THE EPIDEMIOLOGY OF ROAD TRAFFIC ACCIDENTS

Report on a Conference
Vienna, 4-7 November 1975

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INTRODUCTION

In collaboration with the Government of Austria, the Regional Office for Europe of the World Health Organization convened a Conference on the Epidemiology of Road Traffic Accidents in Vienna from 4 to 7 November 1975. The purpose of the Conference was to consider ways in which scientific techniques, including epidemiology, could be applied to the prevention of deaths and injuries from road traffic accidents. The terms of reference included the identification of high-risk groups of road users and of situations in which serious accidents are likely to happen.

The Conference was attended by participants from 18 European countries and by representatives of three international organizations. A full list of participants is to be found in Annex 3.

The Conference was opened by Dr A. Krassnigg, Director-General of the Austrian Ministry of Health and Environment, on behalf of the Minister of Health, Dr Ingrid Leodolter. In his welcoming address he emphasized the importance of the subject and Austria’s concern with the prevention of traffic accidents. He explained that legislative provisions had been adopted as early as 1910 and that the human factors involved in road traffic accidents were recognized as of major importance. If acceptable solutions were to be found to this extremely complex problem, a multidisciplinary approach was necessary. He concluded by wishing the Conference success on behalf of the Federal Government of Austria and of the Minister of Health and Environment and expressed the interest of the Government in participating in further studies in this important field.

Dr F.A. Bauhofer, Director of Health Services of the Regional Office for Europe, welcomed participants on behalf of the Regional Director, Dr Leo A. Kaprio, and thanked the Austrian Government for its generosity in making funds available to assist the holding of the Conference.

Dr Bauhofer outlined the long-term programme that had been developed by the European Office, beginning in 1964. He emphasized that whereas the Regional programme had originally been concerned mainly with the consequences of accidents, it was now necessary to give more attention to preventive aspects, which required a multidisciplinary approach. This second phase of activities had been initiated in 1967 by the Symposium on Human Factors in Road Accidents, organized by the Regional Office in Rome, where the need for concerted action had again been stressed. Although considerable efforts had been made by the authorities concerned and numerous studies had been undertaken in different disciplines, the results achieved so far had been meagre. In consequence the WHO Regional Committee for Europe had on two occasions devoted its Technical Discussions to a consideration of road accidents and in Malta in 1970 had adopted a formal resolution on this subject.

Dr Bauhofer also referred to the important responsibility of public health authorities in the field of accident prevention, not only in obtaining adequate information but also in defining standardized criteria. In conclusion he emphasized the need for national authorities to act promptly, to coordinate their activities further, and to stimulate new thinking; as far as possible, legal and administrative obstacles should be disregarded.

Dr V. Havlovic was elected Chairman, with Mr R. Coirier and Professor P. Novák as Vice-Chairmen. Dr J.D.J. Havard was designated Rapporteur.

The work of the Conference was divided into plenary sessions and into working groups. These groups were constituted so as to ensure a multidisciplinary approach to the topics considered.

The work of each working group was reported back to the plenary sessions for further discussion. An important feature of the Conference was the wide measure of agreement reached on all the important issues discussed.
THE ROLE OF EPIDEMIOLOGY IN PREVENTING ROAD TRAFFIC ACCIDENTS

Exactly 10 years have passed since the WHO Inter-regional Seminar on the Epidemiology, Control and Prevention of Traffic Accidents, was held in Alexandria. On that occasion the Director of the WHO Regional Office for the Eastern Mediterranean, in his opening address (1), emphasized that “road traffic accidents, like diseases, have an etiological history, they affect various age-groups differently, they occur in well-defined situations with a more or less foreseeable frequency, they are not simply unpredictable pieces of bad luck”. His plea for the employment of epidemiological techniques in the prevention of injury-producing road accidents has passed largely unheeded by public health authorities. In all technically developed countries, the last decade has witnessed a considerable increase in mortality from road accidents and in the severity of the injuries that they cause. Little advance appears to have been made by public health authorities in the European Region towards improving the quality of information about road accident mortality and morbidity, and road safety authorities continue to introduce their countermeasures, often on an ad hoc basis, unsupported by adequate research and evaluation.

The first task of the Conference on the Epidemiology of Road Traffic Accidents was to review the definition of epidemiology, insofar as it can be applied to injury-producing road accidents. It was felt that its aims could be described in similar terms to those chosen by the Working Group on the Application of Epidemiology to the Planning and Evaluation of Health Services (2), namely:

1. to describe the distribution and size of disease and disability in human populations;
2. to identify the etiological factors in the pathogenesis of disease or disability;
3. to provide the data that are essential to the planning, implementation, and evaluation of services for the control of road accidents and to the correct assignment of priorities amongst those services.

The Conference also determined criteria for the identification of high-risk groups and the evaluation of screening procedures, taking into account the report on the Symposium on the Identification of High Risk Persons and Population Groups (3). Licensing and other procedures adopted by road safety authorities for the purpose of excluding or controlling high-risk groups of road users should be evaluated by the same criteria as are applied by public health authorities to procedures with which they are more directly concerned, e.g., cervical cytology screening. The existence of such procedures should be justified on a cost/benefit basis, and this is particularly important where they involve the use of health personnel, e.g., medical examinations of drivers.

In the case of environmental factors that influence the risk of injury-producing road accidents, the Conference felt that public health authorities should apply epidemiological techniques to their evaluation, not only with a view to preventing the accident taking place, but also to determine their influence on the severity of injuries received in road accidents. Just as sanitary engineering played an important part in the control of communicable epidemic diseases in the last century, so highway engineering and vehicle design can play an important part in controlling injury-producing road accidents, which represent a major epidemic of noncommunicable disease in the present century. It was decided to exclude from consideration by the Conference first aid in road accidents, emergency treatment, and rehabilitative services, as they have been the subjects of reports issued recently by the WHO Regional Office for Europe.

Finally, it was observed that the “mythology” that surrounds the causation of road traffic accidents appears to be similar in many respects to that which surrounded infectious diseases before their etiology was recognized. Epidemiological techniques, including properly conducted surveys, can do much to dispel the confusion that exists, particularly among drivers of vehicles, about the relative importance of the human and environmental factors likely to increase the risk of injury-producing road accidents.

NATIONAL RETURNS OF ROAD ACCIDENTS

In nearly all Member States, the collection of data on road accident morbidity and mortality upon which national returns are based is carried out by the police at the scene of the accident. As public health authorities have no control over the collection of this information it is important that epidemiologists should test its validity before drawing conclusions from national returns. Most Member States adopt, with minor modifications, the definitions of “persons killed”, “serious injuries”,

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2 The ECE definitions are as follows:

Person killed: Any person who was killed outright or who died within 30 days as the result of the accident.

Serious injuries: Fractures, concussion, internal lesions, crushing, severe cuts and laceration, severe general shock requiring medical treatment and any other serious lesions entailing detention in hospital.

Slight injuries: Secondary injuries such as sprains or bruises. Persons complaining of shock, but who have not sustained other injuries, should not be considered in the statistics as having been injured unless they show very clear symptoms of shock and have received medical treatment or appeared to require medical attention.
and "slight injuries" recommended by the United Nations Economic Commission for Europe (ECE) (4). From the public health point of view, it is necessary to examine the extent to which injury-producing road accidents are reported and included in national statistics, the reliability of the classification of injuries within the definitions, and the significance of these definitions in terms of the clinical severity of the injuries received and the prospect of permanent incapacity.

**Mortality**

The definition of "persons killed" in road accidents is subject to artificial limitation in that it excludes persons dying as a consequence of an accident if they survive beyond a certain number of days. The period recommended by the ECE is 30 days. However, this period is not uniformly adopted by all Member States of the Region and in some countries fatally injured victims are excluded if they survive for periods ranging from the time taken to reach hospital up to 7 days. These differences have given rise to considerable difficulties in comparing road accident mortality rates among different countries and have been the subject of detailed study by the ECE.

Conversion factors have been calculated in order to allow comparison between countries and have been evaluated by means of studies of the time taken to die from road accidents. These conversion factors are now used and recommended by the ECE in its annual statistical returns of road accidents in the European Region, and are also used by other organizations, such as the European Conference of Ministers of Transport (ECMT), in compiling their own reports.

Public health authorities should be extremely careful, however, about the use of such conversion factors in comparing mortality rates between different countries, as the studies upon which they are based take no account of the variable factors influencing the time taken to die following a road accident, such as the age of the victim, the category of road user (e.g., whether or not "protected") and the state of the emergency treatment and intensive care services. The use of a universal conversion factor should therefore be discouraged.

In recent years there has been increasing support for the ECE definition, and the Working Party on Standardisation of International Statistics of the Organisation for Economic Co-operation and Development (OECD) has supported it (5). However, public health authorities should be careful not to support such proposals solely on the grounds of the need for standardization. Other considerations that should be taken into account in determining the most suitable criteria for recording the severity of injuries caused by road accidents are dealt with later in this report (pp. 5-6).

**Morbidity**

Only those injury-producing accidents that come to the attention of the police are included in the national returns of road accident morbidity; it therefore follows that much less reliance can be placed on rates of morbidity than on rates of mortality. The report on the Symposium on Human Factors in Road Accidents (6), organized by the Regional Office for Europe in Rome in 1967, drew attention to the fact that in some Member countries far more victims of road accidents were being treated in clinics and hospitals than appeared in national returns of road accidents; further reference to this was made in the technical discussions held at the nineteenth session of the WHO Regional Committee for Europe in 1969. Since then a number of surveys have been carried out that have enabled the extent of both underreporting and misreporting to be assessed, and these surveys are of considerable help to epidemiologists in determining the quality of the information that can be obtained from returns of "serious" and "slight" injuries in national statistics.

**Underreporting**

A Swedish survey (7), checked the national returns for one region against the patients attending a large hospital for injuries received in road accidents, and found that only 42% of the 770 victims appeared in the national returns. From the epidemiological point of view, the most serious aspect of this underreporting is that there is considerable variation in the extent of under-reporting between different categories of road user and different kinds of accident. The extent of underreporting is much greater in the case of "unprotected" road users (i.e., other than occupants of vehicles).

In one United Kingdom survey (8), only 44% of accidents involving injuries to pedal cyclists were found to have been reported as compared with almost 90% of accidents involving injuries to vehicle occupants. Another United Kingdom survey (9) also showed considerable underreporting of injuries to pedal cyclists (one-quarter of which were reported by the police) as well as a low level of reporting of accidents involving injuries to drivers of vehicles where no other road user was involved. An extreme example is given by the survey (10) conducted in Freiburg im Breisgau of 376 children treated in hospitals for injuries received while riding on the same bicycle as an adult. Only 4 of these cases were known to the police and reported in the official statistics.

It follows that reliance on national returns in assessing the distribution of injury-producing road accidents may lead to errors, and public health authorities would

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*4* Referred to hereafter as "the Rome Symposium".

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be well-advised to check the validity of their own national returns of road accidents by carrying out similar surveys, before reaching decisions on high-risk groups and on priorities in intervention.

**Misreporting**

A further problem arising out of the assignment of severity of injury by the police at the scene of the accident is that it may often be made incorrectly. Police officers cannot be expected to achieve accuracy in such matters. More important still is the fact that the definition of "serious injuries" recommended by the ECE gives little indication of the degree of severity in clinical terms or the prospect of incapacity. It covers anything from a broken finger to total paralysis. It includes, of course, injuries so severe that the victim dies of them outside the period within which death must occur for the victim to be recorded as "killed". In one United Kingdom survey (8) only 34% of the victims detained in hospital and recorded by the police as "seriously injured" were, in fact, severely injured from the clinical or medical point of view; for victims not detained in hospital the proportion was 14%. Again, the extent to which misreporting occurs varies between different categories of road user and different kinds of accident.

The Swedish survey (7) mentioned above showed that in official statistics (based on police returns) injuries to protected road users were far more likely to be correctly reported than injuries to unprotected road users. Taken in conjunction with underreporting this has led to a position where the official statistics in Sweden indicate that twice as many protected road users are injured as unprotected road users, whereas it seems likely from the hospital survey that the numbers are about equal. Moreover, unprotected road users constituted almost two-thirds of those killed and seriously injured and therefore made heavier demands on intensive care services and required longer hospital stays - a feature of some importance to public health authorities.

**DEATH CERTIFICATES**

Information on road accident mortality can also be obtained from death certificates. However, the criteria for reporting deaths differ in important respects from those adopted by the ECE and used for the purposes of national returns. Consequently, they cannot be used in conjunction with the environmental and other data contained in the national returns and this makes international comparisons difficult. The main difference is that no time limit is placed on the period within which death takes place as a consequence of the accident. Deaths that occur as a result of accidents not involving motor vehicles are not included, neither are deaths from accidents occurring off the public highway.

**HOSPITAL RECORDS**

In many Member States, hospital records do not distinguish injuries received in road accidents from those received in other kinds of accident. Where road accidents are identified there is often no indication of the category of road user (e.g., pedestrian or vehicle occupant). The eighth report of the WHO Expert Committee on Health Statistics (1) recommends "that countries compile hospital morbidity statistics .... by diagnosis" and "that the Intermediate List of 150 causes be used for the presentation of morbidity statistics". This should mean that "motor vehicle accidents" are shown separately as cause group AE138 of the Intermediate List, but usually the injuries from road accidents are included under AE139 as "other transport accidents" or under AE146 as "all other accidents".

Because of the importance of linking reliable data from hospitals and clinics on road accident morbidity with the fairly detailed and reliable information recorded by the police on the environmental factors associated with the accident, the WHO Regional Office, in May 1973, sent out a questionnaire to public health authorities. Details were sought about practice in the recording of such injuries in hospitals and what use was made of the information recorded. The replies to the questionnaire showed that public health authorities play little or no part in the provision of statistical information on road accident morbidity and that very little use is made by them of such information as is collected.

In only half of the 26 Member States replying to the questionnaire are injuries treated in hospitals and clinics as a result of road accidents reported to public health authorities and in less than half are records of such injuries kept by health authorities. Only 10 Member States use the ICD for recording injury-producing road

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accidents. In answer to the question as to what use was made of the information by health authorities, only two countries gave any indication that it was used for epidemiological purposes.

The replies to the questionnaire indicated that public health authorities are somewhat uncertain as to the role that they are expected to play in the prevention of road accidents and the degree of confusion shown in the answers from some Member States suggests that they regard the issue primarily as a matter for the police or environmental authorities. The survey tended to confirm the experience of the European Public Health Committee of the Council of Europe (19) which found, in answer to a questionnaire to health authorities on road safety campaigns for children, that such campaigns were taking place in only 11 out of the 18 European countries circularized, whereas independent enquiries disclosed that they were, in fact, taking place in all of them.

PERMANENT INCAPACITY FROM ROAD ACCIDENTS

It is very important that public health authorities should be aware of the extent of permanent incapacity from road accidents in the population. A number of special studies have been carried out which suggest that the pool of permanent incapacity in the community from these injury-producing road accidents is increasing. The reasons for this include the higher proportion of victims in the younger age-groups (who have a much better chance than older road users of surviving the consequences of severe trauma), the increasing differential velocity of road accidents, the increasing number of heavy goods vehicles (with high injury-causing potential) and the advances in techniques of medical resuscitation.

National statistics will often give information about disability, including degrees of disability, but rarely ever is the cause given, except in the case of industrial accidents. A "microcensus" (12) carried out in the Federal Republic of Germany in 1966 showed that there were about 4 million disabled persons (defined as being physically or mentally handicapped or in receipt of a disability pension before retiring age), and that 100,000 of them were disabled as a result of road accidents. In the United Kingdom it has been estimated that about 3% of persons injured in road accidents were still invalids 6 months after the occurrence of the accident (13).

In the absence of any information in national statistics, epidemiologists have to look to the results of special surveys. These are important, not only because they give some idea of the prospect of permanent disability from different kinds of accident to different categories of road user, but because they can be of help in choosing criteria that might be adopted in national reporting systems for determining the prospect of permanent disability. In this respect, a recent United Kingdom survey (8) has shown some useful links between prospect of disability and length of hospital stay. Excluding facial disfigurement and injuries to the eye, it was found that permanent disability is unlikely to be sustained in victims admitted for less than 10 days in hospital (about two-thirds of the victims admitted to hospital). Severe disability was found most commonly amongst those who had to stay in hospital for more than 3 months.

Another United Kingdom survey (14), based on 4342 admissions to the Birmingham Accident Hospital in 1961, showed that 25% of the motor-cyclists, 21% of pedestrians, 21% of vehicle occupants, and 11% of the pedal cyclists were permanently disabled. About one-third of the disabilities were severe, and one-half of moderate severity. More than half of the disablement occurred to victims who were under the age of 30 at the time of the accident. For these victims the quality of life is dramatically altered.

In view of the demands that such long-term incapacity places on the social security services, it is difficult to see why public health authorities are prepared to tolerate a reporting system that gives no information about the circumstances or the extent of incapacity caused by road accidents.

IMPROVEMENT OF THE NATIONAL RETURNS OF MORBIDITY

Previous attempts to improve the quality of the returns of road accident morbidity have been frustrated by the reluctance of police officers to become involved in more detailed work in connexion with accident reporting (in particular, hospital follow-up of the victims) and by the reluctance of hospital medical staff to become involved in more detailed administrative work. The WHO Regional Office for Europe therefore convened a small working party early in 1974 to see whether any workable alternatives could be devised.

Morbidity information system

Meanwhile, a special meeting on road accident statistics had been held by the Group of Experts on Road Safety of the ECE at which the WHO representatives had persuaded the Group to consider a new definition of "serious injury" which would be practicable and which would give some idea of the prospect of disability. The proposed definition was as follows: "A person who 7 days after a road accident, and as a result of that accident, is still bedridden or suffers from total physical or mental incapacity, total incapacity being understood to mean a
reduction of mobility such that the person is incapable of moving from one place to another without assistance.” The assessment of such incapacity need not involve medically qualified personnel, and the adoption of the new definition would provide a greatly improved indication of the severity of road accident morbidity. Furthermore, adding the number of persons severely injured, according to this definition, to the number dying within the seven-day period would provide a single statistical indication of the severity of road accidents which would be of considerable use to epidemiologists.

The Working Group convened by the Regional Office proposed that the new definition should be subjected to a feasibility study conducted in conjunction with the ECE in specific regions of selected Member States, and that the study should include a comparison with the police returns based on the existing definition of severe injury. The reporting form drawn up by the Working Group for use in this joint ECE/WHO feasibility study is attached to this report as Annex 1. Although considerable interest was shown in the proposed study by representatives from Member States attending the ECE Group of Experts, no Member State represented on the Group appeared to be prepared to cooperate in the study.

The Conference felt that high priority should be attached to evaluating the proposed new definition and that the ECE Group should again be invited to participate in the joint study. It was suggested that, if it proves impossible to pursue a joint study with ECE, the Regional Office should consider inviting public health authorities in Member States to carry out the study, leaving out the comparison with police returns. This would at least provide a reliable baseline against which the public health authorities could evaluate important preventive measures about to be introduced in certain countries, e.g., the compulsory wearing of seat belts by motorists and of crash helmets by motor cyclists.

The use by the police of injury coding systems

The Conference noted that a number of injury coding systems had been evaluated in the USA and it was recommended that the Regional Office should draw the attention of ECE to the importance of this type of classification being tested in Member States of the Region, preferably in the form of a joint study in which the assessment of injury made by the police at the scene of the accident could be compared with the assessment made by the doctor or nurse at the hospital to which the victim is taken.

A good example is the State of New York Traffic Records Project in which a New York State Injury Coding Scheme (NYSICS) was evaluated. The form, which is set out in Annex 2 to this report, requires the police officer to determine the location of the most severe physical complaint (by circling an index letter for one of 12 body locations), the type of physical complaint (by circling one of 13 conditions ranging from amputation to complaint of pain) and the state of the victim (by indicating various states ranging from apparent death to shock). Definitions are provided for the assistance of the police.

Twenty-four hospitals in 5 regions of the State of New York participated in the study. It was found that the decisions of the State police corresponded with those of the doctors and nurses in 87.5% of cases (83.9% in the case of other police officers). There was no significant difference between diagnosis by doctors and nurses. The study also provided useful information about the mode of transport to hospital. The opportunity was also taken to compare the scheme with an injury coding scheme that had already been accepted for hospital use — the Abbreviated Injury Scale (AIS) (16). It was found that there was adequate correspondence in 97% of cases.

One of the main advantages to the police of using such a system is that it does not involve any hospital follow-up, a feature that has been responsible for much of the opposition amongst Member States in the Region to other proposals for improving returns of road accident morbidity.

THE VALUE OF INTERNATIONAL COMPARISONS

The only regular publication giving information about road accident mortality and morbidity is Statistics of road traffic accidents in Europe published annually by the United Nations (ECE). The information contained in this publication is very useful for studying trends in different countries, but the figures relating to mortality and morbidity have to be accepted with some reservation in view of the considerations set out in the previous sections of this report. There are also some important gaps in the information that is provided — for example, there is no breakdown in the important age-group 25-64, which represents the period during which the victim of a road accident would otherwise be in the most productive years of his life, and during which the incidence of medical conditions and impairment of function increases progressively.

There have been a number of attempts to supplement the information given in the ECE annual publications by providing additional data collected from Member States by means of questionnaires. They include a special article on road accidents published by WHO in
World Health Statistics in 1968 (17), which covered 21 countries in the European Region, the Report on recent trends in road accidents published by the European Conference of Ministers of Transport in 1972 (18), which included information from 19 countries in the Region, and the Special report on accidents in childhood published by the Council of Europe in 1972 (19), which included information from 18 countries in the Region. All these surveys are based on national returns and suffer from the defects in relation to definitions of morbidity and mortality that have already been considered.

SPECIAL SURVEYS

The importance of special surveys in supplementing and correcting the data provided by national returns has already been referred to in this report. Such surveys have at least two important advantages. Their limited extent enables much more information to be collected than is possible on a national basis (in-depth studies) and they can be carried out in the form of case-control or cohort studies so as to assess the statistical over-representation of various factors thought to be important in increasing the risk of injury-producing accidents.

In-depth studies

A number of studies have already been carried out in Member States of the Region. A recent example was the intensive study of the factors influencing the occurrence of 2130 road accidents between 1970 and 1974 within a 24-km radius of the Transport and Road Research Laboratory in the United Kingdom (20). The sequence of events leading up to the accident was ascertained, together with details of the driver’s driving habits, perception, familiarity with the road and vehicle, alcohol consumption, fatigue, illness, past accident history, etc. From this information an assessment of the contributory factors could be made. There was a refusal rate of only 5%. Detailed environmental data relating to the road, vehicle, weather, etc. were also obtained.

Although the decisions made by the investigating team were necessarily subjective, it is noteworthy that human factors in the road user were assessed as contributory in 93% of the accidents, environmental factors (excluding the vehicle) in 28%, and vehicle defects in 8%. This “clinic” approach to road accident mortality and morbidity was strongly commended by the Director of Health Services of the WHO Regional Office for Europe (21). The Conference, when he drew a comparison between the problem of the epidemiology of road accidents and the challenge that confronted public health authorities in the 19th century from the increase in communicable diseases in urban populations. That challenge was met by a multidisciplinary approach (including town planners, engineers, and the institution of public health laboratories) to the etiology and control of epidemics; a similar approach to the study of road accident prevention would seem to be indicated. It is important that surveys to determine the causation of road accidents should include a study of the attitudes of road users to factors influencing road safety.

The Conference noted that existing studies had suggested certain similarities between injury-producing road accidents in different countries. One study (21) on the injury-producing car accident had shown that there were close similarities between Australian and British urban environments and between rural environments in Worcestershire (England) and Cornell (USA). Comparative analysis of detailed accident data from different countries is feasible and the Conference considered that the Regional Office should consider setting up comparative in-depth studies of road accident morbidity and mortality between selected cities or regions of Member States on the basis of predetermined and standardized techniques for recording data.

Case-control and cohort studies

These techniques are well known to epidemiologists and can be applied successfully to assessing the risk factors in injury-producing road accidents. The main problem with such studies is that they are expensive, difficult to administer, and time-consuming. Furthermore, there are so many human and environmental factors influencing the risk of road accident that very large samples have to be taken. Evaluation of the results of case control surveys has been greatly facilitated by the development of the digital computer, which enables multifactorial analyses to be carried out. Essentially the technique consists of taking matched samples of road users and studying the degree of representation of various factors in relation to accident experience.

A very good example is the “Grand Rapids” survey (22) carried out in Michigan, which set out primarily to discover the extent of over-representation in accidents of drivers with various blood alcohol concentrations. Other variables studied included age, sex, marital status, estimated distance travelled, years of completed schooling, racial characteristics, and drinking habits. The survey proved conclusively that, having taken all these factors into consideration, drivers with blood alcohol concentrations in excess of 80mg/100ml were more likely to be involved in accidents than drivers who had taken very little alcohol or no alcohol at all. The study, together with others of a similar kind, led the OECD Expert Group on Alcohol and Drugs in Relation to Driving Behaviour (23) to recommend the introduction of an 80mg level in legislation. This
recommendation was adopted by the European Conference of Ministers of Transport (24) and has since been incorporated in the legislation of a number of Member States in the Region.

Cohort studies can be used to evaluate intervention techniques. An example of this would be a study of the subsequent accident experience of matched samples of school leavers, in which one group is given intensive instruction on road safety. A study of this kind carried out in the USA suggested that such instruction has no significant effect on future accident experience. Such an assumption is, of course, true only of the kind of instruction used in the particular study.

Roadside surveys

During the last decade there has been a considerable development of roadside surveys designed to provide information about the driving population. The main objects of such surveys are to improve epidemiological data, to compare the effectiveness of countermeasures, and to provide baseline data for comparison with drivers involved in accidents. The problems associated with such surveys were reviewed at an international conference held in Paris in 1974 (25). The conference was primarily concerned with roadside surveys designed to obtain information about the alcohol habit in the driving population, but much other useful information can be obtained, such as the attitude of drivers to aspects of road safety.

A number of interesting facts have been discovered as a result of such surveys in the USA, e.g., whereas routine post-mortem examinations have revealed that a relatively large proportion of drivers killed in road accidents have very high blood alcohol concentrations, very few drivers with such high concentrations are found in the normal driving population in roadside surveys. A survey of driver attitudes should be an essential prerequisite to planning health education measures and can be carried out in conjunction with roadside surveys by giving drivers questionnaires to complete. An international collaborative research programme on driver attitudes is currently being carried out by the International Drivers Behaviour Research Association (IDBRA).

ETIOLOGICAL FACTORS

The occurrence of an injury-producing road accident results from the interaction between the various adverse factors present in the road user and in the environment. These include not only the factors influencing the risk of the accident occurring, but also the factors influencing the extent of injuries received by the road user when an accident has occurred. Road accidents present a formidable problem to public health authorities, both in the identification of the adverse factors in high-risk groups and situations, and in the means of controlling them. They are far more difficult to control than other accidents, such as industrial accidents, where there is a relatively stable environment in which repetitive tasks are performed, so that scientific investigation is relatively easy. It is probably for this reason that the mortality and morbidity from industrial accidents have been far more successfully controlled in Member States, notwithstanding the rapid development of industrialization.

The techniques for identifying the various factors involved in road accidents include the studies referred to in the previous section of this report. The Conference, being concerned primarily with epidemiological principles, did not have time to consider in detail the very large number of human and environmental factors involved in road accidents. They were considered in some detail in the report on the Rome Symposium (6) and reference will be made in this report only to those aspects that are of particular importance to public health authorities.

It is essential that public health authorities should be fully aware of the importance and extent of these adverse factors, including those of an environmental nature. The decision to build a school in a particular place, or to include an intersection at a certain point in the road system, can profoundly influence the accident rate at those sites in the future, by which time it may be too late to take effective remedial action. Highway engineering and mechanical engineering (safety factors in vehicle design) are as important to public health authorities in the 20th century as was sanitary engineering in the 19th century. Public health authorities should involve themselves in planning decisions affecting road safety at an early stage and ensure that important considerations influencing the risk of injury-producing accidents are not overlooked.

In this connexion the rigid departmental attitude of governments to road accident prevention in many Member States can lead to public health authorities concentrating too much on accident and emergency treatment services (for which they have a special responsibility) and too little on the preventive services. The epidemics of communicable disease that caused so much mortality and morbidity in the 19th century were not controlled until the etiological factors were identified and preventive measures instituted. The same must apply to the major epidemic of noncommunicable disease in the present century, i.e., the injury-producing road accident. The fact that another department of government — such as environment, transport or internal affairs — may be charged with responsibility for road safety, should not be regarded by public health authorities as absolving them from taking
any interest in the adverse factors that increase the risk that injury-producing road accidents will occur.

AGE

Children under 15

The risk of injury-producing road accidents is closely related to age and it is important to identify the ages at which the risk is greatest in relation to other factors, such as the category of road user. A recent study by the Council of Europe (19) has described the distribution and trends of mortality in children from accidental causes. For ages up to 14, the overall mortality rate from accidents increased by 3 per 100,000 between 1958 and 1968 in the 17 European countries included in the study, mainly as a result of the increase in the road accident mortality rate (2.6 per thousand) (Fig. 1).

In all countries, the increase has been greatest in the age-group 6-14 years (Fig. 2). Watson (27) has studied the distribution of road accident mortality in children among different categories of road user in 12 European countries and found that in the age-group 6-14 the proportions were: pedestrians, 35-70% (median value 60%); pedal cyclists, 15-35% (median value 25%); and vehicle occupants (passengers), 15-20% (median value 15%). It is interesting to note that some children in this age-group appear to have been killed while actually driving motor vehicles.

A special survey report by the European Conference of Ministers of Transport gives information about road accident mortality and morbidity rates among child pedestrians in 14 European countries (Tables 1 and 2) and shows that in most of them the risk is greatest in the age-group 6-9 years. Difficulties arise in making comparisons in the case of death rates where countries have not adopted the standard definition recommended by ECE, a problem to which reference has already been made in this report.

It is also important to note that rates per 100,000 population in the same age-group do not give a reliable indication of exposure. However, some studies have been carried out taking into account variations in exposure as a result of which the increased risk to child pedestrians has been confirmed, as has the over-representation of boys. A recent British study (28) showed that in fact the raw accident figures greatly underestimate the risk to children aged 5-7 years, and that the greater number of accidents to boys in this age-group is not due to their greater exposure to traffic. It also showed that after the age of 8 boys, given their greater exposure, are no more at risk than girls.

As far as the other categories of road user are concerned there is very little information about the distribution of mortality, and the total numbers are too small to be able to draw definite conclusions. The morbidity figures are many times larger, but as we have already pointed out in this report, the extent of underreporting and misreporting is such that epidemiologists cannot rely on the official statistics. Surveys carried out in different countries do, however, provide useful information and should be supported by public health authorities as the only possible means of monitoring the changes that may occur, e.g., the increase in morbidity that seems to have accompanied the introduction of “high-rise” bicycles (29). Table 3 sets out the casualty rate (killed or seriously injured) for children in road accidents in Great Britain in 1973.

Special attention should be paid to the dangers to young children of travelling unprotected in the front...
Table 1. Number of pedestrians killed in 1970 by age-group per 100 000 inhabitants in each group*

<table>
<thead>
<tr>
<th>Country</th>
<th>0-5 years</th>
<th>6-9 years</th>
<th>10-14 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany, Federal Republic</td>
<td>9.2</td>
<td>13.5</td>
<td>5.0</td>
</tr>
<tr>
<td>Austria</td>
<td>8.7</td>
<td>8.6</td>
<td>6.0</td>
</tr>
<tr>
<td>Belgium</td>
<td>8.0</td>
<td>10.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Netherlands</td>
<td>8.1</td>
<td>6.2</td>
<td>2.5</td>
</tr>
<tr>
<td>Norway</td>
<td>8.1</td>
<td>9.4</td>
<td>2.9</td>
</tr>
<tr>
<td>Ireland</td>
<td>6.3 (0-4)</td>
<td>7.7 (5-9)</td>
<td>3.2</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>5.2</td>
<td>5.7</td>
<td>3.2</td>
</tr>
<tr>
<td>Sweden</td>
<td>4.0 (0-6)</td>
<td>3.2 (7-14)</td>
<td>3.2</td>
</tr>
<tr>
<td>Turkey (1969)</td>
<td>3.8</td>
<td>8.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>3.8 (0-4)</td>
<td>5.5 (5-14)</td>
<td>3.3</td>
</tr>
<tr>
<td>Belgium</td>
<td>3.7</td>
<td>4.1</td>
<td>1.7</td>
</tr>
<tr>
<td>Spain</td>
<td>3.2 (0-14)</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>France</td>
<td>3.2</td>
<td>8.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Italy</td>
<td>3.0</td>
<td>3.3 (6-14)</td>
<td>−</td>
</tr>
</tbody>
</table>

Table 2. Number of pedestrian casualties in 1970 by age-group per 100 000 inhabitants in each group*

<table>
<thead>
<tr>
<th>Country</th>
<th>0-5 years</th>
<th>6-9 years</th>
<th>10-14 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>239</td>
<td>441</td>
<td>277</td>
</tr>
<tr>
<td>Germany, Federal Republic</td>
<td>178</td>
<td>442</td>
<td>171</td>
</tr>
<tr>
<td>Austria</td>
<td>151</td>
<td>337</td>
<td>143</td>
</tr>
<tr>
<td>Belgium</td>
<td>127</td>
<td>244</td>
<td>123</td>
</tr>
<tr>
<td>Denmark (1969)</td>
<td>114</td>
<td>168</td>
<td>109</td>
</tr>
<tr>
<td>Norway</td>
<td>114</td>
<td>165</td>
<td>83</td>
</tr>
<tr>
<td>Netherlands</td>
<td>112</td>
<td>172</td>
<td>60</td>
</tr>
<tr>
<td>Ireland</td>
<td>78 (0-4)</td>
<td>158 (5-9)</td>
<td>82</td>
</tr>
<tr>
<td>France</td>
<td>59</td>
<td>227</td>
<td>82</td>
</tr>
<tr>
<td>Italy</td>
<td>54</td>
<td>96 (6-14)</td>
<td>−</td>
</tr>
<tr>
<td>Sweden</td>
<td>44 (0-6)</td>
<td>48 (7-14)</td>
<td>−</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>30 (0-4)</td>
<td>77 (5-14)</td>
<td>−</td>
</tr>
<tr>
<td>Turkey (1969)</td>
<td>15</td>
<td>38</td>
<td>20</td>
</tr>
</tbody>
</table>

* Based on data from: European Conference of Ministers of Transport (1972).

\( a \) Figures not adjusted to standard definitions.
Table 3. Number of children killed or seriously injured in road accidents in Great Britain, 1973*

<table>
<thead>
<tr>
<th>Age-group</th>
<th>Pedestrians</th>
<th>Pedal cyclists</th>
<th>All road users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Casualties</td>
<td>Casualties rate per 100 000</td>
<td>Casualties</td>
</tr>
<tr>
<td>0-4</td>
<td>2069</td>
<td>50</td>
<td>31</td>
</tr>
<tr>
<td>5-9</td>
<td>5316</td>
<td>118</td>
<td>649</td>
</tr>
<tr>
<td>10-14</td>
<td>3137</td>
<td>73</td>
<td>1361</td>
</tr>
</tbody>
</table>

* Reproduced from: Russam, K. Road safety of children in the United Kingdom, Crowthorne, Transport and Road Research Laboratory, 1975 (TRRL Report 678)

seats of motor vehicles. Information about the extent to which this occurs is not available from national statistics. A special survey (30) carried out in England and Wales during the years 1971-73 showed that the annual number of children killed in accidents in such circumstances exceeds 30 and that a very large number (over 3000) are injured each year. The survey showed that although there are problems associated with the wearing of safety belts by children, those children wearing safety belts were afforded a very high degree of protection against death and serious injury, notwithstanding the mechanical inefficiency of the restraint. Indeed, the risk of death was almost 12 times greater for children not wearing belts.

Young persons (15-24 years)

After the age of 14 the mortality rate for pedestrians falls off in most Member States and begins to increase for drivers and passengers of motor vehicles. There is evidence of an increase in the mortality and morbidity among drivers of low-powered mechanically propelled two-wheeled vehicles, and the Conference noted that in some Member States no licence or registration is required for such vehicles. It is, of course, essential to have information about the number of drivers of such vehicles in order to assess the degree of risk. To some extent the distribution of accidents is affected by the legal requirements as to the age at which such vehicles can be driven. A Danish study (31) showed that, whereas the peak injury-producing rate for pedal cyclists is 11-13 years, the peak for moped drivers is 15-17 (although injury-producing accidents to moped drivers already appear in the age-group 14-15, half a year before the legal minimum age for driving them).

Depending upon the legal age for driving motor vehicles, a sharp rise in the rates of mortality and morbidity from road accidents is seen in most Member States after the age of about 17. The proportion is so large in the 15-24 age-group of males that in some Member States road accidents account for one-half or more of male deaths from all causes in this age-group (Table 4). After the age of 25 the rate falls off fairly rapidly, although this fall is concealed by the official statistics published by the ECE as no breakdown is given between the ages of 25 and 64 — a rather surprising omission when it is realized that road accident victims in this age-group are, in terms of productivity, at their most useful to the community. In some cases it is possible to abstract the necessary information from official volumes of statistics published by Member States, and the graph in Fig. 3 shows that the age distribution of road accident casualties among drivers and passengers of motor vehicles is much the same in all European countries.

The peak mortality and morbidity among drivers and passengers in the 15-24 years age-group of males has been recognized by a number of international organizations. It was the subject of a study by the OECD Research Group SS (Research on Accidents Involving Young Drivers) and the age-group 15-29 was taken for the purpose of a study carried out by the European Public Health Committee (32) where it was noted that in some of the participating countries a large proportion of the vehicles involved in accidents were two-wheelers — mostly mopeds (55% in the French sample and 47% in the Italian sample). The sex ratios in that study were 4.5 males to 1 female, and the peak age distribution was 17-22.
Middle age-groups (25-64 years)

For reasons that have already been examined the Conference was critical of the fact that the ECE annual publication of statistics of road accidents gives no breakdown of ages within the 25-64 years age-group. Comparisons based on such a large age-group are virtually meaningless, and, as can be seen in Fig. 3, important changes occur in accident experience within this age-group as far as vehicle occupants are concerned. The data on which Fig. 3 is based were obtained by consulting the national returns of 4 European countries that gave the necessary age breakdown.

The dramatic reduction in accident involvement of vehicle occupants that occurs when the driver is over 25 years of age (even after allowing for the increased exposure of the 18-24 years age-group) raises important considerations for public health authorities in terms of the application of screening procedures, in particular the use of medical examinations. After the age of 25 the various aspects of motor and sensory performance that are believed to be important in the safe control of a motor vehicle, begin to deteriorate progressively (e.g., reaction time, eyesight, etc.) and the incidence of pathological conditions increases. Yet the risk of accident involvement decreases rapidly.

The reasons for the reduction of accident risk with increasing age after the age of 25 are still not clear. The problem was considered in some detail in the report on the Rome symposium (6), where studies were mentioned suggesting that experience was not an important factor. However, other studies suggest that experience is the main factor. Whatever is the reason, it seems clear that medical fitness of the driver is unlikely to be an important factor as the risk of accident involvement appears to be inversely proportional to the incidence of medical conditions in the driving population between the ages of 25 and 64.

![Fig. 3. Age distribution of road accident casualties (drivers and passengers) in four European countries.](image)

Table 4. Percentage of deaths among men due to motor vehicles in 1972 by country, for all ages combined and in age-group 15-24*

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of deaths due to motor vehicle accidents per 100 deaths from all causes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1972</td>
</tr>
<tr>
<td>Germany, Federal Republic</td>
<td>3.6</td>
</tr>
<tr>
<td>Netherlands</td>
<td>3.7</td>
</tr>
<tr>
<td>Denmark</td>
<td>3.0</td>
</tr>
<tr>
<td>Belgium</td>
<td>3.3</td>
</tr>
<tr>
<td>France</td>
<td>3.6</td>
</tr>
<tr>
<td>Austria</td>
<td>4.6</td>
</tr>
<tr>
<td>England and Wales</td>
<td>1.6</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>2.8</td>
</tr>
<tr>
<td>Italy</td>
<td>3.9</td>
</tr>
<tr>
<td>Sweden</td>
<td>1.9</td>
</tr>
<tr>
<td>Switzerland</td>
<td>4.3</td>
</tr>
<tr>
<td>Scotland</td>
<td>1.8</td>
</tr>
<tr>
<td>Finland</td>
<td>3.6</td>
</tr>
<tr>
<td>Greece</td>
<td>2.1</td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>2.7</td>
</tr>
<tr>
<td>Ireland</td>
<td>2.5</td>
</tr>
<tr>
<td>Norway</td>
<td>1.8</td>
</tr>
<tr>
<td>Iceland</td>
<td>2.0</td>
</tr>
<tr>
<td>Portugal</td>
<td>3.6</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>2.1</td>
</tr>
<tr>
<td>Spain</td>
<td>2.5</td>
</tr>
<tr>
<td>Hungary</td>
<td>2.4</td>
</tr>
</tbody>
</table>


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a 1971
Older age-groups (over 65)

In the case of older drivers the main issue to be determined is the need for medical examination, and the problem is discussed further in the section on Medical Examinations (p. 15). In the case of elderly pedestrians the mortality and morbidity rates show considerable increases compared with younger adult age-groups in most European countries (Table 5). The highest percentage of pedestrians killed in the various age-groups was also found to be in those over 65 years in the 14 European countries included in Fig. 4 — greater than in the 40 years between 25 and 64.

Table 5. Number of pedestrians killed in 1970 per 100,000 inhabitants in each age-group*

<table>
<thead>
<tr>
<th>Age-group</th>
<th>25-64 years</th>
<th>Over 65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td>4.4</td>
<td>32.5</td>
</tr>
<tr>
<td>Germany, Federal Republic</td>
<td>6.1</td>
<td>31.6</td>
</tr>
<tr>
<td>Austriaa</td>
<td>6.7</td>
<td>28.5</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>5.7</td>
<td>27.3</td>
</tr>
<tr>
<td>Denmark (1969)</td>
<td>3.2</td>
<td>24.0</td>
</tr>
<tr>
<td>Ireland</td>
<td>5.9</td>
<td>23.5</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>6.5</td>
<td>20.5</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>3.0</td>
<td>18.3</td>
</tr>
<tr>
<td>Francea</td>
<td>5.7</td>
<td>16.8</td>
</tr>
<tr>
<td>Italya</td>
<td>3.1</td>
<td>16.4</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2.4</td>
<td>16.1</td>
</tr>
<tr>
<td>Norway</td>
<td>2.4</td>
<td>15.3</td>
</tr>
<tr>
<td>Spaina</td>
<td>3.3</td>
<td>14.2</td>
</tr>
<tr>
<td>Sweden</td>
<td>2.2</td>
<td>12.4</td>
</tr>
<tr>
<td>Turkey (1969)</td>
<td>3.6</td>
<td>10.4</td>
</tr>
<tr>
<td>Belgiuma</td>
<td>2.9</td>
<td>9.7</td>
</tr>
<tr>
<td>Portugalb</td>
<td>4.6</td>
<td>9.5</td>
</tr>
</tbody>
</table>

* Based on data from: European Conference of Ministers of Transport (18)

a Figures not adjusted to standard definitions

Public health authorities should therefore recognize the elderly pedestrian as a high-risk group, and make allowance for this in continuing programmes of health education by including advice on the safe use of the road system. Yaksich (33) has enumerated the following physical factors as increasing the risk of accidents to elderly pedestrians: impaired hearing and vision, less accurate depth perception, decrease of lateral field of vision, slowing down of perceptual processes and of speed of reaction, and decreased capacity for learning.

MEDICAL CONDITIONS

Recent studies (34) have confirmed the view expressed in the report on the Rome symposium (6) that medical conditions in the driver appear to be a relatively unimportant factor in increasing the risk of injury-producing road accidents, although their importance varies with the nature of the driving task; a feature that has implications for the use of medical examinations as a screening procedure; these implications are considered in the next section of this report.

Medical conditions may increase the risk of accident in drivers of vehicles, either by leading to loss of control of the vehicle (collapse through sudden illness) or by impairing the various skills necessary for safe driving. Most studies agree that sudden illness is a factor in only about one in 1000 accidents (35). In the case of impaired
driving skills, it is less easy to assess the contribution of medical conditions to an increased risk of accident. In a recent United Kingdom survey covering over 2000 accidents, about 1% of the drivers involved admitted to feeling unwell before the accident (36). In another United Kingdom survey (35) 0.5% of serious injury-producing accidents involving drivers were found to be associated with chronic medical conditions that might (or might not) have contributed to the accident. The study excluded ocular defects, which were not considered. In general, it seems that most serious injury-producing accidents involve medically fit drivers and particularly young medically fit drivers.

EYESIGHT

It is generally accepted that about 90% of the input of information to the driver is through the eyes. Considerable attention has therefore been paid to the contribution of impaired vision in drivers to the risk of injury-producing road accidents. The position is confused. Some surveys have shown that defective eyesight does not appear to be over-represented in drivers involved in such accidents, whereas others suggest that it does. From the epidemiological point of view, it is important to establish what aspects of defective vision are associated with increased risk; whether there are practicable methods of detecting them, and whether their use routinely or in selected groups of drivers can be justified on a cost/benefit basis. The problem is considered further in the section of this report dealing with screening procedures (p. 15).

Professor Liesmaa drew attention to studies (37) he had carried out on the importance of dynamic depth perception in safe driving. This is made up of binocular vision, size of the retinal image, accommodation, motion parallax, brightness of moving objects (e.g., car lights), general perceptibility, and divergence from the background. He regards good binocular visual acuity to be the most important of these components. Amongst the factors he noted in drivers with defective dynamic acuity (as compared with a control group) was delay in decisions to overtake until it was too late to overtake safely, and defective judgement in entering priority roads. One of the main problems, particularly with one-eyed drivers, is the inability to judge accurately the speed of oncoming vehicles. Professor Liesmaa's study is particularly helpful in showing how defective depth perception in the driver can cause road accidents, but it was not related to accident experience and cannot therefore be taken as evidence of the extent to which defective dynamic visual acuity does, in fact, increase the risk of injury-producing road accidents.

ALCOHOL AND OTHER DRUGS

The Conference noted that there is now widespread acceptance of the role of alcohol in increasing the risk of injury-producing road accidents. Although attention has been focused primarily on its effect on driving, at certain times of the day and certain days of the week a high proportion of pedestrians injured in road accidents are found to have been drinking to excess. The participants emphasized the importance, from the epidemiological point of view, of estimates of blood alcohol concentrations being carried out in such cases, although it was realized that medicolegal complications could arise. In the case of drivers, case control studies referred to in the last section of this report have shown the extent of increased risk at various blood alcohol concentrations. Important distinctions must be made between the various groups of drivers found to have been driving with blood alcohol concentrations in excess of the legal limit and these are referred to in a later section of the report (p. 23).

Studies on alcohol in relation to impairment of driving are relatively easy to carry out. It is absorbed rapidly, is evenly distributed in the body, and a proportion is excreted unchanged in the urine and the breath. A direct relationship exists between its observable effects and its concentration in the blood at any given time. Reliable and practicable methods of qualitative and quantitative determination of the concentration of alcohol in the tissues have been developed. Finally, its acceptance as a social habit in most Member States has ensured a ready supply of drivers for case control and similar studies, which have demonstrated clearly the relative risk of accident at different blood alcohol concentrations.

In the case of drugs, however, the position is very different. The metabolism of many drugs is not fully understood, and the drug may be excreted as a mixture of the drug and its metabolites or only as metabolites, so that analytical methods are in a relatively primitive state of development. The serum levels of the drug may show little relationship to the observable clinical effects (e.g., barbiturates and cannabis) and the supply of drivers available for study under the influence of any particular drug is limited. Experimental studies based on driving simulators have been carried out to show that a wide range of psychoactive drugs can impair driving ability, but very little evidence exists in the form of controlled studies to show the extent to which various drugs increase the risk to drivers of involvement in injury-producing road accidents. Such evidence as does exist (38) indicates that stimulant drugs may present a special risk (e.g., amphetamines).

Meanwhile, the position depends largely upon the information that has been gained about drugs in the course of clinical experience and on the results of
experiments involving driving simulators or performance tests on driving tracks. The role of public health authorities, including the medical profession, is important as they are the main purveyors of drugs to the driving population and the problem is considered further in the section on The role of health personnel in education (p. 20).

There remains the problem of abuse of alcohol and of other drugs. Problem drinkers and alcoholics are over-represented in road accidents, and although the evidence is not so clear in the case of dependency on other drugs, the Conference felt that persons known to be dependent on drugs should not be allowed to drive.

PSYCHOLOGICAL AND SOCIOLOGICAL FACTORS

As numerous studies have shown that medical factors (apart from the effects of alcohol) appear to play a relatively minor role in the causation of injury-producing road accidents, considerable attention has been paid to the study of psychological and sociological factors that might influence adversely the behaviour of road users. Such factors were reviewed extensively in the report on the Rome Symposium (6) where reference was made to a number of adverse factors influencing the risk of accident involvement. There was insufficient time for all these factors to be considered in detail by the Conference; it was merely possible to review the role of screening procedures in identifying them and the value of educational and other measures for controlling them.

Controversy continues over the role of personality in determining the risk of accident. One study from Israel (39) has shown that there were only very few and very slight differences in personality between young drivers with a good record of accidents and traffic offences, drivers who had committed traffic offences, and drivers who had both accidents and offences. Another study from Tasmania (40) compared 100 individuals guilty of serious traffic offences with matched controls. The traffic offenders were found to be more likely to have had minor psychiatric symptoms, such as anxiety, and were more likely to be impulsive and lacking in social conscience. A very interesting finding was that traffic offenders reported far greater exposure to "adverse life events" in the 4 weeks prior to committing an offence. However, the risk of accident must not be related too closely to the risk of committing a traffic offence, and the reasons for this are examined further in the section on Sanctions (p. 23).

SCREENING PROCEDURES

Public health authorities should apply to screening procedures for road accident prevention the same criteria as they apply to screening procedures for the control of disease, i.e., a high-risk group must be defined which must be of manageable size and contain a substantial proportion of those likely to benefit from the available screening procedures, and the benefit from the procedure adopted must be commensurate with cost, both at the individual and the public level. The screening procedures for road accident prevention in current use in Member States apply mainly to drivers of mechanically propelled vehicles, and the number of persons holding licences to drive such vehicles has increased rapidly throughout the Region in the past decade.

As the holding of a licence to drive is a legal requirement for driving such vehicles, screening procedures are normally linked with licensing procedures. Exceptions include the use of roadside breath testing for alcohol, which must be regarded as a very effective screening procedure, provided it is used selectively at places and times where drivers are most likely to have been drinking to excess. It is important that screening procedures should be applied to as many high-risk groups as possible, and the Conference noted that in some Member States low-powered two-wheeled vehicles were not subject to licensing requirements. Drivers of such vehicles, especially in the lower age-groups, incur high risk of injury-producing accidents, from which they are relatively unprotected, and public health authorities should draw attention to this where it is appropriate to do so.

It is also important to distinguish between different kinds of vehicle and different kinds of drivers in terms of their exposure to accident resulting in injuries to other road users. Professional drivers, although generally having better accident records than private drivers in relation to distance travelled, are at special risk by reason of the fact that they cannot easily stop driving when feeling unwell, and because of the nature of the vehicles they drive. Accidents involving heavy goods vehicles carry a very high risk of serious injuries to other road users, as do accidents involving public service vehicles, which are constantly stopping and starting at places where people are gathered together. It follows that such drivers should be subjected to more intensive screening procedures than private drivers, and this is reflected in the licensing requirements of most Member States.

MEDICAL EXAMINATIONS

The role of medical examinations in the screening of drivers was reviewed at some length in the report on
the Rome Symposium (6). Surveys conducted since then have tended to confirm the views expressed in that report to the effect that such examinations should be used selectively and not routinely in connexion with licensing procedure. Studies on professional drivers continue to show that the rejection rate on medical grounds is very much higher for examinations carried out on the basis of selective criteria (e.g., involvement in accidents, serious traffic offences, prolonged absences from work) than for routine periodical examinations, and there is now ample evidence for the use of such criteria in determining the need for medical examinations.

Age is the traditional criterion for determining the need for medical examinations. The proceedings of the National Conference on the Aging Driver (41) held in the USA in 1974 revealed that 13% of drivers over the age of 65 suffer from heart disease, malignancy, or cerebral vascular disease. A recent survey (42) carried out on over 3000 professional drivers in Yugoslavia showed that the proportion of unfit drivers rose from 20% at age 55 up to 52% at age 65 and over (in the case of public service vehicle drivers) and 25.5% (in the case of heavy goods vehicle drivers). Over the age of 50 the causes of unfitness in professional drivers were as follows: nervous and mental disorders (28.6%), circulatory disorders (28.3%), ocular disorders (21.8%), alcoholism (6.9%), physical disability (4.8%), endocrine disorders (e.g., diabetes) (3.3%), and miscellaneous (6.3%). The author of the survey concludes that periodical re-examination should be required in the case of professional drivers over the age of 55, which he regards as the "critical age".

A much larger survey carried out on London bus drivers between 1967-71 (43), during which period more than 13 000 drivers were employed, showed that between the ages of 50 and 64 only 15% of disabilities rendering drivers unfit to drive were picked up on routine periodical medical examinations (based on age) as compared with 85% on examinations based on selective criteria (e.g., after sickness or accidents). The overall rate of disability rendering drivers unfit to drive was found to increase with age, but remained low even in the 60-64 years age-group, nearly all of whom were considered fit to hold a private licence. An independent study of London bus drivers (43) showed that the average annual rate of reported accidents fell with increasing age and length of service to such an extent that the rate for drivers aged 60-64 years with more than 14 years' experience was only one-quarter of that for drivers under 30 with less than 4 years' service.

Professional drivers are, of course, a selected group; there is a degree of self selection in the type of individual who chooses that kind of work. In most, if not all, Member States they are subject to further selection procedures, including medical examination, upon appointment. Nevertheless, they provide epidemiologists with an important opportunity for studying the effect of medical conditions on the risk of involvement in injury-producing accidents. The fact that the incidence of medical conditions likely to impair the ability to drive safely increases with age must be weighed against the improvement in driving experience with age and the fact that medical conditions are least likely to be found in the 15-24 years age-group, which has the worst accident experience.

It is important that, when considering the need for medical examinations, public health authorities should base their recommendations on the results of such studies and not on hypothetical assumptions about the relationship between medical conditions and the risk of accident. In this connexion the Conference noted that the draft Directive issued by the European Economic Community (44) requires periodical medical examinations as a condition of holding a private driving licence, and the view was expressed that some evidence in support of such a requirement should be provided before it could receive the support of public health authorities, which have a responsibility for ensuring that the best possible use is made of health personnel in the control of mortality and morbidity.

In the case of private drivers there is a lower exposure to injury-producing accidents in the older age-groups. A survey (45) of all male holders of driving licences over the age of 60 in the Swedish city of Gothenburg showed that by the age of 75 more than three-quarters of them had given up driving, as compared with only 12% in the age-group 60-64. Distances driven also decreased considerably with age; drivers in the 60-64 age-group drove far less than those aged 40. It was noted that the frequency of accidents and offences reported by the police was remarkably low in the oldest age-groups — much lower than that of drivers of about 40 years of age. This provides an interesting contrast with the previously accepted view that there is a sharp rise in accident involvement in the oldest age-groups.

Old age is therefore an indication for medical examination in connexion with licensing procedures, but the results should be used more to advise on limitations of driving and to ensure that medical conditions are controlled rather than to disqualify from driving. Means of transportation are extremely important to the aged in technically developed countries and the White House Conference on the Aging in 1971 ranked transportation as the third most important problem confronting elderly persons, after bad health and poverty.

In many Member States the age at which a medical examination should be made obligatory in the older age-groups of private drivers is largely the result of an arbitrary decision and is not based on the accident experience or rates of disability known to occur in the driving population at different ages. Public health
authorities should insist that such factors are taken into account by licensing authorities, and it must be recognized that they may vary between different Member States. Hence, experts using such criteria in Yugoslavia (42) and the USA (46) have suggested that the critical age for private drivers should be 60 years, whereas surveys carried out in the United Kingdom suggest that there is insufficient evidence to introduce such a requirement under the age of 70.

Public health authorities should also stress the need for such examinations to be directed more towards ensuring that the driving task is equal to the degree of impairment than to disqualifying the elderly driver from driving. The avoidance of night-time driving and of driving on motorways or for long hours, together with other appropriate limitations, should be imposed as appropriate and reinforced where necessary by the issue of a conditional licence, notwithstanding the difficulties such licences present in terms of enforcement. It should be remembered that medical examination is not a suitable means of ascertaining whether a driver can control his vehicle safely in traffic, and whenever there is any doubt about this a driving test should be insisted upon as well.

Finally, medical examinations are of variable predictive value as a screening procedure and licensing authorities are too ready to assume that they can provide an accurate assessment. Even when the examination is comprehensive and carried out by doctors experienced in such work, it will often fail to predict the sudden onset of illness. Thus, cases are known of airline pilots subjected to annual comprehensive medical examinations by experienced doctors collapsing at the wheel of a car from coronary ischaemia.

When medical examination is not comprehensive, or is carried out by relatively inexperienced doctors, as happens in some Member States, there may be a wide variation in the detection of high-risk groups. Errors of refraction in the eye may be easily detected, whereas cases of epilepsy and diabetes may be missed. Professor Michon drew attention to the fact that in the Netherlands only 14% of those rejected for military service on account of epilepsy indicate the fact that they suffer from epilepsy on the driving licence application form.

There was a wide difference of opinion among the participants about the efficiency of routine medical examination of drivers as a screening procedure. Representatives of those countries that do not require such examinations were highly critical of the arguments adduced in favour of them, whereas those who represented countries requiring such examinations were reluctant to accept the evidence that they do not appear to have any significant effect in reducing injury-producing accidents. It is possible, of course, that such examinations may lead to benefits unconnected with road safety, such as the earlier detection of medical conditions requiring treatment in persons who would otherwise not have been examined.

The consensus of opinion in the Conference was that there is no evidence to suggest that Member States not requiring routine medical examinations should require them in future, but it was recommended that those States requiring them at present should continue to require them until such time as studies had been carried out in their own countries to evaluate them.

EYESIGHT TESTS

Reference has already been made in the preceding section to the confused state of the knowledge of the contribution of impaired vision to the risk of accident. Traditionally, the screening test of choice has been an assessment of static visual acuity, whereas the factor that appears to be most important in determining the risk of accident is dynamic visual acuity, in particular depth perception (47). Unless there are gross defects of static visual acuity, such as those that can be detected without the need for a professionally conducted eyesight test (e.g., ability to read a registration plate), static visual acuity does not appear to be a very important factor until the older age-groups are reached. Tests of dynamic visual acuity have not yet reached a stage of development that would justify, on a cost/benefit basis, their use as a routine procedure. The Conference noted, however, that a multipurpose vision tester capable of testing dynamic visual acuity as well as night vision is under trial in the USA.

In a number of Member States field of vision is also tested, and reference was made at the Conference to the fact that private drivers appear to be able to compensate effectively for quite marked degrees of limitation of the visual fields. Professor Michon drew attention to a number of cases where experiments had shown that restriction of visual fields sufficient to preclude the issue of a licence was quite compatible with safe driving.

A study (48) of the visual fields of over 52 000 drivers in North Carolina showed that the retrospective accident experience of those with restricted visual fields (taken as 140 degrees or less) did not differ significantly from those with normal fields (greater than 160 degrees). Although a higher proportion of drivers in the older age-groups had restricted visual fields there was no significant evidence that such defects were related to higher accident involvement for any particular age-group. As might be expected, those drivers with restricted visual fields were found to be slightly over-represented in accidents involving side impacts. As less than 1% of drivers in this large sample were found to have restricted visual fields, the findings of this survey must raise questions about the justification, in
terms of cost/benefit, of the use of visual field tests as a screening procedure for private drivers.

TESTS FOR ALCOHOL AND OTHER DRUGS

The development of qualitative screening breath tests for alcohol has been of considerable help in identifying drivers who have been drinking and such tests are used to a greater or lesser extent in most Member States of the Region. Until recently the instruments used (unlike the more bulky and expensive quantitative instruments) were relatively crude, giving a number of “false positive” and “false negative” readings at various blood alcohol concentrations. Accordingly, their use has normally been restricted to assisting the police to decide whether to detain the driver so that a sample of blood can be taken for estimation by quantitative methods of analysis.

Depending upon the extent to which the law authorizes police officers to require drivers to take such tests in the various Member States, they have been used either in “random” checks or on a selective basis (49). From the cost/effective point of view it is important to know the distribution of blood alcohol concentrations among the driving population at different times and places, and public health authorities should support roadside sampling surveys (50) designed to provide this information, as they enable screening tests to be carried out more effectively, i.e., at the times and places where drivers are most likely to be found drinking to excess.

Recently, portable breath testing devices have been developed which are based on fuel cell techniques and enable an accurate estimation to be made of the blood alcohol concentration. These new devices are likely to improve considerably the efficiency of screening by means of breath tests. They are also of incidental interest to the public health authorities in that, unlike existing instruments, they do not require the cooperation of the subject; a reasonably accurate reading can therefore be obtained from unconscious persons. This raises important issues for the differential diagnosis between alcoholic intoxication and head injury and other clinical states that may exhibit similar signs and symptoms.

PSYCHOLOGICAL TESTS

The use of psychological tests in procedures for screening drivers was considered in the report on the Rome Symposium (6). It was concluded that they had only a very limited place – not because psychological conditions were not important, but because it had not been possible to devise a battery of reasonably practicable psychological tests that could predict high-risk drivers with any acceptable degree of certainty.

Since then some progress has been made and Professor Håkkinen reported to the Conference that his studies had shown that the accident behaviour of professional drivers was highly constant over a period of driving of more than 20 years. If drivers had been selected on the basis of the 5 best test variables there would have been 48.5% fewer accidents than actually occurred, these test variables having a better predictive power than information about the previous accident experience of the drivers in preceding years. If the selection procedure based on these tests had been used before employing the drivers, so as to replace the worst 50% of the drivers by the best 50%, the number of accidents could have been reduced by 40.4%.

The use of psychological test procedures is therefore showing promise in the future selection of professional drivers, and there may be a case for their use on a selective basis for private drivers, e.g., those with bad accident records or repeated convictions for serious traffic offences. However, the use of psychological tests as a routine screening procedure in licensing private drivers is not yet justifiable on a cost/benefit basis, and it is likely to be some time before the driving population is prepared to accept them as an indication for withholding a licence.

DRIVING TESTS

The main function of the driving test is to ensure that the driver is able to control the vehicle properly in traffic conditions. However, from the point of view of accidents it should be noted that the tests seldom take place under conditions where the risk of serious injury-producing accidents is greatest, e.g., at night or at relatively high speeds. It is important that the tests should ensure that the driver not only understands the traffic regulations and the “Highway Code” but is also aware of the human and environmental factors that increase the risk of injury-producing accidents.

INJURY PROTECTION

Public health authorities should pay close attention to the environmental and human factors that influence the severity of injuries received in road accidents. The lack of success that has accompanied attempts to control the occurrence of injury-producing accidents in Member States (as compared with the relative success achieved in
controlling industrial accidents) justifies the importance that is attached to injury protection. In the earlier part of this report distinction was drawn between “protected” road users (vehicle occupants) and “unprotected” road users (pedestrians and cyclists).

The first consideration is to study the nature and extent of injuries received by different categories of road user and, with the aid of that knowledge, to devise the best kind of protection. The Conference noted that a large number of studies had been carried out along these lines and that they formed the basis of important modifications in the external and internal design of motor vehicles and in highway design. The important work carried out by the ECE in this respect was commended by the Conference, and it was recommended that public health authorities should give their fullest support to the adoption by governments of European standards in safety design. Highway engineering was particularly important in this respect, particularly the avoidance or removal of the more lethal aspects of roadside furniture with which vehicles can collide and the proper use of crash barriers, subjects on which OECD has carried out much useful work.

Less expensive, but highly effective methods of reducing injury include the use of crash helmets by motor-cyclists and the use of occupant-restraint systems (e.g., safety belts). Perhaps the most useful contribution that could be made by public health authorities would be to improve epidemiological information by providing a road accident morbidity reporting system adequate to evaluate the effect on injuries of such measures, a requirement that has been emphasized strongly in the earlier sections of this report. Much of the necessary information is available to public health authorities if they choose to collect it.

The Conference felt that the wearing of safety belts was the single most important measure for reducing mortality and morbidity from road accidents in technically developed countries. The reduction achieved in those countries that have made the wearing of seat belts compulsory is impressive and has been well documented. Most studies claim a reduction in both deaths and serious injuries of about 20%. The same reduction is claimed for spinal injuries, which may allay the fears of those who believe that wearing seat belts increases the risk of neck injury. One of the main effects of seat belts is to prevent the occupants being thrown around the interior of the car or out of the car. Head impact is still the most serious cause of injury in seat belt wearers and the most important cause of death among them. Car designers must react to a situation in which the majority of drivers will be wearing seat belts, which means more attention being paid to the roof of the car, the centre pillar and top part of the door, and less attention to features such as shock-absorbing facia panels with which the seat belt wearer rarely comes into contact. One of the main objections to making the wearing of seat belts compulsory is that it affects only the individual concerned. Public health authorities should therefore note that unrestrained individuals increase considerably the risk of injury to other occupants in the car, whether they are personally restrained or not.

Anxiety was expressed at the Conference about the longer-term consequences of the energy crisis. Although there had been an initial reduction in casualties as a result of the speed limits imposed by most Member States in an attempt to conserve fuel, there were other consequences that were likely to increase the severity of injury-producing accidents. These included the expected increase in the proportion of smaller cars, which offer far less protection, the likelihood that cars would carry more passengers than previously, and an increase in the number of large, heavy goods vehicles, which are more likely to cause serious injury to other road users. Public health authorities should emphasize the importance of providing adequate baseline data so that the effect of changes of this kind can be monitored.

Finally, the Conference noted that the extent to which human factors can determine the consequences of injury-producing accidents is often overlooked. The chances of surviving serious trauma are considerably reduced in the older age-groups, and children are at special risk from the consequences of epiphyseal injury. Obviously, road users who are already suffering from disease or disability are not only more likely to be involved in road accidents but are also at greater risk of serious consequences. In most cases it is difficult to compensate adequately for these factors.

However, public health authorities can offer useful advice on some questions, e.g., it is not generally realized that in addition to the increased risk of accident involvement associated with higher blood alcohol concentrations, there is also a significant reduction in the chances of survival when the victim is intoxicated. Environmental authorities can also introduce aids to help disabled persons to use the road system, such as the use of sound signals at light-controlled pedestrian crossings, so that they can be used by blind persons without assistance.

EDUCATION OF CHILDREN AND ADOLESCENTS

Education in the safe use of the road system should be integrated with health education and, for children, with general education at schools. It should no longer be treated as a separate subject under the title of “road safety” and separated from the normal school syllabus (52). The aims of such education in children are to provide them with immediate protection from the
injuries to which they are exposed as pedestrians and cyclists (both high-risk groups), and to prepare them as future users of the road system, particularly as they approach 15-24, the age-group in which there is the greatest risk of being injured as drivers and passengers of cars, mopeds, and motor-cycles.

Public health authorities should emphasize the need for such education to be based on a thorough knowledge of the circumstances in which children are most likely to be seriously injured in road accidents, e.g., when trying to cross the road from behind a parked vehicle. Instruction should be provided by teachers who understand the way in which children think and reason, and the way in which they react to road traffic. Children react in a very different way from adults, and the approach to their instruction in the safe use of the road system must be adjusted accordingly.

EDUCATION AT DRIVING SCHOOLS

The role of the driving test as a screening procedure was considered on page 18, where it was emphasized that candidates for a driving licence should be aware of the human and environmental factors that increase the risk of accident involvement. It follows that driving schools should give attention to these factors in their courses of instruction, and that public health authorities should be prepared to advise them on the content of the courses in relation to fatigue, the use of alcohol, the effects of medical conditions on driving, the use of sunglasses in twilight conditions, and the many other human factors that may increase the risk of accident. It is no longer acceptable that public health authorities should limit their role to the traditional instruction on first aid.

CONTINUING EDUCATION

The report on the Rome Symposium (6) drew attention to the need for continuing education of road users and deplored the fact that much of the publicity to which road users are exposed concentrates on the “negative” aspects of road safety, such as advertisements for fast cars, which often appear to associate fast cars and high speeds with sexual virility. Such advertisements are particularly likely to influence the impressionable high-risk group of young drivers. Advertisements rarely emphasize the “positive” aspects, such as the safety factors in car design, although there are signs that manufacturers are beginning to become aware of the importance of promoting such features in their advertising.

It is left to the traditional road safety campaigns to counteract this negative publicity and to try to instil into road users the need for a positive approach to the prevention of road accidents. One of the main difficulties has been that such campaigns are usually associated with the introduction of other road safety measures, such as legislation, an increase in police activities, and environmental changes, so that it is difficult to evaluate the effects of road safety campaigns in isolation (53). Public health authorities must realize that such campaigns are an important and integral part of overall health education, utilizing the same techniques as are employed in health education and directed towards the same ends - the reduction of mortality and morbidity.

The nature and content of road safety campaigns remains controversial. Experiments have shown that instructive messages, i.e., telling a driver what to do, are far more successful than “motivating” messages, i.e., telling the driver why he should adopt a particular kind of behaviour (54). The message must be as imperative as possible so that it is quite obvious to the individual road user exactly what he is supposed to do on the road. Messages such as “Safety first” and “No accidents please” cannot be expected to be very effective, and this is borne out by experience. Other principles to be followed are the need for the message to hold some personal relevance for the individual road user and the need for “immediacy”. As far as possible the message must reach the road user at the time and place where it can be translated into the appropriate behaviour.

Finally, campaigns must be continued or repeated at regular intervals. An example of the failure to observe this principle is provided by the events following the introduction of the United Kingdom legislation against drinking and driving in 1967. The associated road safety campaign was never repeated, so that by 1975 none of the drivers in the high-risk age-group up to 25 years was ever exposed to it, and it is this group that has shown the worst experience of accidents under the influence of alcohol since the legislation was introduced.

THE ROLE OF HEALTH PERSONNEL IN EDUCATION

Health personnel have a special responsibility to educate drivers attending for the treatment of medical conditions about the possible effects of medical conditions on driving, and, in particular, about the effects on driving of any treatment that may be given. The proportion of the adult population holding licences to drive has increased in all Member States of the European Region in recent years to such an extent that doctors
and other health personnel should assume until it is proved otherwise that ambulant patients over licensing age will drive.

In this connexion the Conference considered that public health authorities should ensure that authoritative handbooks containing advice on the effects of medical conditions on driving should be made available to health personnel. Such handbooks should include suggestions as to the advice to be given to patients under treatment with psychoactive drugs.

Drugs are used in the prevention and relief of symptoms as well as in the cure of disease; it therefore follows that in some cases drivers may be safer driving under the influence of drugs than without them. The obvious example is supplementation therapy in endocrine disorders. It may be significant that there is little evidence of any relationship between the taking of psychoactive drugs in normal doses and an increased risk of involvement in an accident; thus, it must not be assumed that the taking of such drugs in accordance with medical instructions will invariably increase accident risks.

The Conference expressed the view that doctors prescribing psychoactive drugs for patients must assess each case on its merits, taking into account the available information about the patient, his medical condition, and the nature of the driving task, e.g., whether the patient should restrict driving to daytime, certain kinds of roads, and for limited periods of time. The need to distinguish between professional drivers and private drivers (see the section on Screening procedures, p. 15) is particularly important in this respect.

Certain principles concerning the prescribing of psychoactive drugs were considered by the Conference. It was emphasized that the dangers are greatest in the initial period of therapy, i.e., before the extent of the side effects, or indeed the main effect, of the drug on the individual patient, is known. Special attention has to be paid to the dangers of unwanted interactions with other drugs, particularly with alcohol. It must be remembered that adverse reactions and interactions that would be regarded as acceptable in ordinary clinical practice cannot be regarded as acceptable in the driving situation. Particular care is therefore necessary in prescribing new drugs, or drugs that are not experienced in prescribing.

The education of drivers in the dangers of driving under the influence of certain drugs is particularly important in cases where the drug concerned is freely available without the need for a doctor’s prescription. The Conference noted with satisfaction that the Council of Europe’s Committee on Partial Agreement in the Social and Public Health Field had recommended that the containers of such drugs should carry a clear warning. Even in those countries in which most drugs can only be obtained on a doctor’s prescription there remain many that are freely available over the counter, including “cold cures” (containing stimulants) and antihistamines (which are often recommended for travel sickness).

TRAFFIC REGULATIONS

Legislation aimed at influencing the behaviour of road users has an important role to play in reducing the risk of injury-producing accidents. But it must be regarded as a means of reinforcing and supplementing the educational measures discussed in the last section and not as a means in itself. Traffic regulations are mainly codes of conduct and the following requirements laid down by the OECD Research Group on the Effects of the Enforcement of Legislation on Road User Behaviour and Traffic Accidents (55, chapter 13, para. 2) should be noted:

1. They must provide information, i.e., be understandable, relate to a specifically defined situation or procedure, and be capable of straightforward interpretation;

2. They must have no inherent contradictions, i.e., obeying them must not clash with other codes;

3. They must be capable of being obeyed by road users and of being enforced by the police. It is essential that road users know the laws that are currently in force, retain this knowledge, and be brought up to date. They should also understand the reasons for these laws and, ideally, should be persuaded to want to conform to them.

It is particularly important that regulations should be clear and specific. Offences based on terms such as “driving without reasonable consideration”, “driving without due care and attention”, “dangerous driving”, “unlawful overtaking”, and “unlawful pedestrian behaviour”, which are to be found in the laws of many Member States, are neither clear nor specific.

LAW ENFORCEMENT

Enforcement of traffic regulations presents many difficulties. Some regulations are virtually self-enforcing, e.g., observing traffic lights, highway signs relating to lanes, etc. But most regulations require a considerable degree of enforcement if they are to be effective, e.g., speeding, driving under the influence of alcohol. The Conference noted that in many instances the probability of detection is so small that regulations have a negligible effect on the behaviour of road users and are therefore
Table 6. Drivers involved in road accidents while under the influence of alcohol in 13 European countries, 1968-1972*  

<table>
<thead>
<tr>
<th>Country</th>
<th>Total No. of registered private cars (in tens of thousands)</th>
<th>Number of drivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany, Federal Republic</td>
<td>110.16</td>
<td>35 765</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>103.18</td>
<td>41 765</td>
</tr>
<tr>
<td>Italy</td>
<td>73.11</td>
<td>--</td>
</tr>
<tr>
<td>Sweden</td>
<td>19.67</td>
<td>--</td>
</tr>
<tr>
<td>Netherlands</td>
<td>17.25</td>
<td>--</td>
</tr>
<tr>
<td>Spain</td>
<td>13.35</td>
<td>235</td>
</tr>
<tr>
<td>Switzerland</td>
<td>9.79</td>
<td>3 016</td>
</tr>
<tr>
<td>Austria</td>
<td>9.65</td>
<td>2 145</td>
</tr>
<tr>
<td>Denmark</td>
<td>8.88</td>
<td>1 009</td>
</tr>
<tr>
<td>Finland</td>
<td>5.51</td>
<td>766</td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td>5.21</td>
<td>1 824</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>3.56</td>
<td>1 648</td>
</tr>
<tr>
<td>Poland</td>
<td>3.32</td>
<td>--</td>
</tr>
</tbody>
</table>


of little use in reducing road accident mortality and morbidity. A small study in Michigan (55, chapter 1, para. 5) showed that the chance of being detected while exceeding the speed limit on one highway was only once in 7600 violations. The results of such low levels of enforcement are that road users no longer feel any responsibility for observing the regulations, merely considering themselves to be unlucky if they are detected. It is particularly important to enforce speed regulations effectively as high-velocity accidents are associated with severe trauma.

In the case of driving under the influence of alcohol, which is of special interest to public health authorities, enforcement presents a number of difficulties. Most Member States rely on a screening breath test, either to determine that an offence has been committed or, more commonly, to determine whether the driver can be required to supply a sample of blood for quantitative analysis of the blood alcohol concentration. A recent Swedish survey showed that only 18.5% of drivers had ever been stopped by the police for any kind of “control” (traffic check). The 21 000 blood tests carried out annually in Sweden represent about one blood test for every 2 million kilometres travelled (56).

In the USA it has been estimated that in a city with a population of about one million employing about a thousand police officers there will be about four million violations of the traffic regulations and only about 2000 arrests. A sample of a thousand drivers drawn from a social stratum of persons who would be expected to be aware of, and influenced by, traffic regulations, showed that none of them was fearful of being apprehended by the police when driving after having taken excess alcohol (57). In the United Kingdom it has recently been stated by an American expert who studied the position closely that “The risk of apprehension for the drinking driver in Britain is realistically quite minute and this fact is increasingly being learnt by the public, who are adjusting their behaviour in consequence”(56). One reason is that breath alcohol screening is not being used on a sufficiently selective basis, i.e., at the times and places where drivers are most likely to have been drinking. The result is that much police effort is wasted. Surveys of the distribution of the alcohol habit in the driving population are therefore necessary, as noted in the section on Tests for alcohol and other drugs, (p. 18). Meanwhile, there is evidence that there are widespread differences in the extent to which even those drivers who have been involved in accidents are investigated in relation to alcohol consumption. Table 6, constructed from the statistics given in the annual ECE publication Statistics of road traffic accidents in Europe, shows such wide variations that the differences cannot be explained by national differences in the habits of drivers in relation to alcohol.
SANCTIONS

Although the range of sanctions that can be imposed on road users must be sufficient to produce some deterrent effect against breaches of traffic regulations, they must be related to the problem of the individual offender. The imposition of standard penalties for specific offences, particularly if related to the consequences of any accident that may have occurred, has not been found a satisfactory deterrent.

The main problem in determining the appropriate sanction is that very little is known about the reasons why road users violate traffic regulations. Formidable methodological difficulties confront the researcher in criminology who tries to collect the facts. Unlike most criminal offenders, who can be studied in depth whilst serving prison sentences, the great majority of persons violating traffic regulations lead normal lives in the community and are regarded by the community as normal people. From the epidemiological point of view it is important to recognize that although the main object of the traffic regulations is to control behaviour that increases the risk of accidents, it does not follow that risk of accident and risk of traffic violations are influenced by the same factors in the same way. This is clearly demonstrated by the fact that after the age of 25 the risk of violation falls very much more slowly than the risk of accident.

Epidemiological studies on drivers convicted of violation of traffic regulations have been carried out in a number of countries and have been reviewed in the report of the Fourth Conference of Directors of Criminological Institutes, which was organized by the Council of Europe (58). These studies show interesting relationships between violations and age, sex, occupation, etc. Perhaps the most interesting finding is that persons who violate traffic regulations are not markedly different from other criminal offenders. A substantial number of traffic offences are not simply “accidents” – to which individual factors are irrelevant – and traffic offenders are not a unique and homogeneous group apart from other offenders.

It follows that temporary deprivation of the licence to drive is justifiable in cases where drivers repeatedly violate traffic regulations. The Conference was impressed by the “points” system adopted by a number of Member States, which has been the subject of a resolution of the Committee of Ministers of the Council of Europe (59).

The offence that is most directly related to the interests of public health authorities is the drinking/driving offence. As has already been seen, alcohol is a very important factor in increasing the risk of injury-producing accidents, and where alcohol is a factor in an accident, the consequences, in terms of death or injury are likely to be more severe than in accidents from other causes. Furthermore, the social and medical problems associated with the abuse of alcohol are already well-known to public health authorities, which should therefore make available to the courts the expertise that they have gained in dealing with the problem.

The main difficulty is that the existing sanctions applied to persons violating drinking/driving laws take little account of the problems of the individual offender. While the penalty of automatic deprivation of the licence for varying periods may act as a deterrent in some cases, it is unlikely to be an effective deterrent in the case of drivers who are already alcoholics or problem drinkers. Furthermore, in the case of untreated compulsive drinkers, the return of the licence at the end of the period, without any enquiry as to the alcohol habit of the driver, leads to a situation where the offence is likely to be repeated. At least 25% of drivers convicted in Melbourne (Australia) of driving while under the influence of alcohol repeat the offence, some of them four or five times, and many more repeat the offence without being apprehended, or escape prosecution through being killed or injured in an accident (60).

Conviction of a drinking/driving offence has now been recognized as a fairly early sign in the development of alcoholism, and should be taken seriously by public health authorities in view of the relatively late stage at which the condition is diagnosed in most Member States. A recent survey in the Republic of Ireland (61) compared the histories of 100 male alcoholic drivers of cars with matched controls. Whereas the average driver in the alcohol group had received his first formal treatment for alcoholism about the age of 38, he had been involved in his first road accident involving alcohol at least 6 years before that date. Over a third of the alcohol group had been admitted to hospital for treatment of physical conditions related to, or associated with alcoholism, and were recognizably suffering from alcoholism. But many of them received no formal treatment for their alcoholism for 4 years or more after discharge from hospital, during which period they were involved in road accidents associated with alcohol. The authors of the survey point out that the diagnosis is often missed because those who come into contact with the patient, including doctors, nurses, social workers and law officers, are not alert to the problem and assume that the average alcoholic conforms to the stereotype “skid row” down and out. The fact that the majority of alcoholics are well dressed and healthy looking for most of their drinking careers is not generally appreciated.

Although the pattern of drinking and of alcoholism varies from country to country, those drivers violating the drinking/driving laws tend to fall into one of three groups:

(1) Young inexperienced drivers (under 25): These drivers are inexperienced at driving, inexperienced at drinking, and inexperienced at driving after drinking.
There has been a rapid increase in alcohol abuse amongst this age-group in the last decade in almost all Member States. In the United Kingdom there has been an increase of 30% in the convictions for drunkenness (unconnected with driving) within this age-group since 1966, and the proportion of drivers killed in road accidents in this age-group with blood alcohol concentrations in excess of the statutory limit has more than doubled.

(2) Experienced "social" drinkers: These drivers are experienced in drinking, driving, and driving after drinking. They are rarely ever found to have excessively high blood alcohol concentrations, and they have relatively good accident records. In the United Kingdom the proportion killed in accidents over the age of 30 with blood alcohol concentrations in excess of the statutory limit is still well below the level existing before the statutory limit was introduced.

(3) Problem drinkers and alcoholics: This group is no longer in control of its drinking and, in the view of many medical authorities, is in need of treatment.

Public health authorities must insist that these groups of drinking drivers are identified by courts before sanctions are imposed upon them. Experienced social drinkers are receptive to education and deterred by the threat of deprivation of the licence. Problem drinkers and alcoholics are neither receptive nor deterred because their drinking is compulsive. Young and inexperienced drivers pose yet another problem. It is difficult to see how the widespread imposition of prison sentences can help any of these groups. Yet 40% of all prison sentences in Sweden are for the drinking/driving offence and drinking drivers constitute 10% of the prison population of Sweden at any one time (62, pp. 370-371).

Public health authorities must accept responsibility for the drinking driver with alcohol problems, and, as a first step, it should be insisted upon that drivers charged with the offence and found to have exceptionally high blood alcohol concentrations (e.g., in excess of 150 mg/100 ml), should be remanded for medical examination. The Swedish Committee appointed by the Swedish Government to review the drinking/driving legislation drew attention to the need for drivers sentenced to prison to receive treatment and emphasized that the prospects of success are good insofar as the driver convicted of the drinking/driving offence is often in an early stage of the disease (62, p. 372). The US National Highway Safety Administration has recommended that courts should be given powers to commit medically diagnosed alcoholic drivers to hospital rather than to prison, after conviction for the offence (63).

ENVIRONMENTAL LEGISLATION

Legislation controlling the design of vehicles (both interior and exterior) and factors associated with the construction of roads, roadside furniture, etc. plays an important part in reducing road accident mortality and morbidity and, in this respect, should be regarded as public health legislation. The Conference did not have time to consider this important subject in sufficient detail. However, there was complete agreement that Member States should endeavour to incorporate in national legislation the recommendations of intergovernmental organizations such as the United Nations Economic Commission for Europe and the Council of Europe, both of which have studied the subject in considerable depth. As with human factors, it is important that recommendations should be supported by adequate research, and in this field much useful work has been carried out by the OECD Steering Committee on Road Research through its expert groups, such as the Expert Group on the Effect of Roadside Obstacles on the Severity of Road Accidents. It is important that public health authorities should be aware of recommendations relating to the safety of the environment in respect of road users.

COSTS AND BENEFITS

The evaluation in terms of cost of the various measures designed to reduce the mortality and morbidity from road traffic accidents poses many interesting questions for the economist. The occurrence of road accidents inflicts a burden on the community, which may be considered in two parts (64):

(1) The pain, fear, and suffering imposed by the occurrence, or the risk of occurrence, of road accidents. These are considered to be of great importance in a society that values human life and welfare.

(2) The more concrete and ascertainable burdens constituted by the net loss of goods and services due to death and injury and the expenditure of resources necessary to make good the effects of the accident, e.g., the medical expenses, vehicle repairs, and costs of administration. To these must be added the burden on the social services of the victims who have suffered permanent incapacity as a result of the accident.

It is impossible to assess pain, fear, and suffering in financial terms, and it is difficult to estimate the cost of the items under (2). But a number of countries have carried out estimates that enable them to calculate the costs of road accidents, and it is important that
cost/benefit analysis should be applied to the various measures that are considered for controlling injury-producing road accidents. The Ninth Round Table on Transport Economics held in Paris in 1970 (65) concluded that before any action is taken it is essential to know what the current situation really is and to make arrangements to enable proper monitoring to take place. A well designed continuous system of data collection is far preferable to occasional surveys, however large the scale. In other words, the improvement of national returns, along the lines set out in an earlier section of this report (pp. 2-4), is of fundamental importance to the cost/benefit approach to the prevention of road accidents.

New measures to improve road safety must be subjected to the same field trials and evaluation as other public health measures (66). Too often road safety measures have been introduced on an ad hoc basis, unsupported by adequate research and evaluation. The introduction of steel-studded tyres was cited as an example of a measure that failed to achieve results for reasons that would have been apparent if adequate field trials had been carried out. Because of the damage they did to road surfaces, more resistant road surfaces were introduced which themselves increased the danger of skidding (67). Furthermore, drivers found that they could control their cars at faster speeds on slippery surfaces and consequently drove faster.

As far as the control of injury-producing accidents is concerned, adequate evaluation has been seriously hampered by the poor quality of the basic data upon which decisions have to be made. Too many international organizations concerned with road accidents are making too many recommendations on the basis of too little research.

Public health authorities are familiar with the principle that the benefit from intervention must be commensurate with cost, both at the individual and public level. Very expensive measures such as the erection of fences between opposing carriageways on motorways prevent relatively few injury-producing accidents, whereas some relatively inexpensive measures, such as the carrying of rear reflector plates by heavy goods vehicles and the wearing of reflective material by unprotected road users, may prevent a large number of such accidents. The proper use of public health resources and the extent to which they should be used in selection procedures (e.g., medical examinations of drivers) must constantly be borne in mind in relation to the consequential benefits in terms of reducing mortality and morbidity from road accidents.

THE ROLE OF PUBLIC HEALTH AUTHORITIES

Throughout this report indications have been given of the ways in which public health authorities can play a more active role in the prevention and control of injury-producing road accidents—a role far removed from their traditional role of dealing with the consequences of such accidents by means of first aid, emergency treatment, and rehabilitative services.

The first step towards achieving this role must be the instruction of public health personnel in the epidemiological approach to injury-producing road accidents. In this connexion, the Conference felt strongly that this subject should be included in the courses of instruction of such personnel and that, where appropriate, university departments of traffic medicine should be set up, as recommended by the Council of Europe (68), to facilitate such instruction and to administer and coordinate research.

The variety of disciplines concerned in the prevention of road accidents has led to the involvement of a large number of international organizations, both governmental and nongovernmental, including many that are not normally in contact with public health authorities. The Regional Office has held two meetings of international organizations concerned with the prevention and control of road accidents in Europe, in 1968 and in 1971; the report on the most recent meeting, which gives detailed information about the activities of 30 international organizations, has been issued and is available from the Regional Office. A further meeting will be held in 1976.

SUMMARY OF CONCLUSIONS

National returns of road accident mortality and morbidity

Conversion factors used for the purpose of comparing road accident mortality between different Member States are unreliable and misleading. There is considerable underreporting of road accident morbidity, particularly in respect of “unprotected” road users. Existing criteria upon which the classification of road accident morbidity is based are misleading and give no indication of the prospect of permanent incapacity.

Hospital-based statistics

The majority of Member States do not collect data from hospitals on road accident morbidity, and those that do collect such data rarely ever make use of it for epidemiological purposes.

Permanent incapacity from road accidents

Surveys suggest that the number of persons permanently incapacitated from injuries received in road
accidents is increasing in all technically developed countries, and is involving an increasing proportion of road users in the younger age-groups.

Road accident morbidity information systems

A feasibility study should be carried out on the proposals of the WHO Regional Office for Europe for adoption of a new definition of "serious injury" in road traffic accidents, based on length of hospital stay and the degree of incapacity of the victim.

Injury coding systems

Public health authorities should also support a feasibility study of an improved system of reporting by the police of injuries received in road accidents, based on the location and type of injury and the state of the victim. There would be considerable advantage in combining the two studies (i.e., a joint study with that proposed in the preceding paragraph).

Comparative analysis of road accidents

Comparative analysis of detailed accident data between selected urban or rural environments in different Member States is feasible and the Regional Office should consider setting up comparative in-depth studies of road accident mortality and morbidity between selected cities or regions on the basis of predetermined and standardized techniques for recording data.

Roadside surveys

Roadside surveys designed to provide information about road users (e.g., alcohol habit, attitudes to road safety, seat belt wearing, etc.) can provide useful baseline data on which to evaluate countermeasures and should be regarded as an essential prerequisite for the planning of health education (road safety) measures.

Risk factors

The occurrence of an injury-producing road accident depends on the interaction between the various adverse factors present in the road user and in the environment. Public health authorities should be fully aware of the importance and extent of these adverse factors and should involve themselves in planning decisions affecting road safety (e.g., siting of a school) at the earliest possible stage so as to ensure that they are not overlooked.

Children at risk

The increase in the fatal accident rate among children between 1960 and 1970 in Europe was mainly the result of the increase in the number killed in road accidents. There is considerable underreporting of the morbidity of child pedestrians and cyclists so that the risk is underestimated in many Member States. Public health authorities should support special surveys designed to provide more reliable data so as to enable any changes in the casualty rate to be monitored (e.g., the introduction of high-rise bicycles). For children travelling unrestrained in the front seats of cars the risk of being killed in a road accident has been found to be about 12 times greater than that for children wearing seat belts — irrespective of the mechanical efficiency of the restraint (i.e., even if the children are wearing belts designed for adults).

Young people at risk

In some Member States almost half of all male deaths in the 15-24 years age-group are from road accidents — mostly drivers or passengers of motor vehicles (including mopeds and motor-cycles). The reasons for the high risk of death or injury in this age-group have not yet been fully identified; they should be given more attention by public health authorities in view of the importance of this age-group to the community.

Old people at risk

The mortality and morbidity rates for pedestrians over the age of 65 are very much higher than those for younger persons in most Member States, and the percentage of pedestrians over the age of 65 killed in Europe is greater than that for the 40-year period between 25 and 64. Public health authorities should recognize this risk by including in their health education programmes advice to old people on the safe use of the road system.

Medical conditions as risk factors

A number of surveys have shown that medical conditions in nonprofessional drivers do not appear to be an important cause of injury-producing road accidents. Most injury-producing road accidents involve medically fit drivers, particularly young drivers in whom medical conditions are least likely to exist.

Defective eyesight as a risk factor

Surveys comparing the accident records of drivers with or without good eyesight have not yet produced conclusive results and the position remains confused. The evidence suggests that dynamic depth perception is an important factor in safe driving.
Alcohol and other drugs as risk factors

A direct relationship has been shown to exist between blood alcohol concentration and risk of accident involvement. The effects of other drugs on the risk of accident are far more difficult to establish. Persons suffering from drug dependency should not be allowed to drive.

Psychological and sociological risk factors

Road users who have difficulty in adjusting to their sociological environment, as manifested by repeated convictions for minor criminal offences, financial disasters, marital breakdowns, attendances at venereal disease clinics, etc. are overrepresented in road accidents. Lack of social conscience and a tendency to impulsive acts is commonly found.

Screening procedures

Public health authorities should apply to the use of screening procedures in road accident prevention the same criteria as they use in applying screening procedures for the control of disease. Licensing procedures should therefore embrace all high-risk groups. It was noted that in some Member States low-powered two-wheel vehicles that expose relatively unprotected road users to a high risk of injury-producing accidents are not subject to licence restrictions. The screening procedures for professional drivers of heavy goods vehicles and public service vehicles must be particularly strict, as the risk of injury to other road users is very high when such vehicles are involved in accidents.

Screening for medical conditions

There is no evidence that routine periodical medical examinations of drivers are justifiable on a cost/benefit basis (in terms of a reduction in casualties). Furthermore, medical examination is relatively inefficient in predicting the onset of sudden illness. Accordingly, medical examinations should be used selectively in licensing procedures, determined by criteria that have been found to be most effective, e.g., prolonged absence from work, involvement in serious traffic offences or accidents. In the case of the older driver, the age at which medical examination is called for should be decided in the light of the accident experience or rates of disability known to occur in the community at different ages, and not by arbitrary decision. The examination should be directed more to ensuring that the driving task is equal to the degree of impairment found, rather than to deciding whether the driver is fit to hold a licence. More use should be made of "conditional" licences, e.g., licences that exclude night-time driving, driving on motorways, long periods of driving, etc.

Screening for defective eyesight

Except in extreme cases, defective static visual acuity and restricted fields of vision (which are the most commonly tested aspects of vision in drivers for licensing purposes) are not important in determining the risk of accident in driving. Many Member States exclude drivers on the basis of such tests while permitting drivers with defective depth perception to hold a licence. A multipurpose vision tester capable of testing dynamic visual acuity is at present undergoing trial in the USA.

Screening for alcohol and other drugs

Psychological screening

Psychological test procedures have not yet been developed to a stage where their use as a routine screening procedure for private drivers can be justified on a cost/benefit basis. Recent studies suggest that their use in the selection of professional drivers could reduce substantially the number of accidents.

Driving tests

In addition to ensuring that the candidate has adequate control of the vehicle and a knowledge of the traffic regulations it is important that he should be fully aware of the human and environmental factors that increase the risk of accident.

Injury protection

Public health authorities should give their full support to the adoption of measures designed to reduce the severity of injuries received in road accidents. The wearing of safety belts is considered to be the single most important factor in reducing mortality and morbidity from road accidents in technically developed countries. It was noted with concern that the initial reduction in casualties brought about by the speed limits introduced at the onset of the energy crisis is beginning to be offset by other factors that are likely to increase the severity of injury-producing accidents, e.g., increasing use of smaller cars (offering less protection) and an increase in the number of heavy goods vehicles.
Education of children and adolescents

Education in the safe use of the road systems should be regarded as part of health education, integrated into the school syllabus and no longer isolated as a separate subject under the title of "Road safety". Instruction should be based upon proven facts relating to high-risk groups and situations, and should be delivered by teachers who are thoroughly conversant with the way in which children think and reason.

Education at driving schools

Public health authorities should be prepared to advise on instruction in the human and environmental factors that increase the risk of accident, e.g., fatigue, alcohol, illness, etc., in addition to their traditional role of providing instruction in first aid.

Continuing education

Road safety campaigns should be regarded as an integral part of overall health education, utilizing the same techniques as health education and directed towards the same ends, i.e., the reduction of mortality and morbidity.

The role of health personnel in the education of drivers

In technically developed countries, doctors and other health personnel should regard all patients over licensing age as probable drivers, unless proved otherwise. Public health authorities should assume responsibility for ensuring that such personnel are in possession of the necessary information about the effects of medical conditions and drugs on the ability to drive safely, including the appropriate advice that should be given to patients. Drugs available without the need for a doctor's prescription (counter sales) should be required to carry a warning if they are likely to impair the ability to drive safely.

Traffic regulations

Traffic regulations are mainly codes of conduct and should be regarded as a means of reinforcing the educational measures mentioned above and not as a means in themselves. Therefore, they must be clear and specific.

Law enforcement

Traffic regulations depend for their effect on an adequate level of enforcement. In many cases, the probability of detection is so low that road users experience no sense of responsibility for observing the regulations and consider themselves merely to be unlucky if they are detected. An adequate level of enforcement is therefore especially important with regulations such as speed limits (which are intended to prevent high-velocity accidents involving risk of severe trauma) and offences involving alcohol (which are far more likely to cause severe injury-producing accidents than other causes of accidents).

Sanctions

Offenders against traffic regulations are not markedly different from other criminal offenders, and traffic offences should not be regarded as “accidents” to which individual factors are irrelevant. Penalties should be related to the problems of the individual offender, particularly in the case of the drinking/driving offence, where widely different groups of offenders can be identified. A conviction for this offence is now widely recognized as a fairly characteristic early indication of alcoholism. Drivers found to have high blood alcohol concentrations should be remanded for medical examinations before the court pronounces sentence.

Environmental legislation

Public health authorities should support the inclusion in national legislation of the recommendations of intergovernmental organizations concerned with making the environment safer for road users, e.g., safety factors in vehicle design.

Costs and benefits

Improvement of the national returns of road accident mortality and morbidity as recommended earlier in this report is the first requirement for applying cost/benefit principles to road accident prevention. Road safety measures should be subjected to the same requirements in terms of field trials and evaluation as other public health measures, and should not be introduced on an ad hoc basis. The proper use of public health resources and the extent to which it is justifiable to use them in selection procedures (e.g., medical examinations of drivers) should constantly be borne in mind in relation to the expected consequential benefits in terms of a reduction in casualties.

The role of public health authorities

The epidemiology of road accidents should be included in the courses of instruction of public health personnel. Where appropriate, university departments of traffic medicine should be set up to facilitate instruction and to coordinate research among the many disciplines involved in the subject. Public health authorities should play a more active role in the prevention and control of injury-producing road accidents — a role that is far removed from their traditional one of providing first aid, emergency treatment, and rehabilitative services.
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REPORTING FORM ON ROAD TRAFFIC ACCIDENT CASUALTIES
JOINT ECE/WHO FEASIBILITY STUDY

(To include all cases attending hospitals during the period . . . . . . . . (6 months) . . . .)

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<tr>
<td>1. Number of persons attending hospitals or clinics as a result of a road traffic accident</td>
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<tr>
<td>2. Number of persons who died within 24 hours after first attendance</td>
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<td>3. Number of persons admitted to hospital and still detained in hospital at the end of 24 hours after first attendance</td>
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<tr>
<td>4. Number of persons who died within 7 days after first attendance</td>
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<td>5. Number of persons admitted to hospital and still detained in hospital at the end of 7 days after first attendance</td>
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<td>5a. Of these, the number of persons included within the proposed ECE definition of “seriously injured”</td>
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<td>6. Number of persons within the proposed ECE definition who are no longer detained in hospital at the end of 7 days after first attendance</td>
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<td>7. Number of persons who died within 30 days after first attendance</td>
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<td>8. Number of persons admitted to hospital and still detained in hospital at the end of 30 days after first attendance</td>
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<td>8a. Of these the number of persons who are bedridden or suffering from total physical or mental incapacity</td>
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<td>9. Number of persons transferred to other hospitals</td>
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<td>(a) within 7 days after first attendance</td>
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<td>(b) within 30 days after first attendance</td>
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*The term “hospital” is defined as follows: a hospital is a residential establishment which provides short-term and long-term medical care consisting of observational, diagnostic, therapeutic and rehabilitative services for persons suffering or suspected to be suffering from a disease or injury, and for parturients. It may or may not also provide services for ambulatory patients on an outpatient basis. (World Health Organization Technical Report Series, 1966, No. 336).

b Record only first attendance at a hospital after the accident.

c A person seriously injured is a person who 7 days after a road accident, and as a result of that accident, is still bedridden or suffers from total physical or mental incapacity. “Total incapacity” means a reduction of mobility such that the person is incapable of moving from one place to another without assistance.

d This information can be obtained from the local coordinator to the survey if he is supplied with a list of those persons included in the answer to question 3 who have since been discharged or transferred to another hospital.

e See note c for definition of total incapacity.

The completed form is confidential.
SUPPLEMENTARY INFORMATION

The names and addresses of all persons included in the total figures given in answers to questions 5a and 9 should be supplied to the coordinator of the survey in order to ensure that they are correctly identified with the other information collected about the accidents in which they were injured. It should also be stated which of these persons have been referred or transferred from any other hospital that they may have attended as a result of their accident.

It should be emphasized that the final analysis of results from this study will be in such a form that no individual can be identified.

Any names and addresses supplied to the coordinator and used only for the study will be treated in the strictest confidence and not passed to any other authority.
TEST OF ALTERNATIVE INJURY CODE

Police agency ____________________________ Date of accident ____________________________

CONFIDENTIAL REPORT

Directions: This report form is to be filled out for every person injured or killed in a traffic accident. Circle first the location of the most severe physical complaint in column 1 and then circle the type of physical complaint in column 2 pertaining to the anatomy. Also indicate victim's status by checking appropriate item in column 3. Code only what is observed at the scene — no hospital follow-up is necessary. Definitions of types of physical complaint and victim's status are on reverse side of form.

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<tr>
<th>Location of physical complaint</th>
<th>Type of physical complaint</th>
<th>Victim's status</th>
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<tr>
<td>A. Head</td>
<td>1. Amputation</td>
<td>[ ] Apparent death</td>
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<tr>
<td>B. Face</td>
<td>2. Concussion</td>
<td>[ ] Unconscious</td>
</tr>
<tr>
<td>C. Eye</td>
<td>3. Internal</td>
<td>[ ] Semiconscious</td>
</tr>
<tr>
<td>D. Neck</td>
<td>4. Minor bleeding</td>
<td>[ ] Incoherent</td>
</tr>
<tr>
<td>E. Chest</td>
<td>5. Severe bleeding</td>
<td>[ ] Shock</td>
</tr>
<tr>
<td>F. Back</td>
<td>6. Minor burn</td>
<td>[ ] Normal</td>
</tr>
<tr>
<td>G. Shoulder — upper arm</td>
<td>7. Moderate burn</td>
<td></td>
</tr>
<tr>
<td>H. Elbow — lower arm — hand</td>
<td>8. Severe burn</td>
<td></td>
</tr>
<tr>
<td>I. Hip — upper leg</td>
<td>9. Fracture — dislocation</td>
<td></td>
</tr>
<tr>
<td>J. Knee — lower leg — foot</td>
<td>10. Contusion — bruise</td>
<td></td>
</tr>
<tr>
<td>K. Abdomen</td>
<td>11. Abrasion</td>
<td></td>
</tr>
<tr>
<td>L. Victim (overall status)</td>
<td>12. Complaint of pain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13. None</td>
<td></td>
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<table>
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<tr>
<th>Victim</th>
<th>Ambulance used</th>
<th>Yes</th>
<th>No</th>
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<tr>
<td>Last</td>
<td>First</td>
<td>M.I.</td>
<td></td>
</tr>
<tr>
<td>Address</td>
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</tr>
<tr>
<td>City</td>
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<td>ZIP Code</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driver's name if not victim</td>
<td></td>
<td></td>
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</table>

Officer's comments:

Instructions for officer's comments:
(1) If injury cannot be coded, describe in writing.
(2) If two severe injuries are sustained by the victim describe second injury in this space.
Definitions
Physical complaints

Column 2

1. Amputation — severed parts.
2. Concussion — dazed condition as a result of blow to head.
3. Internal — no visible injury but signs of anxiety, internal pain, thirst.
5. Severe bleeding — steady flow of blood that is not controlled.
7. Moderate burn - reddening, blistering of skin over large area.
8. Severe burn — reddening, blistering or charring of the skin over a large portion of the body.
11. Abrasion — top layer of skin is scraped.
13. None — no visible injuries but victim is other than normal.

Abnormal behaviour should be stated in officer’s comments (i.e., mental illness, drug use, impairment similar to that produced by alcohol).

Definitions of victim’s status

Column 3

1. Apparent death.
2. Unconscious — victim unaware of his surroundings, does not respond to stimuli (verbal or physical).
3. Incoherent — lacking orderly continuity of thought.
4. Shock — depressed condition of all body functions, resulting from serious injury or incident.
5. Normal — conscious and aware of surroundings.
# ANNEX 3

## LIST OF PARTICIPANTS

<table>
<thead>
<tr>
<th>Country</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Austria</strong></td>
<td>Dr. V. Havlovic, Federal Ministry of Health and Environmental Protection, Vienna&lt;br&gt;Dr. K.J. Höfner, Institute of Traffic Psychology, Austrian Traffic Safety Board, Vienna</td>
</tr>
<tr>
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<td>Dr. G. de Block, Medical Inspector, Department of Health Assistance and Protection for the Public, Cité administrative de l'Etat, Ministry of Public Health and Family Welfare, Brussels&lt;br&gt;Professor M. Graffar, Vice-President, School of Public Health, Free University of Brussels, Brussels</td>
</tr>
<tr>
<td><strong>Bulgaria</strong></td>
<td>Dr. I. Djarkov, Chief of Section, National Research Institute of Social Hygiene and Organization of Public Health, Sofia</td>
</tr>
<tr>
<td><strong>Czechoslovakia</strong></td>
<td>Professor P. Novák, Chief Surgical Department, State Hospital, Bratislava</td>
</tr>
<tr>
<td><strong>Denmark</strong></td>
<td>Mr. A. Dornonville de la Cour, Deputy Director-General, Danish Office of Statistics, Copenhagen</td>
</tr>
<tr>
<td><strong>Finland</strong></td>
<td>Professor S. Hikkinen, Helsinki University of Technology, Espoo&lt;br&gt;Dr. M. Liesmaa, Assistant Chief Surgeon, Helsinki University Eye Hospital, Helsinki</td>
</tr>
<tr>
<td><strong>France</strong></td>
<td>Mr. R. Coirier, Officer-in-charge, Office of Emergency Medical Services, Directorate-General of Health, Paris&lt;br&gt;Mr. Y. Systermans, Studies Officer, National Organization for Road Safety, Arcueil</td>
</tr>
<tr>
<td><strong>Germany, Federal Republic of</strong></td>
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</tr>
<tr>
<td><strong>Greece</strong></td>
<td>Dr. D. Trichopoulos, Professor of Hygiene and Epidemiology, University of Athens Medical School, Athens&lt;br&gt;Dr. Anna E. Kalandidi-Elefteriadis, Lecturer, Department of Hygiene and Epidemiology, University of Athens Medical School, Athens</td>
</tr>
<tr>
<td><strong>Hungary</strong></td>
<td>Dr. Edit Katona, Centre for Health Education, Ministry of Health, Budapest</td>
</tr>
<tr>
<td><strong>Netherlands</strong></td>
<td>Dr. R. Vos, Chief, Division of Road Accidents, Ambulance Transport and Rehabilitation, Inspectorate of Health, Leidschendam</td>
</tr>
<tr>
<td><strong>Norway</strong></td>
<td>Mrs. G. Lettenstrøm, Chief of Section, Central Bureau of Statistics, Oslo&lt;br&gt;Mr. T. Sager, Research Economist, Institute of Transport Economy, Oslo</td>
</tr>
<tr>
<td><strong>Poland</strong></td>
<td>Professor S. Piatkowski, Chief, Orthopaedic Clinic, Faculty of Medicine, Lublin</td>
</tr>
<tr>
<td><strong>Spain</strong></td>
<td>Mr. E. Gonzalez-Novoa Serrano, Chief, Data Processing, Directorate-General of Traffic, Madrid&lt;br&gt;Mr. A. Calvo Peribáñez, Psychologist for the &quot;Jefatura Central de Trafico&quot;, Madrid</td>
</tr>
<tr>
<td><strong>Sweden</strong></td>
<td>Professor G. Voigt, National Institute for Forensic Medicine, Lund</td>
</tr>
<tr>
<td><strong>Switzerland</strong></td>
<td>Mr. P. Borel, Chief of Technical Services, Swiss Office for Accident Prevention, Bern</td>
</tr>
<tr>
<td><strong>Turkey</strong></td>
<td>Dr. E. Aker, Director-General of Public Health, Ministry of Health and Welfare, Ankara</td>
</tr>
<tr>
<td><strong>Union of Soviet Socialist Republics</strong></td>
<td>Dr. V.I. Gurjev, Institute of Traumatology, Moscow</td>
</tr>
<tr>
<td><strong>United Kingdom</strong></td>
<td>Dr. S. Sevitt, Consultant Pathologist, Birmingham Accident Hospital, Birmingham</td>
</tr>
<tr>
<td><strong>Yugoslavia</strong></td>
<td>Dr. M. Mikov, Director, Occupational Health Service, Institute of Public Health, Novi Sad&lt;br&gt;Dr. P. Todorović, Chief, Department of Traffic Medicine, Institute of Public Health of the Republic of Serbia, Belgrade&lt;br&gt;Dr. I. Jelčić, Head, Institute of Traffic Medicine and Psychology, Republican Secretariat for Internal Affairs, Zagreb</td>
</tr>
</tbody>
</table>
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