ROAD TRAFFIC ACCIDENTS*
EPIEIDEMIOLOGY, CONTROL AND PREVENTION

INTRODUCTION

Accidents today are among the leading causes of death—in some cases the No. 1 cause—in many parts of the world, particularly in the more highly industrialized nations. The great number and more serious injuries cause enormous human suffering and economic loss. Accidents have become a new 'epidemic' of public health importance, calling for great efforts in control and prevention.

Among all types of accidents—in the home, in places of work (e.g. mines and industries), at play (e.g. sports), and elsewhere—those caused by motor vehicles claim the largest toll of life and tend to be the most serious. The present study of road traffic accidents is by Dr. L. G. Norman, Chief Medical Officer of the London Transport Executive and is an outgrowth of the interest in this problem that was aroused by the 1961 World Health Day with its theme 'Accidents and their prevention'.

The problem of road traffic and accidents on a large scale has arisen for the first time in the present century. All other epidemics throughout history have been due to the onslaught of agencies external to man, principally the protozoa, bacteria, and viruses. A terrible penalty in mortality has already been paid as the cost of integrating the motor vehicle into modern life. The motor vehicle itself has developed from somewhat primitive beginnings to a stage in which a set of armchairs, fully enclosed in a mass of metal often weighing a ton or more, can be hurled from a standstill to 50 or 60 miles an hour or more in a matter of seconds by the lightest touch of a couple of levers; and all this occurs on roads that were mostly built for horse traffic. It is not surprising that an accident problem has arisen.

A somewhat similar problem arose in the 19th century during the early development of railways, but in 1830 railway tracks were segregated from all other traffic, including pedestrians. This would appear to be the safest line of development for the handling of motor traffic, particularly in built-up areas and on main roads.

Road accidents are amenable to consideration by the methodology applied to epidemic disease, including the detailed investigation of individual accidents and the application of epidemiological techniques, as discussed later. All road users are concerned in the prevention of accidents, but attention must focus especially on drivers of motor vehicles because they may endanger the lives of other road users as well as their own. It is increasingly realized that driving is a privilege and not an inherent right; a privilege that can and should be withdrawn if it is shown that it may endanger others.

When one considers the achievements of human beings on the road in a detached way—for instance, by trying to determine what sort of automatic device could be introduced to do the job instead—one is lost in admiration for their success. Thus in the USA in 1959, the average driver would have had to travel about 400,000 miles before becoming involved in an accident resulting in injury to a person severe enough to cause death, or disablement beyond the day of the accident. At an average speed of 30 miles an hour, this represents a driving time of about 13,000 hours. Since the average "development time" for an accident is probably less than 10 seconds, drivers appear to possess remarkable powers of concentration. It has been suggested that the limit of human performance is being reached in this respect and that the consequent accidents are the inevitable price of motorization. It has been demonstrated in other fields, in industry for example, that accidents are preventable, and motor vehicle accidents are no exception. The motor vehicle itself has developed from somewhat similar accident prevention measures.

Finally, in the prevention of mortality among the injured in road accidents, a high standard of emergency care is vitally important. Modern accident hospitals have a most important place in the emergency facilities and the casualty and the surgical team should be brought together in the shortest practicable time after an accident.

CHAPTER I. IMPORTANCE OF ROAD TRAFFIC ACCIDENTS

Mortality and morbidity from road traffic accidents assume greater importance as a country becomes more highly developed. Thus the size of the problem is indicated by the fact that, in 1957, in the 47 member states of the WHO, 102,552 people in a total population of some 650 million were killed in such accidents. No records are available of the much larger numbers that are injured, many of them seriously and some permanently crippled or disabled. The present position is that all over 100,000 people are killed in road traffic accidents in the world annually and this number is increasing.

Males aged 15-30 are especially involved; fatal accidents in this group represent not only tragic family losses, but also a serious economic loss to the community, for the education and training of these young men has been wasted. It has been estimated in Canada that only one in ten of these children who reach their first birthday and would normally survive to the present life expectancy of 70 years, the loss from road traffic accidents each year is more than 105,000 years of normal life expectancy. Statistics put the mortality from motor accidents into perspective and call attention to the fact that in many countries deaths from motor vehicle accidents in males in 1958 exceeded those from tuberculosis (all forms), acute poliomyelitis, typhoid fever, diphtheria and diabetes mellitus, added together. Among females in these countries fatal road traffic accidents were fewer, but still prominent among the causes of death. In the USA for example, deaths from traffic accidents exceed the combined deaths from all infectious and communicable diseases. These accidents may be considered a major cause of death in the maximum wage-earning period of a man's life. The economic loss in addition is particularly serious. It has been estimated that in Japan the cost of property damage alone from road traffic accidents is about R\$4,038,000 a year.

CHAPTER II. EPIDEMIOLOGICAL FEATURES

Epidemiological techniques are especially appropriate for the study of road traffic accidents because so many variables are involved in their causation. The size of the population at risk of accident according to sex and in age groups, must be known in order that the incidence of accidents may be calculated.

Road traffic accidents do not usually have a single 'cause'. Each individual accident is likely to have several causative factors. Search for single causes of accidents is therefore likely to prove unproductive. Instead, a general conceptual framework is required in which the different elements in accident situations can be evaluated and identified for analysis. One of the most important of these factors is the deleterious effects of alcohol on the performance of road users, described in Chapter IV.

Mortality Rates from Motor Traffic Accidents

It is important that an attempt should be made to collect national data on a prospective basis. The only existing data is not being done, so that accident rates in different countries are not comparable. The information so acquired can be used to reveal favourable and unfavourable trends in individual countries.

National Mortality Rate

The countries which showed a rising mortality from 1955 to 1958/1959 were the Union of South Africa (white popula-
The proportion of multiple-vehicle accidents to the total number of road traffic accidents increases as traffic increases. For example, in the UK the proportion of accidents involving 3 or more vehicles rose from 1.5% in 1936 to 4.7% in 1953. Again, the number of pedestrian casualties per motor vehicle decreases as the number of motor vehicles increases. Thus, between 1946 and 1953 the number of pedestrian casualties per registered motor vehicle was approximately halved. In Switzerland, Sweden, the UK and Ireland, pedestrian fatalities per million vehicle-miles of travel were also approximately halved in the same period. However, during this period the total number of pedestrians killed annually increased in each of these countries.

Age and Sex Differences in Road Traffic Accident Mortality

In the countries from which accident statistics are available, the peaks are well marked. There are two peaks of mortality, the 15-24 and the 65-and-over age groups. The high mortality from road traffic accidents among young men in the more highly motorized countries is striking.

In every country, taking all ages together, the mortality of road traffic accidents is 3-5 times higher in males than in females. As might be expected, no difference is evident below the age of one year, but already at the age of 1-4 years males have a higher mortality. It appears likely that the ratio of male to female pedestrian mortality is roughly the same in most countries.

Categories of Road Users in Road Accidents

1. Pedestrians. The age distribution of fatally injured pedestrians is not even. The child pedestrian from the age when it begins to walk to the age of 10 is at special risk; so is the elderly pedestrian from the age of 65 upwards. The accident rate per million living is very high in pedestrians over 80 years of age. Part of the high mortality in elderly pedestrians is due to the increased liability of the older person to succumb from an accident which a younger person might survive. This is shown by the ratio of injured to killed pedestrians of different ages; there is a steady reduction in this ratio with increase in age.

The total number of pedestrians injured is about 25 times the number killed. Minor injuries are not always reported. There is a seasonal variation in pedestrian deaths; as might be expected more deaths occur in the winter months with their longer hours of darkness. Pedestrian mortality is high at periods of peak travelling during working days.

2. Pedal cyclists. There is a relatively high proportion of pedal-cyclist deaths in the total road traffic accidents among children from about 7 to 15 years of age, and in elderly people from the age of 50 upwards. The cyclist is unprotected physically, except where special cycle tracks are used, and a severe degree of injury may follow even a minor collision with a motor vehicle.

3. Motor cyclists. The motor cyclist is also relatively unprotected. In the UK in 1959, out of a total of 6,520 persons killed in road accidents, 1,128 (17.3%) were motor cyclists. In the USA there are only about 1% of motor cyclists and they accounted for 1.3% of the fatal accidents in 1957. Motor-cycle deaths affect the younger age groups most heavily: about 70% of such deaths were in the age-group of 18-40 in the UK in 1959.

The following information is of importance:

(a) Motor cyclists aged 16 appear to have appreciably more accidents both per rider and per miles than those aged 17.

(b) The same conclusion holds as the age range 17-20 is ascended. The older the rider, the lower the accident rate.

(c) Motor cyclists with less than 6 months' experience have about twice as many accidents as those more experienced.

(d) The more powerful the machine the higher the accident rate.

(e) The above conclusions are unaffected by the exclusion of accidents involving only slight injuries; for the heavy machines a higher proportion of accidents were serious and fatal.

(f) There is no difference in the accident rates between motor scooters and motor cycles of the same cylinder capacity.

4. Drivers of cars, commercial and passenger vehicles. It has been shown that when injuries do occur, they are nearly as often fatal in car drivers as in motor cyclists. The motor vehicle driver is not alone responsible for road traffic accidents. Nevertheless, the following factors are known to affect the incidence of accidents among drivers:

(a) Age and experience. It is generally accepted that younger drivers have more accidents than middle-aged ones. Thus drivers under the age of 25 have a considerably worse accident ratio than that of all drivers taken together, both for fatal accidents and for all types of accidents. However, the lowest fatal accident ratios are those for drivers aged 55-59, which are less than half those for drivers under the age of 25. In some countries, insurance companies, before issuing a policy, require that all owners of a motor vehicle should submit a medical certificate of their fitness to drive. The records of insurance companies do not always provide satisfactory material for an analysis of road traffic accidents.

(b) Sex of drivers. Contrary to popular opinion there is little evidence to show whether male or female drivers are the more liable to accidents. It appears, however, that the accident rate of woman motor vehicle drivers is disproportionately high.

Incidence in Urban and Rural Areas

There are considerable differences in the incidence of different types of road traffic accidents between urban and rural areas. Collisions between motor vehicles resulting in fatal injuries are 6 or 7 times more numerous in rural than in urban areas. Similarly, overturning, running off the roadway, and collisions with fixed objects as fatal causes of accidents are much more common in rural areas.

Seasonal Prevalence

In countries with well-marked seasons there is a difference of incidence at different times of the year. Thus, in winter, fog, ice and snow lead to increased collisions. In the USA the highest adult pedestrian mortality occurs in December; the number of pedestrian casualties per motor vehicle was also approximately halved. In Switzerland, Sweden, the UK and Ireland, pedestrian fatalities per million vehicle-miles of travel were also approximately halved in the same period. However, during this period the total number of pedestrians killed annually increased in each of these countries.

Incidence in Darkness and Daylight

It is generally accepted that accidents occur more frequently in the hours of darkness than in daylight. Night fatal accidents on main rural roads reach a peak rate between 2 and 4 a.m. in the USA. During these, hours the rate is about 21 fatal accidents per 100 million vehicle-miles travelled, more than twice as high as from 9 to 11 p.m. From 6 a.m. to 6 p.m. the rate is below 5 fatal accidents per 100 million miles travelled.

Hour of the Day and Day of the Week

In the USA the time of day with the highest accident rate is from 4 to 8 p.m. This is because more people are travelling...
then than at any other time. As would be expected, school children have relatively high casualty figures on Mondays and Fridays between 8 and 9 a.m. and 4 and 5 p.m. compared with other times.

CHAPTER III. CAUSATIVE FACTORS

There is usually more than one 'cause' of any single road traffic accident.

The Road

There is a strong association between road traffic accident rates and design, construction and surfacing of roads. Well-designed roads tend to reduce accident frequency, as do well-lighted roads.

Climatic conditions probably influence the incidence of road accidents. In the USA, 82% of road accidents occur in clear or cloudy weather, 13% in rain, and 3% in fog.

In the design of roads, complete segregation of pedestrians from traffic, where separation is practicable, reduces to a vanishing point the risk of injury to pedestrians. Similar separate provision for cyclists also reduces the hazard to that category of road user.

The Vehicle

The proportion of accidents in which a mechanical defect or failure of the vehicle makes a gross and obvious causative contribution is small (2.5% in the UK). In various countries there is compulsory testing of all motor vehicles; in New Zealand, for example, this is required every 6 months and about 40% of vehicles are found to have defects, most of them readily remediable. Defects in such important safety factors as brakes, lights, tyres, and steering are evidently common. Even minor defects are important.

The driver of a modern vehicle sits in an atmosphere which may be fairly completely sealed from the outside air. The resulting warm and comfortable conditions may induce drowsiness. The air intake for car heaters and ventilators should be so positioned that it is well away from the exhaust of the next vehicle in front. If this is not done, a dangerous quantity of carbon monoxide may be drawn into the vehicle while it is stationary in traffic.

These problems of vehicle design rest with the vehicle manufacturers. But a higher standard of safety in the vehicle may mean a higher first cost.

The Driver and other Road Users

Driving is a skill which requires training, and like other skills it can be maintained at a high level only by regular practice. It has been calculated that during an average mile, 200 observations and 20 decisions are made, and that 1 error per 2 miles and 1 near-collision per 500 miles occur. A personal and emotional adjustment offers a promising field for the study of accident causation. The proposition that 'a man drives as he lives' was originally put forward by Tillman and Hobbs. They found that a high-accident-rate group of taxi drivers contrasted with the low-accident group in showing marked intolerance for authority, aggression, and an unstable home background. This lent support to the view that the personal characteristics of the road users exert considerable influence on the accident rate.

It appears that as a man ages in the middle range, his reactions become slower, his hearing diminishes, and his eye-hand coordination deteriorates — but he becomes a safer driver. This is probably due to the avoidance of the accident situation which increased experience permits him to do.

Accident Proneness

It is preferred that the term 'accident repeater' be used rather than 'accident prone', because some drivers have repeated accidents while others have fewer than the average. The improvement or elimination of accident repeaters would obviously be effective in reducing the number of accidents but, if the condition is temporary, a new crop of 'accident repeaters' might be found in successive time periods. It is possible that a small group of problem drivers exists, but such a group has not yet been clearly identified.

Fatigue

A recent view is that fatigue is an outcome of frustration and conflict within the individual. Motor vehicle driving in itself does not produce the usual symptoms of physical fatigue, unless it is prolonged for many hours. While no detailed studies have been made of fatigue in relation to road accidents, it is known that in a proportion of accidents the driver was asleep, and it is assumed that fatigue may be a contributory factor in a larger number of accidents. For example, 3.8% of drivers involved in fatal accidents in the USA in 1959 were recorded as having been asleep or fatigued at the time of the accident.

The proportion of all road traffic accidents which is due to fatigue in a driver is unknown. Skill fatigue may be of some importance in the causation of road accidents, but the part which it may play is as yet unknown. The concept of skill fatigue was developed earlier in aviation-accident studies. At first the right actions tend to be performed at the wrong time, then later wrong actions are performed and gross errors are made. A typical example, of a kind which many experienced drivers have observed in themselves, is that of a driver at night who 'halts at an intersection where there are no traffic lights and waits patiently for the green; then, 'pulling himself together', he dashes on, intent on the clear roadway ahead and deriving no meaning from the headlight of the oncoming vehicle'.

Speed

The speed of a vehicle is, or should be, entirely under the control of the driver. Proceeding at a speed that is excessive in view of the traffic conditions is a common contributory cause of accidents, and one for which the driver must be held at least morally if not always legally responsible. In the USA excessive speed is the commonest of the recorded faults of drivers involved in accidents and was recorded in 31% of all fatal road accidents in 1959. In the UK, in 1958, excess of speed was given as a cause of 7% of accidents in that year.

It is probable that many accidents would not have happened at all if the vehicle concerned had been proceeding more slowly in the first instance. The effect of speed may be considered in another way. If all vehicles were mechanically controlled to say, a maximum speed of 70 m.p.h., fatal and serious accidents would be virtually eliminated, but such a price might be considered too high, in social and economic values, to pay for safety.

It is not always realized that the distance within which a vehicle will stop after the brakes are applied increases with the square of the speed. If on a dry road a vehicle with excellent brakes, travelling at 30 m.p.h., stops in 45 feet after the brakes are applied, at 60 m.p.h. this distance will become 180 feet — four times the braking distance at twice the speed. In an emergency, these distances must be added the distance travelled during the reaction-time period, i.e. the interval before the driver actually applies the brakes. A study of speed in relation to injuries to the occupants of motor vehicles involved in collision was undertaken by the Automotive Crash Injury Research Team (1958). It was found that a steady increase in the frequency of dangerous and fatal injuries occurred as impact speed or travelling speed increased.

CHAPTER IV. ALCOHOL AND ROAD TRAFFIC ACCIDENTS

There is much evidence to indicate that alcohol consumption by a road user is a major factor in road traffic accident causation. The only controlled study of pedestrian fatalities so far made showed that 47% of those killed had a blood-alcohol level of 50 mg. per 100 ml., a much higher proportion than in a control group of pedestrians not involved in accidents. The pedestrians fatally injured who were included in this study consisted largely of a group of middle-aged people who had been drinking heavily.
Proportion of Road Traffic Accidents caused by Alcohol

A considerable body of evidence has been collected on this important problem. Official statistics may underestimate the number of accidents caused by alcohol where they are based on police reports and police may be reluctant to record that a drink contributed to an accident unless there is a likelihood of prosecution following. Thus, while in the UK in 1958 only 0-66% of the accidents were considered to be due to drivers being under the influence of drink or a drug, Spriggs (1956) studied police reports of all fatal road traffic accidents and concluded that in 9% there was a reasonable probability of intoxication, and in a further 15% there was a suspicion of intoxication. Of the deaths after 10 p.m., 30% were considered to be due to intoxication.

Quantitative Relation of Alcohol Consumption to Driving Safety

The effects of small doses of alcohol on the efficiency of performance in a Miles motor-driving trainer were studied by Drew et al. in 1958/59. It was found that the level of alcohol in the blood is a good indicator of the extent of impairment of performance.

Urinal and blood analyses were compared with blood analysis and the results obtained with a 'breathalyzer' apparatus were regarded as good enough to warrant consideration from a practical point of view.

The performance of drivers in an actual driving class after taking alcohol was studied. Three groups of drivers were given the tasks of deciding whether they could drive between two posts and then actually undertaking the drive. It was found that the performance of the drivers, as well as their judgment, deteriorated progressively as they consumed more alcohol. An important finding was that the trustworthiness of a man's judgment of his driving skill was impaired after even a small quantity of alcohol, producing a blood concentration lower than 50 mg. per 100 ml.

The BMA report in relation to road accidents contained, inter alia, the following conclusions:

'It is a high proportion of accidents in which pedestrians have received fatal injuries it has been found that the victim has taken alcohol; relatively low concentrations of alcohol in the tissues cause a deterioration in driving performance and increase appreciably the likelihood of accidents; clinical examination in the absence of biochemical tests is neither sufficiently sensitive nor sufficiently reliable to detect deterioration in driving performance of this degree. A clinical examination is, however, an essential part of the examination of persons suspected of driving vehicles under the influence of alcohol. The only way of detecting alcohol at the time of the accident is to stop the vehicle and test the driver's skill. The present procedure of a doctor, who is not clairvoyant, is to advise the driver to drive as a motor vehicle when the concentration of alcohol in the tissues is in excess of a certain level.'

The WHO Expert Committee on Alcohol reports: 'Taking into consideration (1) the investigations performed in recent years on the effect of alcohol on different functions in laboratory experiments; (2) the results of statistically designed practical tests on drivers, air pilots etc., and (3) the statistical evidence from the few adequate studies existing on alcohol and road accidents, the inference cannot be avoided that at a blood-alcohol concentration of about 50 mg. per 100 ml, a statistically significant impairment of performance is observed in more than half the cases examined.'

Chapter V. Medical Factors in Causation

A number of common medical conditions may have a causative relation to road traffic accidents, though they are responsible for only a small proportion of the total of such accidents.

Disease and Road Accidents

Acute diseases, particularly at their onset, may affect the safety of drivers and other road users. No information is available about the number of accidents caused in this way.

Chronic diseases may increase the risk of road users, especially in motor vehicle drivers who suffer from disabilities which may cause a sudden loss of consciousness, impaired concentration or defective eye-hand coordination and reaction to traffic conditions.

Epilepsy

Nothing is known of the number of accidents caused by epilepsy in road users; examples have been reported from time to time, but evidence of the occurrence of the seizure preceding an accident is rarely found. This may be due to concealment or to the transitory nature of the seizure. The general term 'black-out' which, in a driver, accounts for some accidents, may cover some cases of epilepsy. The present practice in the USA regarding the granting of driving licences to epileptics varies from State to State. In 18 States licences were granted on the basis of a medical control of seizures; in others an interval of 1-3 years' freedom from attacks is required. The effectiveness of these procedures in accident prevention is not known. It is probable that epilepsy in its various forms is an occasional cause of motor vehicle accidents. The responsibility for avoiding the hazard appears to lie primarily with the epileptic driver himself, to some extent with the authority which issues driving licences 'when a disability is known', and with the medical practitioner when the driver seeks medical advice.

Cardiovascular Disease

Ischaemic heart disease (myocardial infarction) accounts for a third of the cases of loss of consciousness when driving a motor vehicle. Such cases are rare.

It has been shown that the risk of a second coronary episode may be about 10 times as high as the risk of the first. For this reason it is generally recommended that a man should not drive a passenger-transport vehicle after he has been found to have ischaemic heart disease.

Diabetes Mellitus

Drivers of any kind of motor vehicle whose diabetes is controlled by diet alone do not run the risk of hypoglycaemia and are safe to continue their work so far as their diabetes is concerned.

Impairment of Hearing

Little is known about the accident liability of deaf or partially deaf drivers. Deafness would appear to be a handicap to a pedestrian, but there are no statistics of accident-frequency in the deaf. Nevertheless many opinions have been expressed, most of them suggesting that traffic accidents are no more frequent among deaf drivers than among those of normal hearing. Some consider that the deaf are generally safer drivers and that presumably they are cautious and alert because they are more aware of their handicap. At present there is no evidence on which to suggest that deafness in motor vehicle drivers contributes at all to the total of road traffic accidents. Deafness would appear to be a more likely hazard to a pedestrian.

Eyesight and Road Accidents

Defective colour vision has not been shown to be associated with any increased liability to road traffic accidents, and unless in special circumstances does not seem to be in any way a factor in accident causation.

Drugs and Road Users

All types of road users, including pedestrians, will obviously become unsafe if they use the roads after consuming narcotic or hypnotic drugs in sufficient amounts. Drug addicts, at least in the active phase of their addiction, should not drive motor vehicles. In addition, performances of drivers may be adversely affected by many drugs which are in common use today, many of them obtainable without a doctor's prescription.

There are now in common use powerful drugs which can lower the blood pressure, affect the personality and alter the blood chemistry, and any of these may adversely affect the patient's performance and safety as a motor vehicle driver. It is the duty of the doctor who prescribes a drug which may be dangerous to a driver to inform his patient of the possible dangers of driving after taking it.

Chapter VI. Prevention: Present Practice and Future Perspectives

The Road

In 1952 in the UK, pedestrian fatalities fell by over 10%; this was the year in which the 'zebra' pedestrian crossings were
introduced. There are innumerable specific examples where the widening of a narrow section of road, the building of an overpass (flyover) or underpass or other road improvements have been the subject of accidents occurring in particular sites. As far as pedestrians are concerned, complete segregation from the highways is possible in some areas as a very effective accident-prevention measure. Such separation may be possible on main highways and in some city shopping and business areas.

The Vehicle
Improved visibility for the driver is a feature of present-day vehicle design and may be presumed to reduce accident risks. Study of the effects of safety belts in preventing casualties has verified the importance of their role in injury reduction. The Automotive Crash Injury Research Team has also shown that the removal of dangerous projections from the interior of vehicles contributes considerably to reduction of injuries affecting the occupants. It is generally agreed that the removal of sharp and dangerous projections from the exterior of vehicles reduces the injuries to pedestrians involved in collisions with motor vehicles.

Good maintenance of motor vehicles is the responsibility of the owners of the vehicles and should be a factor in reducing traffic accidents. In 1949, the 12 States of the USA required periodic inspection of vehicles and in these States the motor vehicle death rate per 100 million vehicle-miles was 5.9 compared to 7.2 in States not requiring inspection.

The Road User
Improved performance by road users is probably the most important factor in accident prevention. The evaluation of the results of training of drivers is of great interest.

An example of the effectiveness of legislation covering road users in the prevention of road accidents is provided by those countries in which legislation makes it an offence for a driver with a blood-alcohol concentration above a stated amount to drive a motor vehicle. When the State of Tennessee in the USA introduced mandatory blood-alcohol tests for drivers in 1956 associated with surprise highway checks by the police, there were 16% fewer fatalities than in 1955. During the same period 40 other States of the USA showed an increase in traffic fatalities.

Emergency Medical Care
Efficient accident services, promptly available, may in some instances save life more frequently and may, prevent the worsening of injuries received in road-traffic accidents. Accident services, more speedily available in cities than in rural areas, therefore play an important part in the prevention and reduction of mortality.

Modern accident surgery can make a valuable contribution; prompt and efficient treatment by an experienced surgical team considerably increases the patient's chance of recovery in many cases and shortens the period of incapacity in most. In major cities it is relatively easy to organize the rapid removal of casualties to particular hospitals where special units for accident surgery are provided. In rural areas there may be great distances between the site of an accident and the nearest surgical team, but a well-organized casualty service can still do much to promote recovery from injuries received in motor traffic accidents.

The Future
The road user. Effective prevention of road traffic accidents is, in the main, in the hands of the road users. A steadily improving standard of performance by road users will reduce the accident toll correspondingly. No single measure is likely to be effective in itself and increasing efforts are needed in many sectors as new generations of road users grow up and need to acquire safe habits and techniques.

Education. Safety education should start with very young children who should be taught how to behave as pedestrians in modern road traffic. Such education must be the responsibility of the parents until the child attends school. Education in road safety continues through life into old age when pedestrians are especially vulnerable. An important aim of road-safety education is to improve the driver-pedestrian relationship. Certain safety rules should be impressed on pedestrians at an early age, such as the importance of facing oncoming traffic and of wearing some white object at night so as to be clearly visible to motorists.

Training. The training of motor vehicle drivers is of the greatest importance. Before being allowed to drive on a public road unaccompanied by an experienced driver, the learner should have a thorough grounding, not only in the technique of handling the vehicle, but also in behaviour on the road and in safety. The training period before a driving licence is first obtained should be spread over a period of several months, although it may be less if training is given full-time. Whether driving a motor vehicle is regarded as a privilege or as a right, no one should be permitted to drive until he has shown himself to be competent.

General
In urban areas, and particularly in modern cities, speed restrictions are commonly imposed on motor vehicles. Where there are large areas of business properties in which legislation makes it an offence that they are strictly enforced. Thus, if pedestrians are permitted to cross roads only at recognized and clearly marked crossings where they have priority, there should be a reduction in pedestrian accidents. This legislative procedure should be regarded as only the first step in the important principle of segregating pedestrians from road traffic.

It is essential that public opinion should hold widely and strongly to the view that safety is more important than speed. Good manners are life-saving on the road.

Both for accident repeaters and drivers who have been found guilty of traffic offences, a 'traffic clinic', such as those in Detroit and in the State of New Jersey in the USA, may be of considerable value.

Finally, there is the difficult question of education and legislation regarding consumption of alcohol by drivers. As discussed earlier, it appears likely that some 25-30% of road accidents are associated with the consumption of alcohol and would probably not have occurred if road users had not been drinking. In most countries it is an offence to drive (in some, to be in charge of) a motor vehicle while under the influence of alcohol to such an extent as to be incapable of proper control of the vehicle. This usually means clinical intoxication and, as has been shown, a driver's performance and safety begins to deteriorate considerably before intoxication is apparent clinically. Tests may be made after accidents or at other times, generally using breath-exhalation tests, which are considered to give a reliable indication of the amount of alcohol in the blood stream. There can be no doubt that if no motor vehicle drivers ever drove when their blood-alcohol level was 50 mg. per 100 ml. or more, there would be a reduction in accidents, and legislation to this end might therefore be an effective accident-prevention measure.

CHAPTER VII. NEED FOR FURTHER INVESTIGATIONS AND RESEARCH

The author concludes that there is an important need for the collection, summarizing and distribution of research findings, both from a national and an international point of view. The research projects discussed above do not form a complete list, nor are any project been discussed in detail, but sufficient indication has been given of the many fields in which research is needed.

However, in other recommendations that can be inferred from the writing — the author makes no direct suggestions — a plea is made for insisting that a man drives as he lives.