go to bed?	**Time** **……:……AM / PM**	
29. During the last month when have you usually gotten up from bed?	**Time** **……:……AM / PM**	29a Av. hours of sleep Calculated (29-28) [___ ___]
30. During the last month, how many hours of actual sleep do you get in a day?	**……**	Total sleep Work +Home
31. In the last month have you had problems sleeping?	**Yes** **1** **No** **0**	
Medical History		
32. Are you on any regular medication? 33. For which condition?	**Yes** **1** **No** **0** **……** **……**	
34. Do you take any herbal preparation/ medication?	**Yes** **1** **No** **0**	

THE BUS DRIVER STUDY ID NO. = [_____ _____ _____]

35. Do you drink alcohol?	**Yes** **No**	**1** **0**	
35a Do you smoke?	**Yes** **No**	**1** **0**	
36. Do you have a valid NHIS card?	**Yes** **No**	**1** **0**	
37. CAGE score			
Have you ever felt you should Cut down on your drinking?	**Yes** **No**	**1** **0**	Each YES answer = 2 points
Have people Annoyed you by criticizing your drinking?	**Yes** **No**	**1** **0**	Total
Have you ever-felt bad or Guilty about your drinking?	**Yes** **No**	**1** **0**	……
Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a Hangover (Eye opener)?	**Yes** **No**	**1** **0**	

THE BUS DRIVER STUDY ID NO. = [_____ _____ _____]

93 86 79 **Sleep And Cognitive Questionnaires 72 65**		
38.Serial seven	**1** ▫ **2** ▫ **3** ▫ **4** ▫ **5** ▫ **Each correct answer = 5 marks**	Easy Moderate Difficult Appropriate Inappropriate Useful tool Not useful Undecided
39.Stroops test Stroops test	**Time** **……**	Easy Moderate Difficult Appropriate Inappropriate Useful tool Not useful Undecided
40.Trail Making Test	**Time** **A** **……** **B** **……**	Easy Moderate Difficult Appropriate Inappropriate Useful tool Not useful Undecided
41.Blood Pressure (Two minutes apart)	**1. /** **2. /** **3. /**	**Time** **1. _____ :____** **2._____:_____** **3. _____:_____**

THE BUS DRIVER STUDY ID NO. = [_____ _____ _____]

42. You chanced on a fellow driver who had an accident and crawled out of car. **He is lying by roadside in pain.** You stop to attend to him. What would you do for him?	**Initial answer** **Other _____ 3** **Send Him to hospital 2** **Apply first Aid 1** **Examine A, B, C 0**	Airway Breathing Circulation
43. If initial answer is 1,2 or 3 Prompt that patient is in pain, with cuts and bruises. **What specific immediate attention would he give?**	**Circle as many that is done** **Call for help 1** **Check airway 2** **Reassure patient 3** **Carry patient 4** **Secure bleeding 5** **Stabilize 6** **Give pain killer 7** **Other_____8** _____	
44. At work where do you commonly take a nap, sleep break?	**Other…… 3** **In my car 2** **On a bench/chair 1** **In a rest room with bed 0**	

THE BUS DRIVER STUDY ID NO. = [_____ _____ _____]

45. If unable to make a return journey where do you regularly sleep?	**Guest house** **0** **Company rest flat** **1** **Friends/relative** **2** **In car** **3** **Other _____** **4**	

Thank you very much
Any other comments

……

……

……

Trail Making Test (TMT) Parts A & B

Instructions:

Both parts of the Trail Making Test consist of 25 circles distributed over a sheet of paper. In Part A, the circles are numbered 1 – 25, and the patient should draw lines to connect the numbers in ascending order. In Part B, the circles include both numbers (1 – 13) and letters (A – L); as in Part A, the patient draws lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.). The patient should be instructed to connect the circles as quickly as possible, without lifting the pen or pencil from the paper. Time the patient as he or she connects the "trail." If the patient makes an error, point it out immediately and allow the patient to correct it. Errors affect the patient's score only in that the correction of errors is included in the completion time for the task. It is unnecessary to continue the test if the patient has not completed both parts after five minutes have elapsed.

Step 1: Give the patient a copy of the Trail Making Test Part A worksheet and a pen or pencil.

Step 2: Demonstrate the test to the patient using the sample sheet (Trail Making Part A – *SAMPLE*).

Step 3: Time the patient as he or she follows the “trail” made by the numbers on the test.

Step 4: Record the time.

Step 5: Repeat the procedure for Trail Making Test Part B.

Scoring:

Results for both TMT A and B are reported as the number of seconds required to complete the task; therefore, higher scores reveal greater impairment.

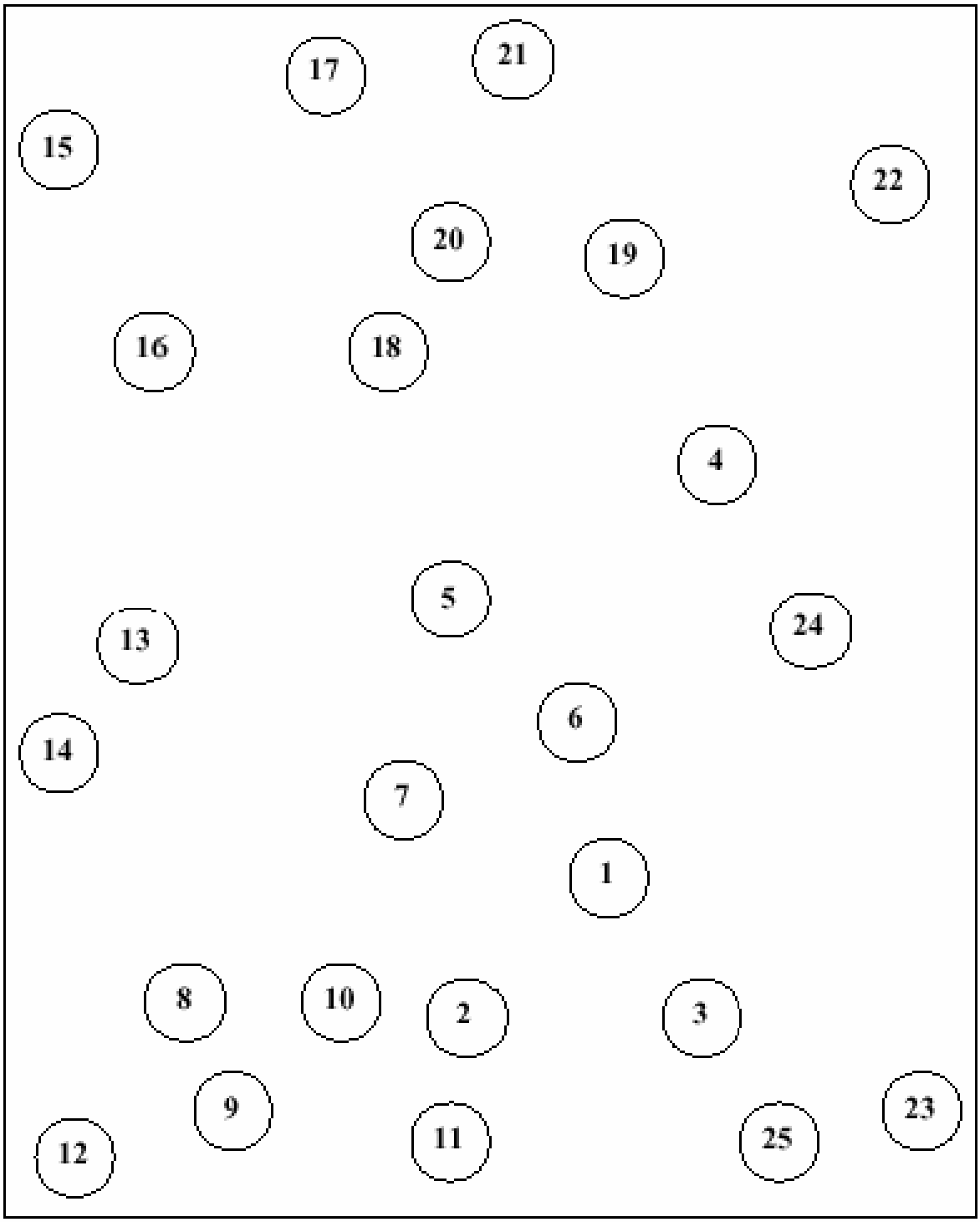
	Average	**Deficient**	**Rule of Thumb**
Trail A	29 seconds	> 78 seconds	Most in 90 seconds
Trail B	75 seconds	> 273 seconds	Most in 3 minutes

Sources:

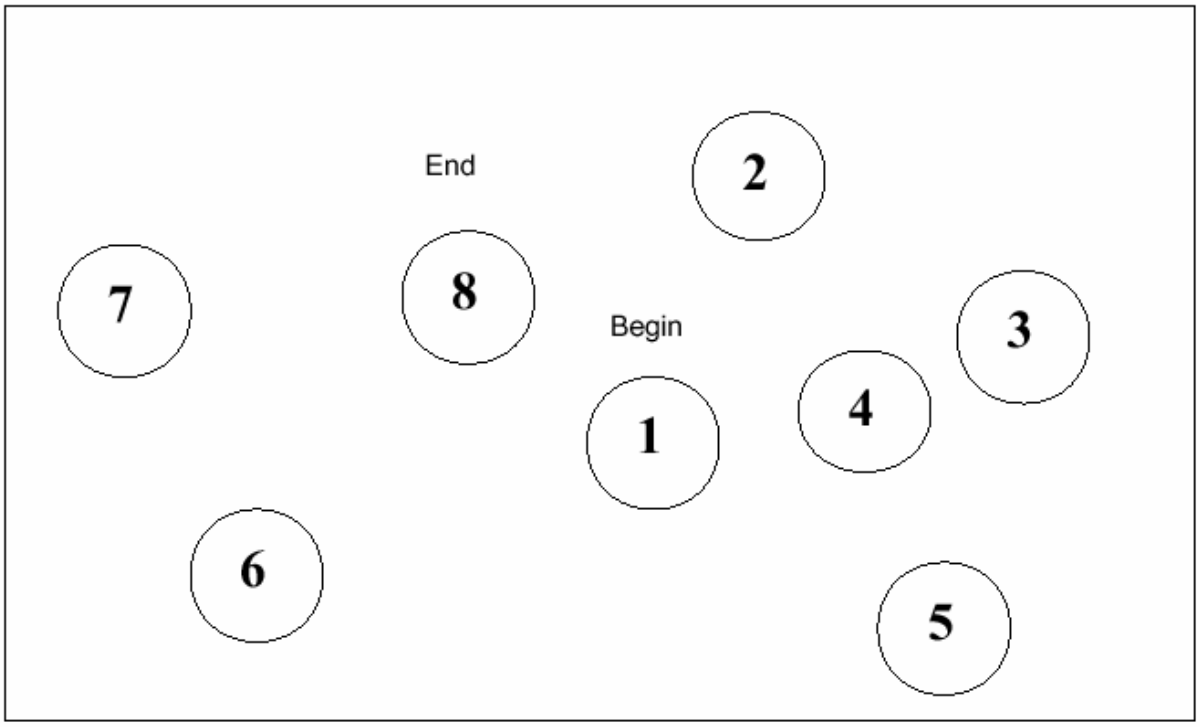
- Corrigan JD, Hinkeldey MS. Relationships between parts A and B of the Trail Making Test. *J Clin Psychol*. 1987;43(4):402–409.
- Gaudino EA, Geisler MW, Squires NK. Construct validity in the Trail Making Test: what makes Part B harder? *J Clin Exp Neuropsychol*. 1995;17(4):529-535.
- Lezak MD, Howieson DB, Loring DW. *Neuropsychological Assessment*. 4th ed. New York: Oxford University Press; 2004.
- Reitan RM. Validity of the Trail Making test as an indicator of organic brain damage. *Percept Mot Skills*. 1958;8:271-276.

Trail Making Test Part A

Patient's Name: _____ Date: _____

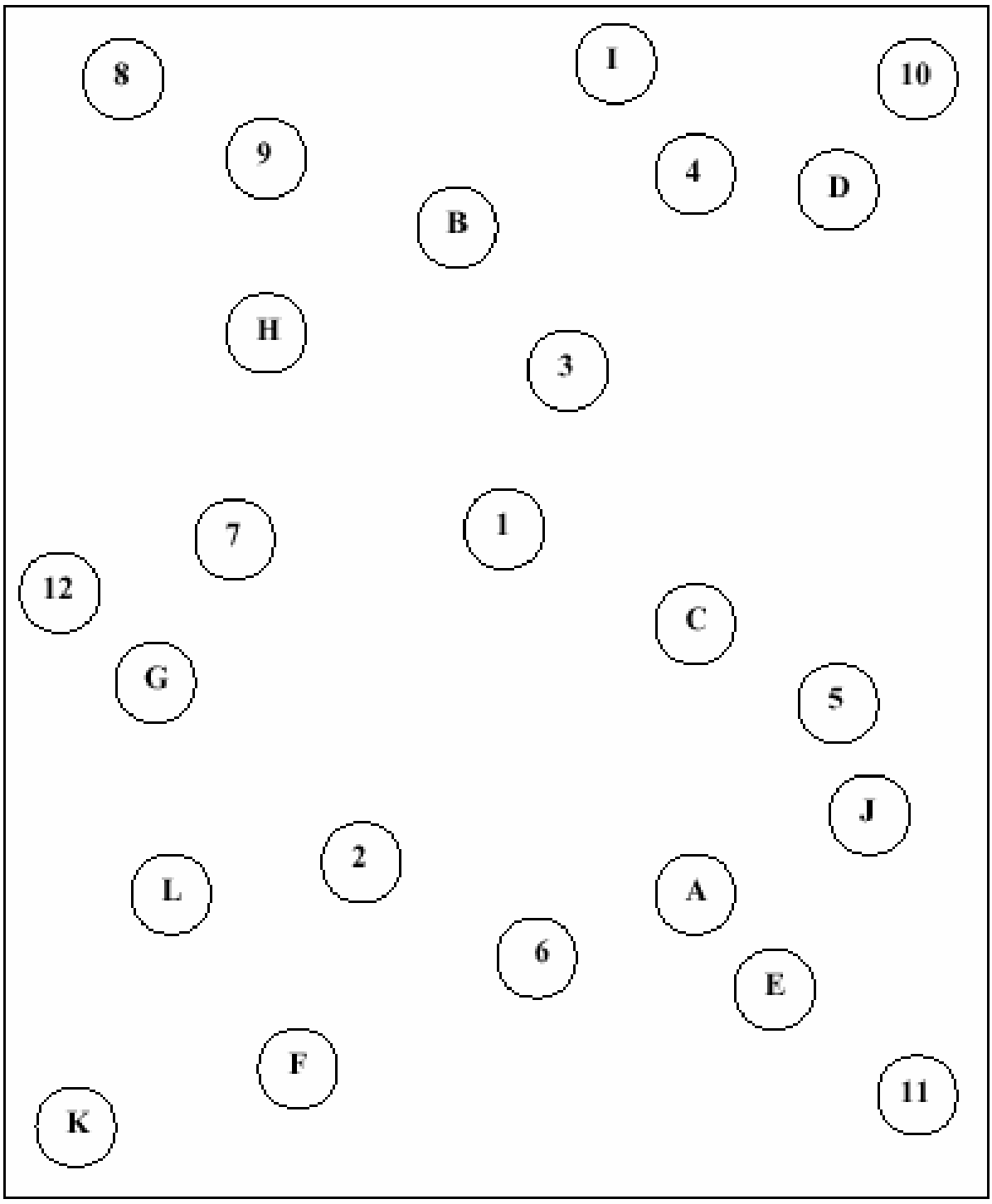


Trail Making Test Part A – *SAMPLE*



Trail Making Test Part B

Patient's Name: _____ Date: _____



Trail Making Test Part B – *SAMPLE*