A STUDY OF ROAD TRAFFIC ACCIDENTS IN LAGOS

THESIS
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BY

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S U M M A R Y

There has on the whole been very little study on Road Traffic Accidents in Nigeria. Such studies that are available have been limited to review of specific injuries, their management and outcome (Oyemade, 1973; Oluduro, 1977). Kale et Aina 1976 carried this further by reporting on Post Mortem findings on coroner cases who died from road traffic accidents.

In generality the scopes of these studies have been limited and sketchy, and the conclusions could only be drawn with reservations. It therefore seems appropriate to undertake an epidemiological study of road traffic accidents in the Metropolis of Lagos to fill a large number of gaps that exist on this subject.

5,802 victims involved in 1,650 road traffic accidents in Lagos, brought to, and managed in the Lagos University Teaching Hospital between 1st January, 1978 and 31st December, 1978 formed the study group of this work.

Standard proforma was designed and used to record their age, sex, occupation, and account of the accident with regards to time, their status as road users, drivers, passengers, pedestrians, motor cyclists, pillion passengers and cyclists.

The victim gave his own account of the accident. Enquiry was made into the road condition of the Metropolis of Lagos, and traffic flow pattern. History of the accident, past medical history of victim with regard to eye sight and diabetes mellitus were obtained from the victim. A full examination was carried out to detail all inquiries in addition to state of level of consciousness or unconsciousness as well as any possible reception of first aid treatment. Author also inquired into alcohol consumption pre accident condition.

Blood samples were taken immediately on arrival to determine blood sugar level and the blood pressure was measured.

It was not possible to determine the alcohol blood level because of lack of facilities.

A check was carried out on the obituaries of victims of road traffic accidents in the country during the period of study in two national daily newspapers to find out the number of professionals who lost their lives through the accidents.

The effect of the campaign to stop hit and run drivers was studied and so also was that of the number of accidents on a road before and after bumps were erected on it.

Of these victims 5,146 had multiple injuries, 886 had head injuries, and 54 fractured the cervical vertebrae as the result of whiplash injury. Injury to the long bones accounted for 2,300 cases and of these 697 victims injured the tibia.

3% of the fatalities were from the professional group. 9 victims were dead on arrival at the hospital, and 113 died in the hospital, representing a mortality of 2.1%. 32 of the victims died within the first six hours in the hospital. Of the 113 who died in the hospital, 41 victims died as a result of head injuries. The average number of injuries found on the driver and pedestrian was 1.9 and in the case of motor-cyclist and passenger it was 1.4 injuries.

Low blood sugar (38 mg % to 42 mg%) was found among commercial drivers involved in road traffic accidents. 43.7% of the drivers took alcohol prior to driving.

Only 4.9% of the victims had first aid treatment at the scene of the accident.

The difference between three yearly eye test of drivers using spectacles for driving and not involved in road traffic accidents and those involved in accidents was highly significant ($P < 0.00006$). There was 30% reduction of accidents on a road where bumps were erected.

20 of the drivers admitted that the accidents occurred as they were overtaking other vehicles, 100 drivers said there were no road signs to show the speed limit and 5 vehicle drivers lost control of the vehicles because of burst tyres, while 15 who drove at night reported that there were no street lights on when the accidents took place.

The highest accidentsfigure (106) in an hour was between 5 p.m. and 6 p.m. and most people were injured in the months following raining season i.e. October to November (1,301 cases).

In the Lagos University Teaching Hospital, of the 55,772 patients treated in 1978; the number of road traffic accident victims was 5,802, representing a hospital incidence of 10.4%. The hospital serves a population of one million out of 4.5 million of the state, and there are 8 other main hospitals, a number of health centres and private clinics that treat Road Traffic Accident victims in Lagos State.

With the high number of head injuries to the motorcyclists, it is possible that the wearing of crash helmet will reduce the number of this injuries.

As all the fracture of the cervical vertebra resulted from whiplash injury to vehicle occupants, it is possible that a form of restraint against the body being thrust forward in the moving vehicle could reduce the severity of neck injury. 66.7% of the drivers died of head injuries.

CHAPTER ONE

INTRODUCTION

Nigeria lies within the tropics between latitudes 4° and 14° East of the Greenwich Meridian. This country is bounded on the West by the Republic of Benin, on the North by Niger Republic, on the East by the the Republic of Cameroun and on the South by the Atlantic Ocean. It has an area of 923,768 square kilometres.

Lagos is the capital of the Federal Republic of Nigeria and covers an area of 3,345 square kilometres. It is made up of three islands and the mainland. Most of the industries and the airport are located on the mainland, while two of the islands are residential areas, and the third the commercial centre. Lagos is on the South West of the country. It is bounded on the south by the Atlantic Ocean, and only 6° above the equator. Two thirds of the area is urban, and the rest rural area.

Very Very few roads have footpaths or sidewalks. Pedestrian crossings and overhead bridges are few and far between. Some of the feeder roads are not motorable on account of the potholes in them. Many roads get congested as these are the only ones open to traffic all the year round.

Lagos, being on the coast is subjected to heavy rains for about six months of the year. During this period potholes are made wider and deeper, and the roads slippery. Open drains are found on the sides of the roads and some of these are blocked causing overflow and flooding of many roads.

Workers commute between the islands and mainland to their offices, factories etc. and this causes heavy traffic on the road all the year round.

With the density of traffic and pedestrians on the roads at the same time, and taking into consideration the conditions of the roads and weather, it is not surprising that the Teaching Hospital treats about 6,000 cases of accident victims in a year.

A review of available literature revealed the dearth of reported work on the epidemiology of Road Traffic Accidents in Nigeria. Available statistics from Police Department, and Hospital records in the country are rather vague and not reliable; but the impression gleaned from these imply an upward trend in incidence of Road Traffic Accidents.

Thus for 1974 of the 18,660 people reportedly injured 4,922 were fatal. In 1975 the figures were 5,552 and in 1978 the number had risen to 9,252 (Table 2).

It has been estimated that in Nigeria, accidents currently cost the equivalent of between two and three percent of our Gross National Product (GNP) per year. (Oluduro, 1977). The economic loss to the country was about one hundred billion naira in 1975. (One naira is equivalent to 0.8 pounds sterling (N1=£0.8).

The Federal Government and State Governments have built new highways in order to reduce the number of casualties. Road Safety Committees have mounted campaigns on road safety in the country but the toll of the injured still goes up. Accident centre and Casualty Departments have been improved so that victims taken to these places will have a chance of survival.

Recognising this problem, the author decided to find a basis on which the casualty rate could be reduced.

The author set out to find the predisposing factors of Road Traffic Accidents; the nature of injuries and analysing the morbidity and mortality pattern. The treatment and response to treatment by the victims will be noted and recommendations for minimising the immediate and long term results of injuries.

It was against the stated lack of reliability of statistics in Nigeria that the author set out to carry out this pilot study in order to more precisely

relate the various parameters of factors known to influence the epidemiology and outcome of accidents in the Lagos Metropolis and evaluate findings with the hope of highlighting factors which might help in reducing the incidence, morbidity and mortality figures resulting from Road Traffic Accidents.

CHAPTER TWO

REVIEW OF RELEVANT PAST WORK

The death of Bridget Driscoll of Crystal Palace, London, was one of the first of two deaths of pedestrians due to motor vehicle accident recorded in Britain in 1896, according to Gibson (1975).

The Royal Society for the Prevention of Accidents (1972) recorded that by the year 1972, the number of deaths had risen to 7,763 and during that year 91,338 people were seriously injured and 260,626 slightly injured.

It was shown by Leeming (1969) that motorways reduce the number of accidents, and with the help of Mr. Drake, County Surveyor of Lancashire in Britain, he studied the number of accidents on the A6 and M6 Motorways between Broughton and Hampson Green in Lancashire or roughly between Preston and Lancaster, and found significantly fewer accidents on these motorways compared with the same distances on other types of road. The motorway has many built-in safety features which include central reservations separating traffic travelling in different directions, hard shoulders for emergency stops and service facilities well away from the traffic lanes, entries and exits for the use of the service areas are well defined and only in the line of the flow of traffic.

According to the Road Research Laboratory in Crowthorne, 91% pedestrian casualties took place in built-up areas; child pedestrians under ten years of age, and the elderly from sixty-five years upwards are a special risk. The same Research Laboratory also found that in pedestrian casualties 57 percent of the fatalities were due to head injuries and the rest caused by multiple injuries or injury to the chest and abdomen.

The Buchanan Report in 1963 suggested the segregation of pedestrian from motor vehicles. It was reported that Cumbernauld New Town in Stirlingshire, Scotland had done this and pedestrian casualties were drastically reduced. Buchanan estimated that by the year 2010 there will be forty million vehicles on the roads in Britain, thirty million of them private cars; resulting in greater congestion of the highways. It can be surmised that with the old system of highway usage the casualties figures will be high.

Tillman and Hobbs (1949) found in Canada that drivers who were accident repeaters showed marked aggressive anti-social tendencies, more frequent appearances in court in both youth and adult life for non-traffic offences, a higher incidence of venereal diseases and a greater rate of attendance at social and welfare agencies.

Willett (1964) had also found that in the 653 persons found guilty of serious traffic offences, 23.2% had been convicted previously for non-motoring offences. Offenders tended to commit the same or even worse motoring offences repeatedly and habitual offenders were very common among those disqualified from driving.

Canty (1953) stated that personality of a person in the car does not change, but that the driver has more freedom to demonstrate the presence of unsocial, irresponsible and even antisocial traits. He concluded that chronic traffic violator are social misfits.

Quenault (1968) has compared the style of driving of persons convicted of careless driving with random controls and divided them into four groups. The "safe drivers" were fully aware of the relevant information on road signs and conditions and reacted to it without unnecessary manoeuvres of risks. The "injudicious drivers" were fully aware of the information, but from time to time made false judgements. The two remaining groups showed lack of awareness or neglect of relevant information.

ALCOHOL

In a survey carried out by Mr. V. Sheehan on patients admitted to Drogheda Hospital, Ireland, it was found that 127 (24%) of 531 motor drivers had taken alcohol before their accidents as had 62 of the 310 motor cyclists,

18 of the 226 cyclists and 43 of the 307 pedestrians studied. It must however be observed that there were no control studies.

1. Drivers

Cohen et al (1958) studied the performance of bus drivers after taking alcohol and then driving. Three groups of bus drivers were asked whether they could drive through the gap between two posts at a specified distance away, and after giving a positive answer were made to drive through them. It was found that there was a relationship between the quantity of alcohol consumed and the level of deterioration of the performance of the drivers. An important finding was that the trustworthiness of a man's judgement in his driving skill was impaired after as little a quantity of alcohol as that producing a blood concentration of about 50mg/100 ml.

Drew et al (1958, 1959) studied the effects of peak blood alcohol concentrations of approximately 20, 40, 60, 80 mg/100 ml in a miles motor driving trainer and found that errors in the performance of their subjects increased with increase in blood alcohol. This amounted to about 16% deterioration with alcohol concentration of 80 mg/100ml. The equivalent of three double whiskies give on average, a maximum blood alcohol concentration of 80mg/100ml for an 70.4 kg. man. This finding has been confirmed by several workers.

The driving skill of many persons is adversely affected by relatively small blood alcohol level. Work of this nature led to the introduction of breath-alyser test in Great Britain in October, 1967 and led to a fall in accident rates particularly during the dangerous hours of darkness such that by May 1968, 866 fewer people had been killed on the roads compared with the previous year. There was a fall in casualties of 49% between the hours of 10.00 p.m. and midnight during the month of November, 1967 despite a one percent increase in road traffic compared with the previous year.

2. Pedestrians

With regards to pedestrians Gerber (1957) and Eckert et al (1959) found 52% intoxicated among 121 pedestrians killed. Haddon et al (1961), after they found a high proportion of intoxicated pedestrians among those fatally injured in New York, made a study of pedestrian fatalities. They found that 47% of those killed had a blood alcohol level of 50 mg/100 ml or above, a much higher proportion than in the control group of pedestrians not involved in the accidents. From every victim killed at a scene of accident blood-sample was taken for alcohol content analysis. The following week on the same day and at the same hour as that of the accident, they visited the scene of accident interviewed four people of the same sex and the same age as the victim.

They proceeded to take blood from these for blood alcohol content. Analysis of the data from this showed that in contrast to members of the control group the pedestrians fatally injured consisted of two discreet groups - a group of elderly who had been drinking little or not at all and a group of middle aged persons who had been drinking heavily.

McCarroll et al (1962) found 43% of 200 pedestrians killed in New York were intoxicated and Solheim (1964) in Oslo that 20% of fatally injured pedestrians age 20 years or older had a blood alcohol concentration over 0.05% at the moment of the accident. In Norway it is forbidden to drive when the blood alcohol is above this limit. A blood test is also carried out on people suspected of alcoholic intoxication who are involved in serious or fatal accidents.

Motor Cyclists

Bothwell (1962) in a comprehensive study of road traffic accident deaths in Western Europe found that in Western Germany there were 109 deaths per 100,000 motor cycles in use in 1959, representing 32.9 percent of all road traffic deaths and in Great Britain these figures were 97 and 25.8. He further revealed in a breakdown of his data that

Relative casualty rates per vehicle mile (cars=1) are

Car	1 killed	1 seriously injured
Motorcycle	18 killed	20 seriously injured
Motor-Scooter	11 killed	16 seriously injured
Moped	13 killed	15 seriously injured.

The epidemiological host/agent/environment triad relationship in motorcycle accidents in terms of riders/machine/road and traffic conditions was also highlighted in this study by Bothwell. His data showed clearly that in 1960 the casualties among motorcyclists were highest in the under 25 years of age and lowest in the age group 60 years to 70 years; and riders with less than six months experience had about twice as many accidents as those with more than six months of experience.

He showed that motorcycles with 40 to 48 cm. diameter were more stable than typical scooters with 25 to 30 cm. wheels.

Crash Helmets

In 1940, shortly after the British Army issued crash helmets to certain motorcyclists, Cairns noted that although only one in twenty of dispatch riders injured had been wearing crash helmet at the time of the accident, the injury of those with crash helmets were mild compared with those without and the frequency of fracture and duration of unconsciousness were less in those who wore than those who did not. The Army Council subsequently made the use of crash helmets compulsory for all motor cyclists in 1941.

In 1941, Cairns found that at the Military Hospital in Oxford, the frequency of head injuries was high among motorcyclists, and in a number of cases the fatal outcome might have been avoided if adequate protection for the head had been worn.

Later studies confirmed that the wearing of a crash helmet reduced by 30 to 40% the risk of injury to the part of the head that was covered. Chandler et Thompson (1957).

The Road Research Laboratory at Crowthorne investigated the best type of protective helmet, as most of those sold to the public at that time did not give adequate protection. Since 1st April, 1957 all crash helmets offered for sale in Britain by law are expected to comply with the standard laid down by the Road Research Laboratory.

Motor Cars

Colonel John Paul Stapp of the Medical Corps of the United States of America Air Force who undertook experiments to show how much force the body can withstand was harnessed to a rocket propelled sledge in various positions which he brought to a stop at different rates of deceleration. At a speed of 1020.2km per hour he brought the sledge to a stop in 1.4 seconds. At the average deceleration of 40g. he experienced discomfort, bruising around the harness, stiffness of neck and temporary shock. (where g is acceleration due to gravity and equal to 981 cm per second per second).

From his experiments he showed that primary forces in a car crash were not only below the level at which death occurs but providing the occupants are fully protected, the injury will be minimal, whereas the secondary collisions of the occupants with objects in the car cause serious injuries.

A car driven against a solid barrier at 48 km per hour will crumble 45 cm to 60cm and the deceleration will be 30 to 40g but inside a car the available space was usually only a few centimetres so that the force generated will be over 100g causing rupture of vessels and fractures. On account of this the interior design of a car he concluded is important for the reduction of the effects of secendary collisions.

Gissane et Bull (1965) found that 21% of occupants of front seats were injured by contact with the windscreen and its surroundings, and that 63% of drivers and 72% of other occupants of front seats received severe injury to the brain.

(1) Seat Belts

At the Road Research Laboratory, Crowthorne, it was found that 70% of cars in road accidents were involved in frontal collisions. 50% of the occupants of these cars received injuries compared with 17% of those in side impacts, 7% of those in rear impacts and 9% of those in cars which overturned.

The workers were of the opinion that a seatbelt prevents the occupant of a car from being ejected out of the vehicle and that it reduces the kinetic energy with which the head or chest strikes an object in the vehicle.

In the United States of America it was proved that ejection from a car after a crash increased the risk of death and fatal injuries five times as compared with those who remain in the vehicle in the same type of crash. This has been confirmed by Gissane (1962) in his Birmingham studies.

Information on the use of seat belts was included in the report of the Motor Vehicle Collision in Ontario, Canada, from July 1971. The results of the first full year of operation were as follows:

> 42.8% of all the fatally injured were drivers and of these drivers, 54.4% had seat belts, but were not using them, whilst 46.1% of all the non-fatally injured were drivers and of these 63.2% had seat belts in their cars but failed to use them.

According to Road Safety Command 3399, 1967 if seat belts are used the number of fatal and serious casualties to people in front seats of cars will be reduced by over 70%.

Bohlin in studies conducted in Sweden in 1968 recorded fatalities amongst unbelted occupants of vehicles travelling at all speeds even as low as 19.2 km. per hour.

whereas of the 28,000 accidents involving cars under 97 km. per hour and carrying 37,000 occupants using the lap-shoulder type of seat belts there was not a single fatality.

In another study carried out by Kihlberg et Robinson (1967) of New York in which 50,000 accidents were analysed, 651 pairs were matched retrospectively for car make and year, direction of impact and severity of crash. They concluded that there was 70% difference in dying between belted and unbelted occupants.

Legal enforcement of wearing seat belts first became effective on 23rd January, 1971 in the State of Victoria, Australia, and during the first twelve months that seat belts were made compulsory there was a 15% reduction in driver and front seat passenger casualties but only 2% among other road users during this period.

Pratt et al (1973) examined the statistical effectiveness of seat belts in reducing the number of motor vehicle drivers killed in Victoria. Tests of data from a population of over 18,000 cases revealed that belt wearing was a highly significant factor in reducing driver fatalities and in reducing the number of drivers injured to a degree requiring surgical or medical treatment.

According to Lister et Milsom (1963) 51% of vehicle occupants were either saved or had the severity of their injuries reduced as the result of using seat belts; but Shennan, (1973) found that the wearing of seat belt had its drawback. He divided the injuries caused by seat belt into three groups, namely abdominal injury, spinal column or pelvic girdle injury and thoracic injury. The injury to the abdomen could be delayed and not appeared until a few days after the accident.

During investigation of protection of children in cars, the Transport and Road Research Laboratory, Crowthone, found that children should use restraints if fitted in the cars and if not available, children should be encouraged to sit on the rear seat or stand on the floor immediately behind the front seats. They should not stand on the rear seats because of the risk of being thrown violently forward in an accident.

Huelke et Gikas (1968) found that ejection of the occupant from the car was the leading cause of death in 139 accidents in which 177 occupants died. 40% of those killed could have survived had seat belts been worn.

(2) Air Bags

In an editorial, the British Medical Journal (1973) advised that a passive restrain system is necessary inside a car. The air bag will reduce the severity of injuries resulting from frontal collision of cars. It automatically inflates when impact occurs, to form a cushion in front of the occupant. As the air bag will be installed when

the car is manufactured, it could take years before the bag is used for the first time. On account of this a method should be devised to test it frequently.

(3) Head Rests

Whiplash injury results from hyperextension of the neck during a road traffic accident since the head of the occupant of the car is thrown backwards relative to the body. If the head is prevented from lolling back more than than 45° from the line of the torso serious injury will not be done to the neck. This type of injury has been studied by Mertz (1967) on a sledge at simulated impact speeds up to 70.4 km p.h. He found that with the proper design of head rest, this injury could be eliminated. Accombination of adequate head and seat support will prevent hyperextension of the neck in rear end collisions at speeds up to 97 km. p.h. as the support will ensure that the forces are distributed over a large part of the body.

The best type of head rest is the onepiece non-adjustable type because if the head rest is not at the proper height more serious injury is likely to result.

To come home to Nigeria detailed information on road traffic accidents are not complete and those who have studied the problem of road traffic accidents have lamented their great difficulty in getting all the facts.

Oyemade (1973) in a review of road traffic accident victims treated at the University College Hospital, Ibadan was, in 1966, 717 and by 1970 had risen to 1,316. It will be noted that these figures reveal that road traffic accident cases presenting for treatment in the hospital nearly doubled in number during the four year period. She also found that although 7% of that hospital beds were continuously occupied by trauma patients, yet a large number of victims who needed hospitalisation had to be treated as outpatients because the beds were just not there to use.

Shojobi (1974) showed that in Lagos State between 1968 and 1973; 9,585 persons were injured on the roads and 1,599 people were killed.

Kale et Aina (1976) discovered that 31% of all coroner post-mortem examinations conducted at the Lagos State Pathology Laboratory were on road traffic accident victims in 1973. 10.1% of the accidents occurred on the Ikorodu Road which is twenty kilometres long. Their study showed that most of the 455 victims died before medical management could be instituted.

Oluduro (1977) found that during the period 1970-75, 70% of the road deaths occurred in accidents in which not more than two vehicles were involved. He also observed from his studies that although 45% of the total driving population were under thirty five years of age, 60% of the fatal crashes occurred in this group.

CHAPTER III

MEDICAL FACTORS IN THE CAUSATION OF ACCIDENTS

A number of acute medical conditions which cause sudden loss of consciousness of the driver of a vehicle can endanger the safety of road users.

Grattan et Jeffcoate (1967) concluded that the incidence of sudden illness in drivers or Motor cyclists involved in minor and serious accidents was 1.5 per 1,000 and when only serious accidents were taken into account it was 4 per 1,000. They also found that chronic disease as a contributory factor had a low prevalence, and accounted for only 0.5% of 593 serious accidents to vehicle drivers or motor cyclists.

Norman (1962) reported that myocardial infarction was a cause of one third of all motor accidents brought about by sudden loss of consciousness of the driver. Nevertheless, such incidents were rare and occurred only once in 448 million vehicle kilometres travelled by drivers of London passenger transport board vehicles. In most cases the drivers had severe chest pain which gave sufficient warning of an attack. The drivers stopped at the road side, and on account of this, few cases have been reported in which the driver involved collided with other vehicles.

Andreasson in a lecture at Third Post-Graduate Course in Traffic Medicine held in Paris in December 1978 reported that an investigation conducted on drivers involved in motor accidents on presentation in hospital, revealed 10,000 diabetic drivers who were not aware that they had the disease until then. Follow up studies showed that they became more careful about their driving after they had been told of their disease and thereafter less prone to accidents. The control of this condition was achieved by either diet alone or by diet and insulin. Where however the control was achieved by diet the accident rate fell to zero, whereas where insulin had to be used the possibility of going into either hyper or hypoglycaemia was always present. Such drivers should be warned about driving.

Herner et al (1966) in their investigation into the cause of sudden illness in drivers concluded that frequent causes were epilepsy and cardiovascular disease, but both accounted for only one in every thousand accidents.

On the other hand Ysander (1966) in his study in Sweden of drivers with chronic diseases, mainly diabetes, cardiovascular disease, renal disorders and disease of sense organs found these conditions did not cause more serious accidents as compared with a control series.

Waller (1965) finding in studies conducted in California supported former views that drivers with diabetes, epilepsy, cardiovascular disease, alcoholism and mental illness caused on the average twice as many accidents per 1,600,000 kilometres of driving as in the control group.

CHAPTER IV

INTERNATIONAL ROAD CASUALTIES

The difficulty of comparing the number of deaths due to road accidents in various countries stems from the fact that the periods allowed after the accident for the death of the victim to be included in the statistics are not similar.

Most countries allow 30 days as the period during which if death occurs after an accident, the death is recorded as due to an accident on the road. The mortality is usually expressed as the number per 100,000 of the population or the number per 10,000 vehicles. The number per 1,600,000 vehicle kilometres driven each year is at times also used.

Table I below shows the true lapse between accident and death in each of five countries for acceptance as Road Traffic Accident death. It will be seen that this variation makes it impossible to properly compare Road Traffic Accident deaths from the different countries.

Country	Time within which death is recorded as due to Road Traffic Accident
Nigeria	1 month
U.S.A.	12 months
Austria	3 days
Poland	48 hours
Belgium	on the spot

TABLE I - Time Death is recorded as due to Road Traffic Accidents in various countries.

Over 250,000 deaths and ten million people injured from road traffic accidents are reported annually all over the world.

France, West Germany, Great Britain and Italy have population of roughly similar size varying between 49 and 58 millions, with the first three having similar numbers of cars on their roads whilst Italy has about two-thirds of these numbers.

In 1970 the number of road deaths in Great Britain was 7,499. France had 14,664 (1969 figures), West Germany had 19,193 and Italy 10,208. It will be seen from the above that France had about twice the number of persons killed as Great Britain whilst West Germany had about two and a half times. Although Italy had about two-thirds the number of cars in Britain, it had over twice the number of fatal cases on the roads.

It is interesting to note that the population of the United States of America is similar to the total population of the above four European Countries, and the total road deaths of the United States and the European countries are similar. This is inspite of the fact that more than twice the number of cars but fewer motor cycles on its roads.

The distribution of deaths between the various road users in the two groups have also been reported as being different. Two-thirds of the road deaths in the United States of America are of car occupants and less than one-fifth of pedestrians whereas in Europe the deaths are divided almost equally among car occupants, pedestrians and riders of two wheeled vehicles.

The crude mortality rate from road accidents in Australia is 28 per 100,000 population as estimated by the World Health Organisation.

Of 500 fatalities in Australia among drivers and passengers reported on by HOSSACK (1972), 25% had head injuries alone, 27% had head and chest injuries and 22% had multiple injuries. A suprise finding was that 7% was due to asphyxia resulting from blood or vomitus.

In the United States of America, road traffic accidents are the main cause of death for people between the ages of 15 and 24 years, and was 40% in 1969 for this age group.

In countries where motor transportation is increasing, fatalities often rise at an alarming rate and this often requires urgent safety measures to be taken by the appropriate authorities, to stem this trend. This appears to be the situation in Nigeria where this trend is illustrated in Table 2.

From this table it will be seen that the period 1974 to 1978 the number of persons killed on the roads has almost doubled.

Year	No. of persons killed.	No. of persons injured.
1974	4,922	18,660
1975	5,552	20,132
1976	6,761	28,155
1977	8,000	30,023
1978	9,252	28,854

TABLE 2. - Number of persons killed and Injured.

SOURCE: NIGERIA POLICE RECORDS.

The number of persons injured dropped in 1978; this could be partly due to the edict that limited the number of vehicles on the roads. Vehicles whose number plates started with an even number were allowed on the roads on Tuesdays, Thursdays and Saturdays only. Whereas those with odd numbers could only use the roads on Mondays, Wednesdays, and Fridays; Sundays were free days for all cars when both odd and even numbers can ply the roads. It may be concluded that the drastic reduction in car number on the road per day might have played a significant role in the reduction of Road Traffic Accident that year.

CHAPTER V

MATERIALS AND METHODS

Pilot Scheme

A pilot scheme was carried out from the 1st of June 1977 to the 31st of August, 1977 to find out the problems which would be involved in carrying out a full scale study on Road Traffic Accidents.

To begin with only the case notes of those admitted to the Lagos University Teaching Hospital as a result of road traffic accidents were studied as it was felt that the main problems could be identified in the shortest time, especially as the serious cases were always admitted to the hospital.

Following consultation with the Family Doctors, and Health Centres of the area, it was decided to limit the study to patients seen at the hospital for only minor cases were treated by the Family Doctors and Health Centres. All serious cases were referred to the hospital, and fatal victims at the scene of accidents were taken to hospital for confirmation of death and the corpse kept in the mortuary for the coroners inquest.

The case notes studied were those of 1975, and contained personal details of the patients such as age, sex, marital status, occupation, next of kin as well as the mechanism and details of the injuries sustained. The treatment carried out on the patients were also reviewed and analysed.

As it was not possible to set up a controlled study for Road Traffic Accidents it was considered that the area covered by the Hospital was the appropriate catchment area, since all injured persons in road traffic accidents in this area who needed hospital treatment would be taken to the Lagos University Teaching Hospital which has the only Accident and Emergency Department covering the area, which is about 1,000 square kilometres (Appendix 2)

The population of the area is one million. The Road Research Laboratory at Crowthorne in England was also consulted and the Author was furnished with literature on work already performed on road safety.

As a result of the pilot study and the knowledge gained from the literature from the Road Research Laboratory at Crowthorne a questionnaire was prepared. A copy of the questionnaire is attached as appendix I.

This form contained the personal details of the person injured - name, age, sex, marital status, occupation, address, date and time of the accident, The class of road user involved was noted. The history of the accident and the type of injury sustained were recorded.

Each injured person who attended the hospital for treatment on account of road traffic accident was interviewed and a copy of the questionnaire completed for the patient. In the case of a child or an unconscious patient, the people who accompanied the patient to the hospital were interviewed and a completed questionnaire form thus made out for the accident victim.

The present survey

(A) The study was carried out on all accident patients seen at the Accident and Emergency Centre of the Lagos University Teaching Hospital. A bleeper system is used to have effective communication system in the hospital for emergency purposes. The bleeper has a range of ten kilometres radius. The author carried a bleeper and so was notified of all road traffic accidents by the Centre as soon as each patient arrived.

Each injured person was interviewed and medically examined in the Accident and Emergency Centre of the Hospital throughout 1978 by the Author and the questionnaire (Appendix I) completed. The Medical examination included the following:

Laboratory and Radiological investigations as indicated. Where the patient was unable to communicate or was in coma, the Police Officers, Ambulance Crew, Fire Brigade Officers and Witnesses and or Interpreters were used to obtain full story of the accident.

The visions of all drivers involved in the accidents were tested. If they were previous spectacle wearers, they were questioned as to when their visions were last tested and or when their glasses were last changed. The visions of a controlled group to these drivers were matched for sex and age were similarly investigated.

All injured persons were asked whether they had consumed any alcohol before the accident. The type of drink, the amount and the time it was taken before the accident were also ascertained.

The blood alcohol concentration was not measured because facilities for doing this were not available in Lagos.

Venous blood was taken from each commercial driver involved in the accidents for which the accident victims in this study were brought to the Accident and Emergency Centre. The blood sugar level was measured. (Appendix 3). The drivers were asked whether they had any meal before the accident.

Each injured victim was carefully examined and the injuries sustained were recorded as to the site of injury, the tissues/organ system involved i.e. soft tissue or bone.

The diagram depicted in Fig. 2 was used to record the bone fractured. This diagram depicted in Fig. 2 was used to record the bone fractured. This was found to give a quick way of making this record in the busy Accident and Emergency Centre. Similarly a table (Table 19) was prepared and used for recording the position and type of soft tissue injuries.

Severity of Injury

The author used the classification recommended by the working party of the United Nations Economic Commission for Europe which is as follows:

DEATHS:

Persons were reported killed only if they die from their injuries within thirty days from the accident.

SERIOUS INJURY:

An injury for which the person is detained in hospital as an in-patient or any of the following injuries whether or nor he is detained in hospital, crushing, severe cuts and lacerations, severe general shock requiring treatment.

SLIGHT INJURY:

An injury of a minor character such as sprain or bruises, persons who complain of shock but who sustain no other injury are only included if they appear to need medical treatment.

The time of day in which the accidents occurred were divided into hourly periods.

The progress of those admitted into hospital wards was followed until discharged or demise, and records made of complications and progress.

(B) A Study of the number of victims of hit and run drivers before and after a public campaign was carried out to stop drivers neglecting their victims on the roads was made to find out whether the campaign affected the number of road traffic accidents.

(c) A check was made on the obituaries in two National Daily Newspapers (Daily Times and Daily Sketch) during 1978 to find out how many people in the professional group lost their lives as the result of road traffic accidents.

(D) The effects of road bumps on road traffic accidents on a five kilometre residential road near the hospital was studied.

CHAPTER VI

RESULTS

The author investigated 1,650 road traffic accidents which occurred during 1978 in the area covered by Lagos University Teaching Hospital in the municipality of Lagos and environs. 5,802 injured persons presented and were managed in the Lagos University Teaching Hospital during the period. Of these, 9 were dead on arrival at the hospital and 113 died in the hospital. This represents a mortality of 2.1 percent.

There were 175 infants among these victims of road traffic accidents who presented at the hospital accounting for 3% of the total people injured. The youngest victim was an infant - 4 months old - with fracture of both femora.

ACCOUNT OF THE ACCIDENTS BY THE VICTIMS

20 of the drivers admitted that accidents occurred as they were overtaking other vehicles. If they had driven with proper attention and due care, it is possible that the accidents could have been prevented.

It is interesting to note that 61 drivers volunteered the information that they were driving well above the speed limit for the Metropolis of Lagos. The speed limit in Lagos is 50 km.p.h. One hundred drivers said there were no road signs to show the minimum and maximum speed limits. But the remaining 115 drivers said there were very few places with road signs.

The drivers of 5 vehicles lost control when the tyres of their vehicles burst.

15 of the drivers who were involved in accidents at night said the roads where the accidents took place had no street lights and the on coming vehicles had full lights on, and in trying to avoid head-on collisions ran into ditches, hit electric poles or knocked down pedestrians.

All the 37 commercial drivers said they did not have breakfast on the morning of the accident but the other 178 drivers had their meals prior to the accidents.

31 of the drivers said there were bumps constructed across the roads so that drivers will be forced to reduce the speed on that section of the road. The remaining 184 drivers did not have bumps on their roads.

1307 pedestrians said there were no footpaths or sidewalks, and the streets had open drains, vehicles were parked indiscrimately and with no pedestrian crossings they were forced to walk near moving vehicles.

1,527 pedestrians said that in order to get from one side of the road to the opposite side, they had to run across the road between moving vehicles as there were no pedestrian overhead bridges or subways.

473 of the pedestrians admitted that the roads had pedestrian overhead bridges, sidewalks and closed drains.

Class of Road User	No. of Persons injured	Percentage
Driver	215	3.7
Motor cyclists	1,103	19.0
Cyclist	87	1.5
Passenger	922	15.9
Pillion Passenger	168	2.9
Pedestrian	3,307	57.0

TABLE 3 - CLASS OF ROAD USERS INJURED

It will be seen from Table 3 that well over half of the accident victims were pedestrians. It is of interest to note that during the period covered by the study, kerbs or sidewalks were not a feature of Lagos roads. Secondly, even in the wide motorways and trunk roads like Ikorodu Road, pedestrian crossings or overhead bridges were rare and far between.

The next most affected group were motor cyclists. It is of interest to draw attention to the fact that although they constitute about one-third (1/3) of pedestrian accident victims only one sixth (1/6) of their numbers were pillon passengers.

This could be due to very few motor cyclists carrying pillion passengers.

Occupation	No. of persons Injured.
Professional	516
Business	784
Housewife	536
Student	711
Labourer	1816
Unemployed	949
Don't know	545

TABLE - 4 - OCCUPATIONAL STATUS

With 1,300 (22.4%) of the victims in the professional and business classes, it is incontrovertible to conclude that this would have involved a loss in the economy of the country.

Age	No. of persons injured
0 - 10 yrs	1,323
10+- 20 "	464
20+- 30 "	1,616
30+- 40 "	1,470
40+- 50 "	676
50+- 60 "	253
TOTAL	5,802

TABLE - 5 - AGE PATTERN

The largest number of people involved in road traffic accidents were in their third and fourth decades of life.

This period constitutes the peak of activity in the working life of our population. People commute between homes and their working places, usually as pedestrians or in vehicles.

They are thus exposed to road traffic accidents. By contrast, there is a sharp fall in number during retiring decades. It is noteworthy to state that in Nigeria voluntary retirement age is set at 45 years old and compulsory retirement at 60.

The explanation for the other peak in incidence occurring during the first decade may be because children commute between home and school during the rush hours of the day and more lacking in road sense, they run the greater risk of involvement in road traffic accidents.

Age	Male	Female
0 - 10 yrs	663	660
10+- 20 "	310	154
20+- 30 "	1,212	404
30+- 40 "	980	490
40+- 50 "	396	280
50+- 60 "	130	123
Total	3,691	2,111

TABLE - 6 - SEX INCIDENCE

It is of interest to note that there is no sex difference in the incidence of road traffic accidents in the age group 0-10 years in Lagos. It must be remarked however that there are no prejudices based on sex differential for children going to school in the same environmental conditions; the boys and girls having equal exposure to the traffic.

In the age group 20 - 30 years, for each female injured, there were three males injured. During the second and third decades of life more males work and often their various occupations take them long distances from home. The females who worked were mainly traders and sold their wares in markets near their houses whilst some were house-bound as housewives and mothers.

No. of victims who had first-aid treatment at the scene of Accident	No. of victims who did not have first aid treatment at the scene of accident
284 (4.9%)	5,518 (95.1%)

TABLE - 7 - First Aid Treatment at Scene of Accident.

Table - 7 shows that very few victims had first Aid Treatment at the scene of accidents. This is not surprising as first aid is not widely taught in the country.

No. of drivers who took alcohol	No. of drivers who did not take alcohol	No. of drivers that could not say whether they had alcohol or not.
94	106	15

TABLE - 8 - DRIVERS WHO HAD ALCOHOL PRIOR TO BEING INVOLVED IN ROAD TRAFFIC ACCIDENT

94 of the 215 (43.7%) of drivers involved in Road Traffic Accidents in the series owned up to having taken alcohol prior to driving. Although as had been pointed out it was not possible to correlate the pattern in Table 8 with the blood alcohol level of all the drivers in the series because of the lack of facilities to do the necessary analysis, this high proportion of alcohol consuming drivers in the group is a possible pointer to the deleterious effect of alcohol on judgement during driving.

	0 - 1 yr	1+ - 2 yrs	2+ - 3 yrs	Over 3 yrs
Accident drivers	10 (10.1%)	7 (7.1%)	24 (24.2%)	58 (58.6%
Non - accident drivers.	34 (32.7%)	31 (29.8%)	10 (9.6%))	29 (27.9%)

TABLE- 9 - INTERVAL ELAPSING SINCE LAST VISUAL TEST.

The time interval elapsing since the testing of the vision of the drivers using spectacles for driving is shown in Table 9. of the 104 drivers involved in the accidents who were using spectacles for driving only 99 could be asked about their vision for 5 died before they could be questioned.

A sample of 104 drivers not involved in road traffic accidents using spectacles for driving who were matched for sex and age were also questioned about their vision.

58.6% of those involved in accidents had not tested their eyes for over three years. But in the case of the drivers not involved in accidents, it was 27.9%.

With 58.6% of accident drivers to 27.9% of non-accident drivers the difference is highly significant ($P<0.00006$).

DATE OF ACCIDENT	TYPE OF VEHICLE DRIVEN	BLOOD SUGAR LEVEL OF DRIVER	DISTANCE TRAVELLED BEFORE ACCIDENT	INJURY SUSTAINED BY DRIVER OR CAUSED TO ROAD USER
JAN. 1978				
3	Lorry	40mg/100 ml	401 km	# Dislocation T11, Haematoma over T11
6	Lorry	42mg/100 ml	360 km	Caused: Hit Van - Quadriplegia # T2 - T3 Sensory Loss T2 - T3
11	Lorry	40mg/100 ml	380 km	# Rt Femur. # Rt Rib & Tibia # Dislocation (Rt) Humerus. # Neck Humerus.
20	Minibus	41mg/100 ml	345 km	Abrasion Rt. Side of Face, Lt Hip. Pytosis (LT) Eye, Conjestion of lungs, Pain in Sternum.
FEB. 1978				
3	Minibus	42mg/100 ml	320 km	# C4. Abrasions Head, Nose (Lt) Hand
9	Minibus	40mg/100 ml	325 km	# (Lt.) Tib & Fib Laceration angle of (Lt) orbit, bleeding from nose. Deeply Unconscious.
14	Lorry	40mg/100 ml	317 km	# Mandible, # Rt. Humerus, Lt. Radius & Ulna # Rt Femur.
17	Lorry	41mg/100 ml	310 km	# Femur, Laceration (Rt) Forearm, Laceration Forehead.
24	Lorry	40mg/100 ml	380 km	# Rt Fibula, Degloving injury to Lt Upper Arm, Degloving injury to Rt. Femoral Condyle

#- FRACTURE C- CERVICAL VERTEBRA T - THORACIC VERTEBRA Lt - LEFT Rt - Right

DATE OF ACCIDENT	TYPE OF VEHICLE DRIVEN	BLOOD SUGAR LEVEL OF DRIVER	DISTANCE TRAVELLED BEFORE ACCIDENT	INJURY SUSTAINED BY DRIVER OR CAUSED TO ROAD USER
FEB. 1978 28	Lorry	42 mg/100 ml	406 km	Caused: Abrasions on both legs. # Skull. # Dislocation (Lt) Hip. Crush Injury (Rt) Foot (a Car Driver).
MAR. 1978 2.	Lorry	39 mg/100 ml	401 km	# Rt. 2nd Rib. Surgical Emphysema, Abrasion (Rt) Cheek.
3	Lorry	39 mg/100 ml	350 km	# Lt Radius & Ulna, # Pelvis. # Lt Femur Laceration Lt. Leg.
22	Lorry	42 mg/100 ml	307 km	# C3, 4, 6, Brachial Plexus Lesion, (Lt) Wrist Drop.
APR. 1978 4	Minibus	42 mg/100 ml	334 km	Caused: Compd # (Lt) Olecranon Compd # Lt. Femur. Transverse # Lt Tibia & Fibula.
12	Lorry	42 mg/100 ml	321 km	# Rt. Radius & Ulna. Potts # Lt Ankle, Abrasions and Lacerations on face.
MAY 1978 2	Lorry	41 mg/100 ml	310 km	Caused: # Rt Femur. # Rt Radius & Ulna Abrasions on body. Laceration Rt Foot.
12	Minibus	42 mg/100 ml	410 km	Caused: # Dislocation (Rt) shoulder, Brachial Plexus lesion. Radial Palsy-Wrist Drop.
17	Lorry	38 mg/100 ml	380 km	Abrasion on face. Avulsion (Rt.) Eye, Multiple # Fronto nasal bones, # Rt. Maxillary bone zygomatic complex.
19	Lorry	39 mg/100 ml	360 km	Laceration (Rt) Palm. # Rt Clavicle. # Rt 2nd, 3rd, 4th, 5th, 6th, 7th, 9th ribs, Rt. Pneumothorax.

- FRACTURE C- CERVICAL VERTEBRA T- THORACIC VERTEBRA Lt - LEFT Rt - Right

DATE OF ACCIDENT	TYPE OF VEHICLE DRIVEN	BLOOD SUGAR LEVER OF DRIVER	DISTANCE TRAVELLED BEFORE ACCIDENT	INJURY SUSTAINED BY DRIVER OR CAUSE TO ROAD USER
JUNE 1978 7	Lorry	41 mg/100 ml	403 km	Abrasions, face, (Rt) Hand, (Rt) Leg, Laceration Head. # Rt Foot - Cunieform Lat. # Rt base, 1st and 2nd Metacarpals.
23	Lorry	40 mg/100 ml	386 km	Caused. # Skull # Pelvis, Extensive Laceration on face.
JULY 1978 14	Minibus	42 mg/100 ml	369 km	Caused. # Rt. Tibia, # Lt. Tibia and Fibula, Ruptured Urethra. Laceration Lt. Leg, Abrasion Face, Rt, Upper Arm.
25	Lorry	39 mg/100 ml	360 km	# C6, C7, Brachial Plexus Lesion, # Lt. Femur. Abrasion on face.
28	Lorry	41 mg/100 ml	395 km	# dislocation Lt Hip. Abrasions on Face and Lt. Foot.
AUG. 1978 17	Lorry	40 mg/100 ml	390 km	# C1, C2 # Rt. Humerus. Abrasions on the Face.
31	Lorry	42 mg/100 ml	362 km	Caused: Multipule # Rt. Radius and and Ulna, Multiple # Lt. Tibia and Fibula

- FRACTURE C - CERVICAL VERTEBRA T - THORACIC VERTEBRA LT - Left Rt - RIGHT

DATE OF ACCIDENT	TYPE OF VEHICLE DRIVEN	BLOOD SUGAR LEVEL OF DRIVER	DISTANCE TRAVELLED BEFORE ACCIDENT	INJURY SUSTAINED BY DRIVER OR CAUSED TO ROAD USER
SEPT. 1978 6	Lorry	40 mg/100 ml	406 km	# Mandible. # dislocation of (Lt) Humerus # Pelvis
14	Lorry	38 mg/100 ml	415 km	# Rt Radius & Ulna. # L2. # Rt Femur. Abrasion of (Rt) Root.
OCT. 1978 5	Lorry	42 mg/100 ml	391 km	# Rt Clavicle. Rt. Brachial Lesion, # Rt 2nd - 3rd Metatarsals.
19	Lorry	41 mg/100 ml	380 km	# Sternum. # Rt 2nd 3rd, 4th Ribs # Dislocation (Lt) Femur.
26	Lorry	40 mg/100 ml	366 km	Caused: # Mid Shaft (Lt) Tibia. # Mid Shaft Lt Femur. Laceration Hand, # Rt Acromion # Rt Coracoid process. Abrasion: Rt Eye Lid, Rt. Parietal Region of Head.
NOV. 1978 14	Lorry	40 mg/100 ml	389 km	# Skull. # Maxilla. # Tibia and Fibula
22	Lorry	39 mg/100 ml	350 km	# Rt Clavicle. # Lt Clavicle. # Rt Scaphold # Lt Tibia and Fibula

KEY # - Fracture C = Cervical Vertebra Lt = Left Rt = Right

DATE OF ACCIDENT	TYPE OF VEHICLE DRIVEN	BLOOD SUGAR LEVEL OF DRIVER	DISTANCE TRAVELLED BEFORE ACCIDENT	INJURY SUSTAINED BY DRIVER OR CAUSED TO ROAD USER
NOV. 1978 24	Lorry	39 mg/100 ml	413 km	Caused: # Dislocation (Lt) Humerus. # Lt 2nd, 4th, 6th ribs. # Tibia and Fibula.
30	Lorry	40 mg/100 ml	389 km	Caused: # Skull # C4, C5 Abrasion on Rt thigh
DEC. 1978 18	Lorry	42 mg/100 ml	311 km	# T12. # Pelvis. # (Lt) Tibia and Fibula
22	Lorry	41 mg/100 ml	297 km	# Maxilla. # Mandible, Laceration on Face Rt. Pott's #

KEY

Fracture
C Cervical Vertebra
T Thoracic Vertebra
Lt Left
Rt Right

TABLE 10 - COMMERCIAL DRIVERS WITH LOW BLOOD SUGAR INVOLVED IN ROAD TRAFFIC ACCIDENTS

Johnson (1977) in a study found the normal fasting blood sugar to be 60± 5mg % in the Lagosian population. He regarded levels of 40mg % as biochemical hypoglycaemia.

Glucose oxidase method is usually 5 mg % higher than the true glucose level.

It will be seen in Table 10 that the fasting sugar level of the commercial drivers involved in road traffic accidents in this study is ranging between 38mg/100ml and 42mg/100ml (oxidase method. See Appendix 3) and falls below this and lies in the hypoglycaemic level so defined for Lagosians by Johnson (1977).

This is inspite of the fact that hyperglycaemia has been documented as the normal metabolic reaction in man during the early phases after injury.

It is therefore not unreasonable to infer that the low sugar level in these individuals could have been a contributory factor to their accident.

Month	Type of Injury			Total
	Minor	Serious	Fatal	
JAN.	201	48	9	258
FEB.	564	59	8	631
MAR.	401	137	15	553
APR.	268	73	8	349
MAY.	297	146	13	456
JUNE	372	85	7	464
JULY	321	114	8	443
AUG.	217	175	9	401
SEP.	266	177	16	459
OCT.	499	185	12	696
NOV.	522	73	10	605
DEC.	283	197	7	487

TABLE II - SEVERITY OF INJURY

Table II shows an analysis of the number and severity of injuries sustained related to period of year and therefore environment conditions.

The number of people injured in road traffic accidents showed marked increases during the months of October and November. It is to be noted that in Lagos, Nigeria this is the period immediately following the long raining season when drivers have the opinion that the roads are dry and they could travel at fast speeds,

but occasionally come across potholes which made the vehicle unstable and so caused accidents. At this time too, pedestrians find the roads slippery as the roads are not usually fully dried following the raining season.

The raining season starts in April and the heaviest falls recorded during the months of June and July, to be followed by a short break in August.

TIME			NO. OF ACCIDENTS
Midnight		1.00 a.m.	9
1.00 a.m.	-	2.00 a.m.	18
2.00 a.m.	-	3.00 a.m.	10
3.00 a.m	-	4.00 a.m.	6
4.00 a.m.	-	5.00 a.m.	13
5.00 a.m.	-	6.00 a.m.	30
6.00 a.m.	-	7.00 a.m.	54
7.00 a.m.	-	8.00 a.m.	73
8.00 a.m.	-	9.00 a.m.	96
9.00 a.m.	-	10.00 a.m.	62
10.00 a.m.	-	11.00 a.m	78
11.00 a.m.	-	12. noon	75
12 noon	-	1.00 p.m.	79
1.00 p.m.	-	2.00 p.m.	81
2.00 p.m.	-	3.00 p.m.	65
3.00 p.m.	-	4.00 p.m.	71
4.00 p.m.	-	5.00 p.m.	80
5.00 p.m.	-	6.00 p.m.	106
6.00 p.m.	-	7.00 p.m.	83
7.00 p.m.	-	8.00 p.m.	64
8.00 p.m.	-	9.00 p.m.	61
9.00 p.m.	-	10.00 p.m.	59
10.00 p.m.	-	11.00 p.m.	45
11.00 p.m.	-	12 midnight	30
Unknown			322
		Total	1,650

TABLE 12 - TIME OF ACCIDENT

Table 12 shows the time of accidents. The largest number of accidents occurred during the day light hours - 7.00 a.m. to 7.00 p.m. There were more pedestrians and vehicles on the roads during this period than during the night hours.

The number of accidents increased from the morning rush hours (7am - 9am) through the working hours and rose to a peak during the rush hours late in day when workers leave their places of work for home (4.00 pm - 6.00 p.m.). It then diminished through the night to the early hours of the morning. The lowest figures being recorded between 3.00 a.m. and 4.00 a.m. (6 accidents).

The highest accident figures of 106 in an hour occurred between 5.00 p.m. and 6.00 p.m., when the combination of a high number of vehicles and pedestrians on the road along with the period of maximum weariness and hence lowered concentration would be expected to predispose to accidents.

Part of the body	Total Abrasions	Total Lacerations
Head	886	738
Face	1,156	1,004
Neck	17	70
Arms	1,216	326
Hands	711	256
Chest	419	116
Abdomen	33	-
GLuteal region	99	42
Back	51	30
Legs	1,236	666
Feet	370	275

TABLE - 13 - SOFT TISSUE INJURIES

Table 13 shows that the largest number of soft tissue injuries occurred on the face, followed by the legs and arms while the least was in the abdomen.

656 victims had only one injury each; but in the case of a person having multiple injuries as the result of road traffic accident, there were 5146 victims in this group.

Part of the body	Total number of injuries.
Skull	565
Maxilla	89
Mandible	37
Cervical Vertebra	55
Clavicle	369
Scapula	84
Sternum	11
Humerus	202
Radius	287
Ulna	220
Metacarpus	106
Rib	277
Thoracic Vertebra	21
Lumbar Vertebra	11
Pelvis	225
Femur	378
Tibia	697
Fibula	516
Metatarsus	51

TABLE 14 - FRACTURES

Injury to the long bones accounted for 2,300 cases. (representing 39.4% of all cases) As will be seen in Table 14 the most injured bone is the tibia which was recorded in 697 victims in this series. Of these 403 were pedestrian victims.

Cont. Table 14 Fractures

The next most commonly injured bone is the skull which accounted for 565 cases (9.7% of total), of these 413 occurred in pedestrians, 53 in motor cyclists and 11 in drivers of vehicles involved in accidents.

Of the 225 cases of fractured pelvis 91 were found among pedestrians, 69 in vehicle passengers and 52 among drivers.

There were 55 cases of fracture of the Cervical vertebra due to whiplash injury. Drivers accounted for 43 cases and vehicle passengers 12.

	FRACTURES									SOFT TISSUES										
	Skull	Mandible	Cervical Vertebra	Humerus	Rib	Pelvis	Femur	Tibia	Fibula	Brain	Lung	Liver	Spleen	Intestine	Urethra	Haemorrhage from limb	Skin (Burns)	Total Injuries	Deaths	Number of injuries per death
Driver	4	1	-	-	2	1	2	-	1	3	1	-	-	-	-	-	-	15	8	1.9
Motor cyclist	7	1	-	1	-	-	5	1	1	5	-	-	-	-	-	-	-	21	15	1.4
Cyclist	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Passenger	5	-	1	-	2	2	1	-	-	4	-	-	1	-	2	-	-	18	13	1.4
Pillion Passenger	2	-	-	-	-	-	-	3	3	3	-	-	-	-	-	-	-	11	7	1.6
Pedestrian	23	-	-	4	6	1	6	9	8	18	2	3	6	3	2	1	2	94	70	1.9
Total Injuries	41	2	1	5	10	4	14	13	13	33	3	3	7	3	4	1	2	159	113	1.4

TABLE - 15 Types and number of injuries on victims who died in the hospital

	0 - 5 mins.	5-10 mins	10-30 mins	30-60 min.	1-3 hrs	3-6 hrs	6-12 hrs	Over 12hr	Total
Driver	-	-	-	1	1	1	-	5	8
Motor cyclist	3	1	2	-	2	1	-	6	15
Cyclist	-	-	-	-	-	-	-	-	-
Passenger	-	1	3	-	1	1	1	6	13
Pillion Passenger	1	1	1	-	-	1	-	3	7
Pedestrian	6	3	5	4	16	9	7	20	70
Total	10	6	11	5	20	13	8	40	113

TABLE - 16 - TIME OF DEATH OF THE VICTIMS IN HOSPITAL

Table - 16 shows an analysis of death from Road Traffic Accidents against time of arrival in hospital of victims.

Months	No. of people killed	No. of Professionals killed
January	90	2
February	141	6
March	136	2
April	135	8
May	131	5
June	83	1
July	92	3
August	75	4
September	66	3
October	224	7
November	221	3
December	118	2
Total	1,512	46

TABLE - 17 - NUMBER OF PROFESSIONALS KILLED

SOURCE: DAILY TIMES AND DAILY SKETCH.

Table - 17 shows the number of people who died as the result of road traffic accidents in the country as recorded in the obituaries of two national daily newpapers.

3.0% of those who died were in the professional group.

Year	1978												1979	
MONTH	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb
Number of Accident	2	3	3	2	3	4	4	3	3	2	1	0	0	0

TABLE – 18 – ACCIDENTS ON ROAD WITH BUMPS

Table – 18 shows the effect of bumps erected on a residential road.

The bumps were erected at the end of July and within six months of the erection the number of accidents was reduced by 30%.

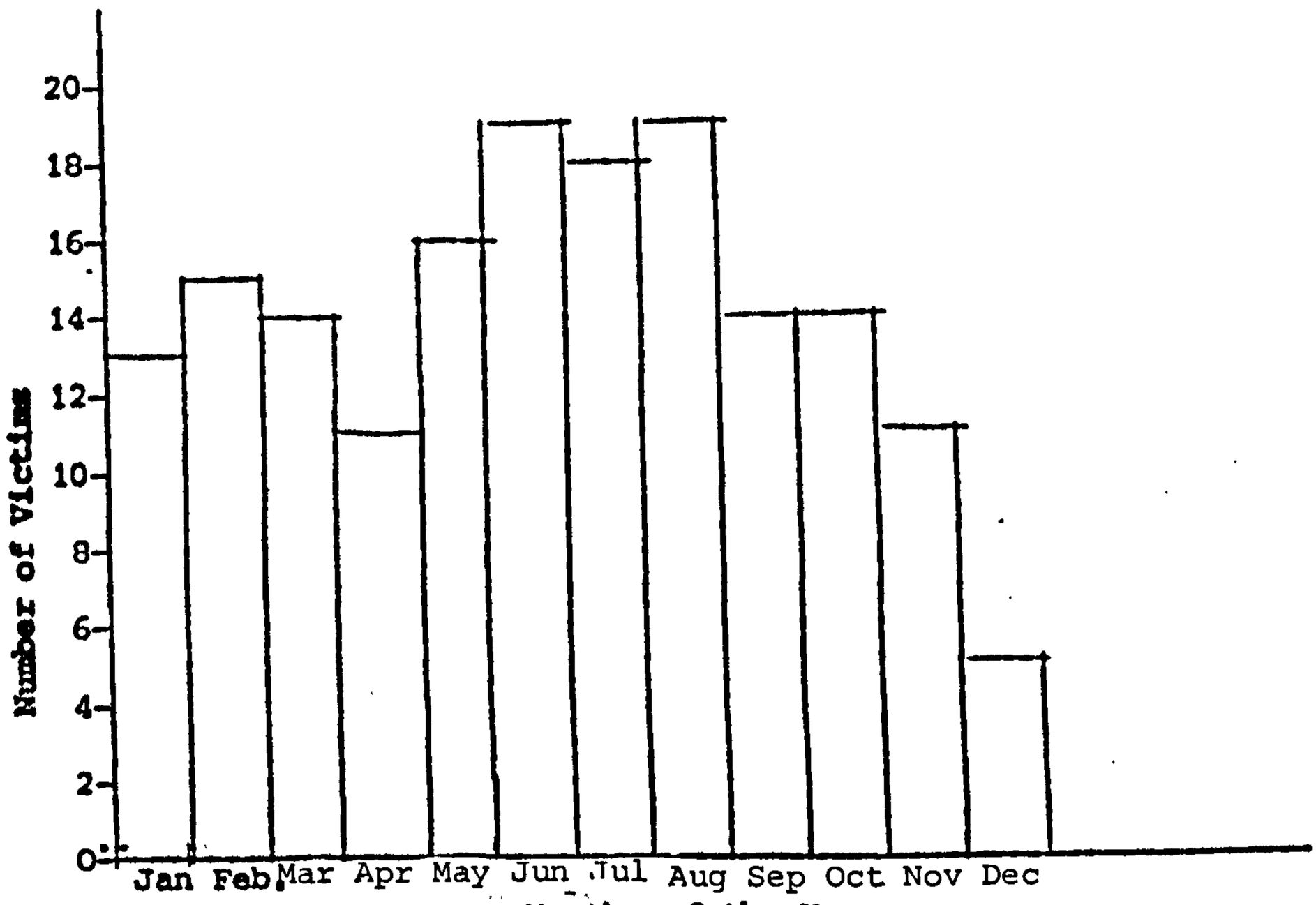

FIG. 1 - Victims of Hit and Run

Figure - 1 shows victims of hit and run road traffic accidents.

A campaign was started in June educating the public to give assistance to victims of road traffic accidents and for drivers not to leave victims of their accidents on the roads, but to get medical help for them. Within three months, the number of victims as seen in fig. I started to fall. If the number of victims for the months of January 1978 (13) and February 1978 (15) are compared with January 1979 (3) and February 1979 (2) it is obvious there is marked difference in incidence for the same periods of these years when environmental conditions can safely be assumed to be the same and in the absence of any major road constructions during the period.

CHAPTER VII

DISCUSSION

During the period covered by this study 55772 patients were treated in the Lagos University Teaching Hospital. Of these 5802 presented with injuries sustained in Road Traffic Accidents. This figure represents a hospital incidence of 10.4% 9 victims of these Road Traffic Accidents were dead on arrival and 113 died later in hospital making a total of 122 and a mortality of 2.1%. Over the same period computed statistics by the Road Traffic division of the Nigeria Police for the Metropolis of Lagos showed that 3706 accidents only were documented as having occurred. (GAMBO, 1980). These resulted in 728 deaths of which 653 (89.7%) were reported to have died on the spot and 75 occurred in hospital. Not surprisingly no figures on actual number of people injured were available. The 5802 injured patients presenting in Lagos University Teaching Hospital can in no way be regarded as the total number of injured persons in road traffic accidents in the Metropolis of Lagos in 1978 when it is brought home that Lagos University Teaching Hospital is one of several hospitals dealing with these cases. The National Orthopaedic Hospital with a bed capacity of 1000, the General Hospital with 600 beds and a large number of private hospitals and clinics as well as Government Health Centres take a fair patient load in this area and the fact that record keeping in these latter hospitals, health centres and clinics have been reported as poor (Adisa, 1976) makes it at the moment difficult if not

impossible to get a true incidence of road traffic accident victims in the municipality.

Our finding in Lagos is not in anyway unique for the experiences of other workers in various areas of the world seem to support this difficulty in computing a reliable incidence of road traffic accident victims. Thus in a study in Sweden Thorson and Sande, (1969) reported that only 28% of persons seriously injured were reported as such in the official road accident statistics. A further 20% were recorded as slightly injured. Thus about one half of the seriously injured did not appear at all in the official figures. Similarly Bull and Roberts (1973) concluded from their studies in Birmingham that about one-sixth of serious injuries and one third slight injuries did not appear in Police notifications.

Of the 5802 injured patients managed in the Lagos University Teaching Hospital over the period of the study 3307 (57%) were pedestrians.

In a Metropolis where as stated previously, pedestrian or side walks are literally absent in all their road netwalk and where therefore pedestrians have to struggle for the use of the road with others, where zebra crossing are absent, where flyovers across express roads within the city are few and far between, where there is little or no respect for the highway code, it it is not surprising that pedestrians should take the brunt of the injuries.

The Author found in this series that 1307 pedestrians out of the 3307 injured (more than one-third of them) gave information suggesting that they were of the opinion that vehicles were indiscrimately parked at the site of their accidents and that they were forced thereby to walk on the road close or in between moving static vehicles. It is pertinent to observe that Smeed (1964) had opined that increased measures to prevent parking on roads might give up to a ten percent reduction in accidents.

One thousand one hundred and three (1103) of the injured patients in this series are motorcyclists and 168 were pillion passengers with these motor cyclists. Thus this group of injured totalling 1271 (21.9% of the road traffic accident victims in this series) formed the next major group. It is to be noted that as stated previously motorcyclists in the metropolis of Lagos ride between vehicles moving in opposite direction because as they related to the Author during enquiry, the presence of open drains on the sides makes their choice of driving on the nearside unwise. They are also in the habit of threading their way between moving vehicle in the direction of traffic flow in an attempt to beat traffic hold up.

Victims of road traffic accidents who were occupants of cars and lorries (i.e. drivers and passengers) in this series totalled 1137 (19.6% of total victims of road traffic accidents in the whole series). Of this 215 were the drivers themselves and 922 their passengers. Under the road traffic laws, all commercial vehicles

are required to obtain certificate of Road Worthiness every year. It is strongly rumoured that this law is flouted as a result of malpractices by law enforcing agents on one hand and the vehicle owners whose vehicles ply the roads without this document. Sixty one (61) of the drivers involved in accidents in the series themselves admitted flouting traffic regulation at the time the accident occurred. They admitted they were driving well above the speed limit in the area. Twenty (20) of them said they were actually overtaking other vehicle improperly when their accidents occurred.
It is of interest to note that Cohen (1968) concluded from his studies that a speed limit in urban areas when obeyed led to a reduction in fatalities and injuries sustained as a result of road traffic accidents. During the course of this research work, a study carried out over a five kilometre stretch of road near the Lagos University Teaching Hospital showed a 30% drop in the number of accidents following the erection of bumps on the road aimed at forcibly reducing the speed of vehicles plying a built-up area where children were many and in the habit of playing and running across the road.

In this series, studies of drivers using spectacles who were involved in road traffic accidents showed that 58.6% of them had not retested their eyes for over 3 years before the accident. Thus compared with a control group of drivers using glasses who were not involved in accidents in the same area, of the same age and sex and apparent health status in whom only 27.9% had not retested their eyes for over 3 years.

Norman (1969) had observed that deterioration of vision may be so gradual that it may be unnoticed and as inadequacy of distant vision is most frequently found in older drivers, he maintained that there is good reason to hold that older drivers should have a visual test conducted by their opticians as a pre-requisite to each triennial renewal of their driving licence.

Ninety four drivers (42.7%) of those involved in road traffic accidents in this series admitted to drinking "Ogogoro" - the locally prepared spirit from sugar cane and usually sold on the road side - before their accidents. Cohen (1968) observed that alcohol in small quantities adds to intrinsic danger on the road although no driver is absolutely safe however sober he or she is. Sheehan (1973) found that 24% of drivers in the Republic of Ireland took alcohol prior to the driving which led to their accidents. Norman (1963) concluded from his studies that up to 25% of Collisions would be prevented if all road users avoided taking alcohol before using the road.

It is noteworthy to emphasize that all the 37 commercial drivers involved in road traffic accidents in this series said they had not had their meals for several hours prior to their accidents. Blood sugar level determination showed blood sugar levels in the range 38 mg% - 42mg%. This falls below the upper limit of hypoglycaemic level as defined by Johnson (1977) in his studies of blood sugar level of Lagosians. He concluded from his studies that the normal fasting blood sugar of the Lagosians is 60$\pm$5mg% and regarded levels

of 40mg% as biochemically and clinically hypoglycaemic.

Gissane and Bull recorded in their series in 1964 a finding of an average of 5.6 injuries on victims who died as a result of accidents on the Motorways (Expressways) as compared with 3.7 on victims died from accidents on other types of road. This may be interpreted as indicating that speed to a great extent determines the number (and therefore severity) of injuries sustained in road traffic accident.

The finding in the present series was an average of 1.4 injuries on driver victims and 1.9 injuries on pedestrian victims.

These figures are lower than both figures of Gissane and Bull. It is more likely that the speeds of the vehicles travelling on the highways of the metropolis of Lagos are more comparable to those on the urban ways of Britain than the motorways; and even then the number of injuries on the victims in the Lagos series compared with those on non-motorway victims of Gissane and Bull are 1.9 : 3.7; this is approximately a half. It seems more fruitful to look for the factors responsible for death in area other than speed and number of injuries.

According to the Road Research Laboratory (1963) investigation of Coroners' report in Britain showed that between 60 and 70 percent injuries causing or capable of causing death were to the head and neck of vehicle occupants.

In this series 8 drivers and 70 pedestrians died. Of these 4 drivers (50 percent) and 23 pedestrians (32.9%) had head injuries, some with gross brain damage.

It is important to note that post mortem reports were not available on two drivers and 20 pedestrians. Correcting for these it can be surmised that 4 of the 6 driver victims (i.e. 66.7%) and 23 of the 50 pedestrian victims (46%) on whom post mortem reports were available died as a result of head injuries. These compare closely with the 60-70 percent found by the Road Research Laboratory team (1963).

Among the victims of road traffic accidents treated at the Lagos University Teaching Hospital, there were 55 cases of fracture of the cervical vertebra. 43 (78.2%) of the victims were drivers and the remaining 12 were vehicle passengers. Seat belts are not worn by vehicle occupants in this country.

In an editorial commentary the British Medical Journal (1973) observed that during the first twelve months of seat belts being made compulsory in Victoria State, Australia there was a reduction of 12.5% road casualties compared with a 5% rise in each of the previous 10 years.

Pratt et al (1973) found from test of data from a population of over 18000 cases that seat belt wearing was a highly significant factor in reducing driver fatalities.

Russell (1980) reported that in January of last year Sir Henry Yellowlees, Chief Medical Officer said that if all motorists and front seat passengers wore seatbelts it would prevent 1000 deaths and all 11,000 serious injuries from accidents a year as well as saving

£100 million (N125 million).

Pedestrians often suffer more than any other class of road users. Of the 113 deaths in the hospital as a result of road traffic accident during this study 70(61.9%) were pedestrians and this supports the findings of Gissane and Bull (1961) in Birmingham where out of 149 road fatalities, 87 were pedestrians, and on taking the whole series of 183 fatalities in and outside the city 97 resulted in the deaths of pedestrians.

Segregation of pedestrians especially in market area from the traffic could reduce the toll of pedestrians deaths. Most Nigerian mothers carry their babies on their backs and when such a mother is involved in an accident it is not unusual to find that the child she carries has also sustained injuries occasionally fatally. This association confirms our previous observation. (SHYNGLE, 1978).

Author recorded a total of 122 deaths in the present series. Of these 9 were reported as dying on the spot, 65 died within six hours of arrival in the hospital and the remaining 48 died later. Thus 113 road traffic accident victims reached the hospital with various injuries and in various haemodynamic and respiratory deficiency states. Thirty-two of the 65 (i.e. 49.2%) who died within 6 hours of arrival in hospital died within 1 hour of arrival (Table 16)

It appears as if correct first aid and/or better resuscitation could have improved their chances of survival.

CHAPTER VIII
CONCLUSION

In this study of 1650 accidents in Lagos and in which 5802 road traffic accident cases which were managed in the Lagos University Teaching Hospital in one year (1st January 1978 to 31st December 1978), the following were found.

The most frequently injured road user was the pedestrian. They accounted for 57.0%, whilst the least frequently injured is the cyclist accounting for 1.5% of all cases. This probably is not unexpected in a population in which the pedestrian form by far the largest road users, and in which many more people commute from one place to another, more by cars, buses and lorries than do by cycles.

Of the 3307 pedestrians injured, 6 were dead on arrival, and 70 subsequent on arriving in hospital; this makes 76 (2.3%) deaths occurring in this group, on the other hand of 1271 motor cycle riders (motor cyclists and pillion passengers) injured, 23 died (1.8%). Of the drivers, 9 died. It is obvious that the road user at greatest risk in Lagos Metropolis is the pedestrian, followed by the motorcyclist.

The number of injuries sustained per person in each of the above group-driver, pedestrian, pillion passenger - was not significantly different from the number of injuries sustained by the others.
However 23 out of 3307 (0.7%) pedestrians as compared with 9 out of 1271 motor cyclists and pillion passengers, and 4 out of 215 drivers died as a result of injuries

which included the by far more serious fractures of the skull.

Slightly over a fifth (22.4%) of all the injured belongs to the professional group. This is the group in which the car users are to be expected and in which members would be expected to have better road sense. It is also of note that 3% of all the fatal cases occurred in this group.

The largest number injured as the result of road traffic accidents occurred in the age group in the third decade of life. Nigeria has a young population and the peak of its work force is to be found in this age group. This therefore may account for the above. The next highest incidence was found in the first decade of life where 1323 out of 5802 injured occurred.

When the sex distribution pattern of injuries in the two age groups are compared (Table 6); It is of interest that three times as many males as females are injured in the third decade of life.

In the first decade of life approximately as many males as females are injured. This is the period of schooling and both sexes are exposed equally to the dangers of the road, but during the third decade, which is the period when people go out to work, there are few women going to work far from their homes as most of them trade near by. That is, the proportion of the ratio; male to female road users by interference are the periods that injuries tend to occur, possibly, peak period of road usage differ considerably in the two age groups.

43.7% of all the drivers injured in road traffic accidents in this study admitted to having taking alcohol prior to starting on their journey or during their journey. The selling of locally produced alcohol at the road side during all hours of the day was found to be rampant and possibly contributes to the high alcohol consumption amongst drivers in the metropolis.

58.6% of drivers who normally wear glasses were injured or suffered road traffic accident injuries and gave history of not having their eyes tested over the proceeding three years. Evidence was obtained from opthalmology colleagues that significant changes occur in the eyes which may necessitate spectacle changes to age. This figure is very much lower than in the control group of drivers who had, had their eyes regularly tested during the proceeding three years and had not been involved in road traffic accident.

An immediate post accident post injury blood sugar in 37 commercial drivers investigated revealed a blood sugar level between 38mg% and 42 mg%. In the stress produced immediate post injury is hyperglycaemia. The normal blood sugar in Nigerians of the same sex and age group had been reported on by Johnson (1977) as 60 ± 5mg%. It appears that hypoglycaemia from not having meals for long periods before their starting to drive may be a major factor in causing road traffic accidents in these drivers.

The peak period for road traffic accidents causing injuries bringing the victims to the Lagos University Teaching Hospital during the period of 1st January 1978

to 31st December 1978 was found to be between 5 p.m. and 6 p.m. Although there were, more accidents during the daylight hours, increasing during the rush hours in the morning (7am - 9am) and the evening (4pm - 6pm). These period coincide with the rush hours in Lagos, when a large number of people are commuting between their homes and places of work/school and vice versa.

1301 victims were injured during the months of October and November out of 5802 who were injured during the twelve months when this research was conducted. These are the months following the long raining season which lasts from April to September, when a number of roads are flooded, and the pot-holes made wider and deeper. It may be imagined that drivers misjudge the size of the pot-holes still with water and it is possible that the driver could be less careful and thereby making the vehicles unstable and so could cause accidents.

There are few road signs and a number of roads have no side walks. Pedestrians are forced to walk between vehicles that are parked indiscrimately. It was found in this study that road traffic accidents were reduced by 30% where bumps were constructed on a residential road.

Only 4.9% of the victims received first aid at the scene of their accidents. If first aid is widely taught in the country it is possible that more victims will have more chances of survival.

The victims of hit and run got to 19 in the month of June and after a campaign to stop it, the lowest figure of 5 was obtained in December for the year 1978. This is indicative that compaign on road safety can

produce good results as evidence by that of the above.

Considering the number of vehicle occupants who had fracture of the cervical vertebra, a form of restraint against the body being thrust forward when any moving vehicle stops will seem desirable.

It is paradoxical that at a time when many motor cyclists are dying from head injuries as found from this study a number of states in the Federation of Nigeria are passing laws to abolish the compulsory wearing of crash helmets. One can only conclude that those who advise are giving what must be concluded as bad advice.

The overall view which emarged from this study is that if the roads are better maintained, sign posted and vehicles parked properly, the number of accidents in the country could be reduced.

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APPENDIX I

QUESTIONNAIRE - ROAD TRAFFIC ACCIDENT

A. PERSONNAL DETAILS

1. HOSPITAL UNIT NO.

1	2	3	4	5	6

2. DATE OF ACCIDENT _____

3. SURNAME (block letters) _____

4. FORENAMES _____

5. ADDRESS _____

_____

6. OCCUPATION _____ 7 [ ]

(If an adult, or father's occupation in case of a child, husband's occupation in case of housewife)

In the remainder of the form, except where otherwise stated, record the answers by entering the appropriate number in each box.

7. DATE OF BIRTH e.g. 28th June, 1975 - 28 06 75

Day	Month	Year

8 - 9 [ ][ ]

8. SEX
1 = Male
2.= Female

10 [ ]

9. MARITAL STATUS

1. = Single
2. = Married
3. = Widowed
4. = Other
5. = Not applicable (if under 16 years)

11 [ ]

10. PERSONS INVOLVED IN ACCIDENT

1. = Driver
2 = Passenger
3. = Pedestrian
4. = Motor cyclist
5. = Pillion Passenger
6. = Cyclist

12 [ ]

B. MEDICAL DATA

11. ACCOUNT OF ACCIDENT GIVEN BY THE VICTIM

_____

_____

_____

_____

12. WAS ANY FIRST AID TREATMENT GIVEN AT THE SCENE OF ACCIDENT.

1 = Yes
2 = No
3 = Not applicable

13 ☐

13. HAD ALCOHOL BEEN TAKEN BY DRIVER

1 = Yes
2 = No
3 = Not known

14 ☐

14. IF DRIVER USING SPECTACLES, FOR DRIVING WHEN WAS VISION LAST TESTED?

15 ☐

1 = 0 - 1 year
2 = 1 - 2 years
3 = 2 - 3 years
4 = Over 3 years

15. BLOOD SUGAR OF COMMERCIAL DRIVER _____

16. SEVERITY OF ACCIDENT

1 = Slight
2 = Serious
3 = Fatal

16. ☐

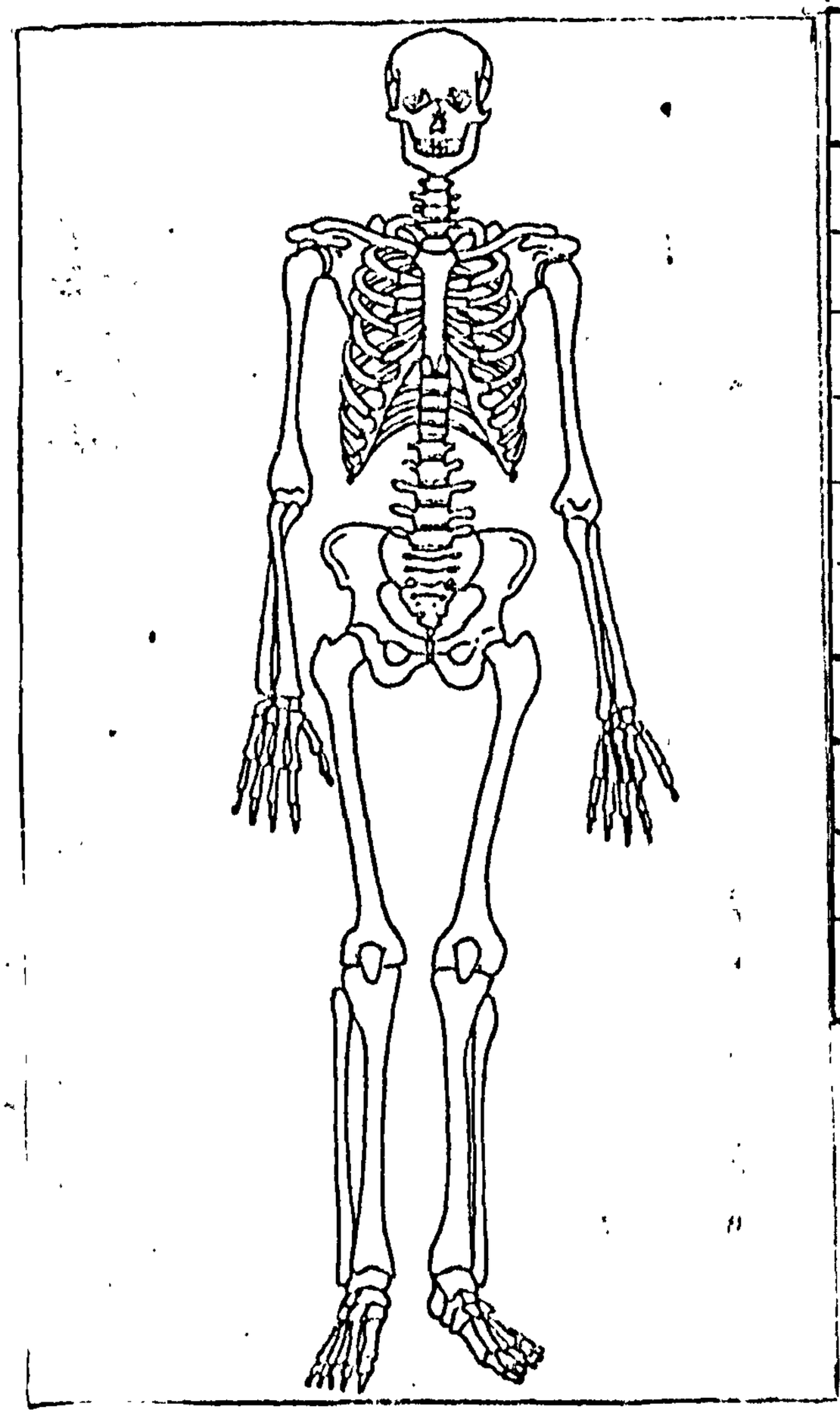
17. TIME OF ACCIDENT _____

18. DETAILED INJURIES SUSTAINED

ABRASIONS	RIGHT SIDE	LEFT SIDE
LACERATIONS		

Table - 19 Abrasions and Lacerations

Indicate Fractured (Sites) on the Diagram.



(Soft Tissue)

SITE OF SOFT TISSUE INJURY	RIGHT SIDE	LEFT SIDE
Head		
Face		
Neck		
Arms		
Hands		
Chest		
Abdomen		
Gluteal Region		
Back		
Legs		
Feet		

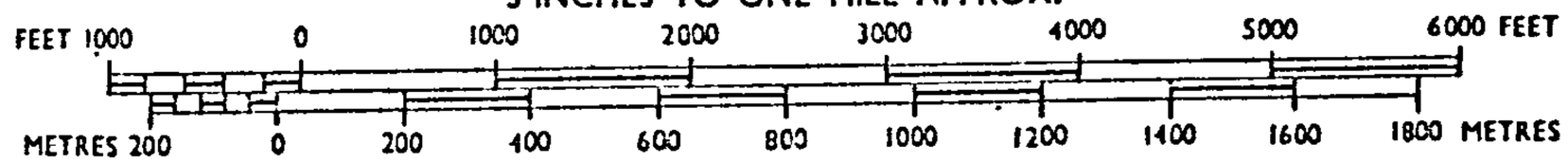
Tick (✓) site of injury in the appropriate box.

Fig. 2 Bony injuries.

LAGOS

SCALE:- 1:20,000

3 INCHES TO ONE MILE APPROX.



LEGEND

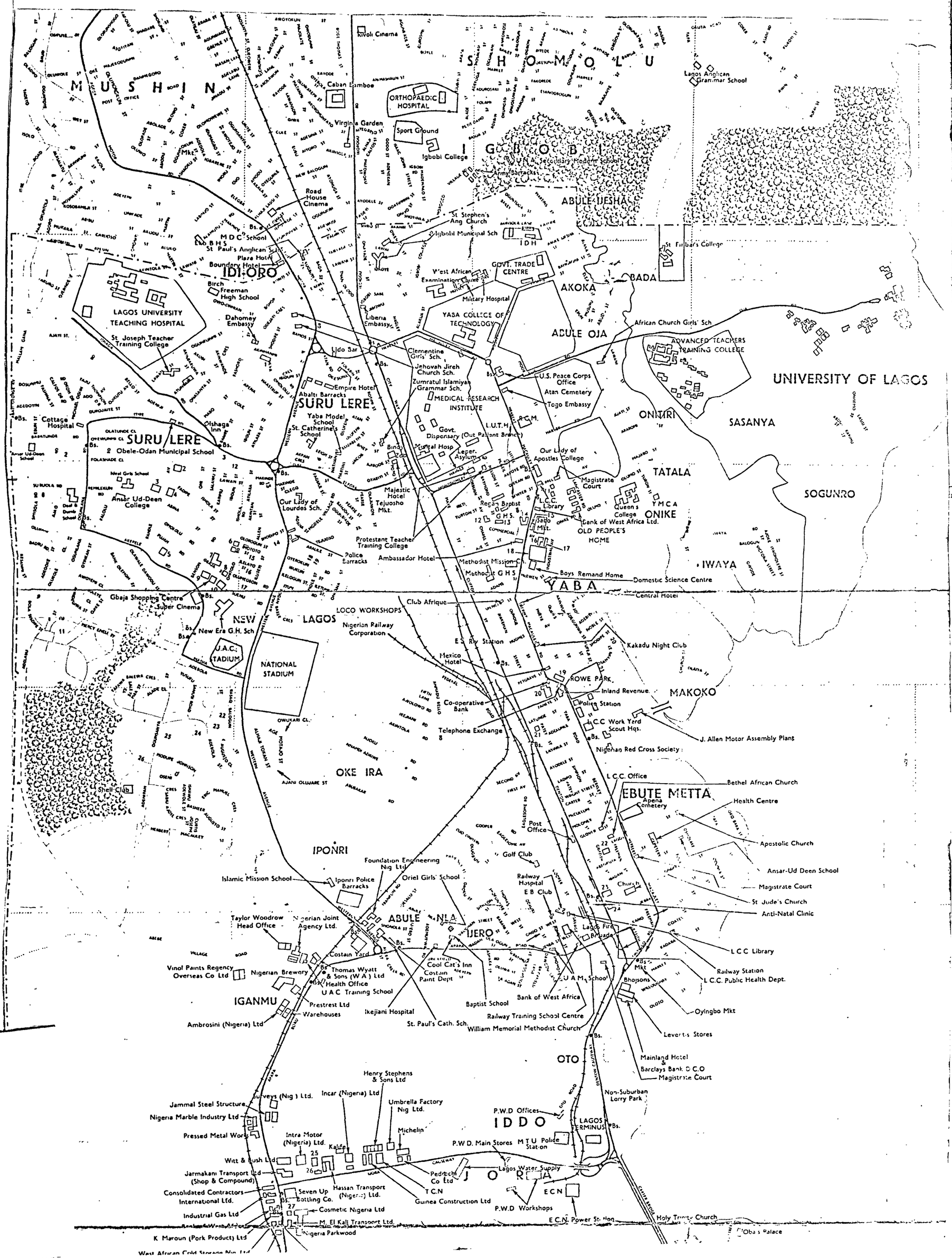
BS..... Bus Stop

Direction of Flow of
.....Traffic in One-way lanes

HOSPITAL CATCHMENT AREA

DRAWN AND PRINTED BY NATIONAL SURVEYS. LAGOS

Appendix 2.


MUSHIN
SHOMOLU
IGBOBI
IDI-ORO
LAGOS UNIVERSITY TEACHING HOSPITAL
St. Joseph Teacher Training College
Dahomey Embassy
Birch Freeman High School
Boundary Hotel
Plaza Hotel
St Paul's Anglican Sch
MDC School
Road House Cinema
Caban Bamboo
Virgina Garden
ORTHOPAEDIC HOSPITAL
Sport Ground
Igbobi College
Army Barracks
Lagos Anglican Grammar School
ABULE IJESHA
St Stephen's Ang Church
Igbobi Municipal Sch
IDH
St Finbar's College
GOVT. TRADE CENTRE
West African Examination Council
BADA
AKOKA
Military Hospital
YABA COLLEGE OF TECHNOLOGY
Liberia Embassy
ADULE OJA
African Church Girls' Sch
ADVANCED TEACHERS TRAINING COLLEGE
UNIVERSITY OF LAGOS
Ido Bar
Clementine Girls' Sch.
Jehovah Jireh Church Sch.
Zumratul Islamiyah Grammar Sch.
MEDICAL RESEARCH INSTITUTE
U.S. Peace Corps Office
Atan Cemetery
Togo Embassy
Empire Hotel
Abalti Barracks
SURU LERE
Yaba Model School
St. Catherine's School
Cottage Hospital
Olshaga Inn
Obele-Odan Municipal School
Govt. Dispensary (Out Patient Branch)
L.U.T.H
P.C.M.
ONITIRI
SASANYA
Binns
Central Hosp
Leper. Asylum
Our Lady of Apostles College
TATALA
Ideal Girls School
Ansar Ud-Deen College
Our Lady of Lourdes Sch.
Majestic Hotel
Tejuosho Mkt.
Magistrate Court
Regan Baptist
G.H.S.
L.C.C. Library
Queen's College
YMCA
ONIKE
Bank of West Africa Ltd.
OLD PEOPLE'S HOME
SOGUNRO
Protestant Teacher Training College
Police Barracks
Ambassador Hotel
Methodist Mission Ch
Methodist G.H.S
Boys Remand Home
Domestic Science Centre
IWAYA
YABA
Central Hotel
Gbaja Shopping Centre
Super Cinema
New Era G.H. Sch
U.A.C. STADIUM
NEW LAGOS
NATIONAL STADIUM
LOCO WORKSHOPS
Nigerian Railway Corporation
Club Afrique
E.S. Rly Station
Kakadu Night Club
Mexico Hotel
ROWE PARK
Inland Revenue
MAKOKO
Co-operative Bank
Police Station
L.C.C Work Yard
Scout Hqs.
Telephone Exchange
J. Allen Motor Assembly Plant
Nigerian Red Cross Society
OKE IRA
L.C.C. Office
Bethel African Church
EBUTE METTA
Apena Cemetery
Health Centre
Shell Club
Post Office
Apostolic Church
IPONRI
Foundation Engineering Nig Ltd
Golf Club
Ansar-Ud Deen School
Islamic Mission School
Iponri Police Barracks
Oriel Girls' School
Railway Hospital
E B Club
Church
Magistrate Court
St Jude's Church
Anti-Natal Clinic
Taylor Woodrow Head Office
Nigerian Joint Agency Ltd.
ABULE NLA
IJERO
Lagos Fire Brigade
L.C.C Library
Costain Yard
Vinol Paints Regency Overseas Co Ltd
Nigerian Brewery
Thomas Wyatt & Sons (W A) Ltd
Health Office
U A C Training School
Cool Cat's Inn
Costain Paint Dept
U A M School
Bhojsons
Railway Station
L.C.C. Public Health Dept.
IGANMU
Prestrest Ltd
Warehouses
Ikejiani Hospital
Baptist School
Bank of West Africa
Oyingbo Mkt
Ambrosini (Nigeria) Ltd
St. Paul's Cath. Sch.
Railway Training School Centre
William Memorial Methodist Church
Leventis Stores
OTO
Mainland Hotel
Barclays Bank D.C.O
Magistrate Court
Henry Stephens & Sons Ltd
Surveys (Nig) Ltd.
Incar (Nigeria) Ltd
Umbrella Factory Nig Ltd.
Non-Suburban Lorry Park
Jammal Steel Structure
Nigeria Marble Industry Ltd
P.W.D Offices
IDDO
LAGOS TERMINUS
Pressed Metal Works
Intra Motor (Nigeria) Ltd.
Michelin
P.W.D. Main Stores
MTU Police Station
Witt & Bush Ltd
Lagos Water Supply
Jarmakani Transport Ltd (Shop & Compound)
Pedrosch Co Ltd
JORDAN
Consolidated Contractors International Ltd.
Seven Up Bottling Co.
Hassan Transport (Nigeria) Ltd.
T.C.N
Guinea Construction Ltd
ECN
Industrial Gas Ltd
Cosmetic Nigeria Ltd
P.W.D Workshops
M. El Kali Transport Ltd.
E.C.N. Power St. Hon
Holy Trinity Church
K Maroun (Pork Product) Ltd
Nigeria Parkwood
Oba's Palace
West African Cold Storage Nig Ltd

Appendix 3.

Method used for determination of Blood Sugar

Protein free filterate was obtained by pipetting 0.1 ml. blood into 2.9 ml. of precipitating reagent. (The reagent is made up from the following:-

NHCl,
Sodium tungstate,
Sodium hydrogen phosphate and
Sodium Chloride Solution).

1.0 ml. of filterate was added to 3.0 ml. of the colour reagent, (This reagent was made up from the following:-

Hydrogen Phosphate,
Glucose oxidase (Ferm cozyma)
Peroxidase and
4 - amino Phenazone (AAP).

The solution obtained by the mixture of the filtrate and colour reagent was incubated at 37^{oc} for ten minutes. The resulting colour was read at 520 nanometer (NM), to give the blood sugar level of the drivers.