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GUIDING PRINCIPLES IN THE MEDICAL EXAMINATION OF APPLICANTS FOR MOTOR VEHICLE DRIVING PERMITS

INTRODUCTION

1. In 1955 the World Health Organization convened a meeting of a consultant group on medical requirements for the licensing of motor vehicle drivers. At this meeting the document "Guiding Principles in the Medical Examination of Applicants for Motor Vehicle Driving Permits" was approved and in 1956 this document (WHO/Accid.Prev./1 Rev.2/24 February 1956) was mimeographed and circulated to governments. Some of the material contained in this document is now out of date; in addition, as a result of recent developments the report did not mention certain important medical matters, either at all or in sufficient detail. The opportunity has now been taken to correct these deficiencies.

2. The Economic Commission for Europe, in 1965, circulated member governments to ask in what respects their national rules or guidelines differed from the principles of "Guiding Principles in the Medical Examination of Applicants for Motor Vehicle Driving Permits" (WHO, 1956) and to ask what amendments or additions, if any, they would like to see made to these principles. Replies were received from 17 countries, and have been incorporated so far as possible in the document that follows.

3. It is generally agreed that a reasonable standard of mental and physical fitness in drivers should be required as a contribution to road safety. A higher standard

should be required for public service vehicle and heavy goods vehicle drivers than for private car drivers.

4. Since 1956 many studies of this work have been undertaken and a rather more liberal view is now taken of the influence of medical conditions on road safety, both of the effect of chronic medical conditions in the causation of traffic accidents and of the effect of medical conditions which may actually cause a sudden loss of consciousness while driving. Some evidence that medical conditions are responsible for a small proportion of road traffic accidents, possibly of the order of one per cent. to one per thousand, has been obtained from Sweden (Herner et al., 1966) and the United Kingdom (Grattan, 1967). It is not known, however, whether the more serious accidents tend to be caused or associated with medical conditions. Furthermore, Waller (1965) has shown that drivers with certain chronic medical conditions have about twice as many accidents, mile for mile, as drivers without these conditions.

5. Many authorities, national and international, have studied the problem of medical fitness and road safety. Useful reports have been issued by the British Medical Association (1954), the American Medical Association (1959), the Canadian Medical Association (British Columbia Division) (1962) and the Medical Commission on Accident Prevention (in the Press). The World Health Organization, in 1962, published a general review of the Epidemiology, Control and Prevention of Road Traffic Accidents (WHO, 1962). Among the many authorities concerned is the International Congress of Traffic Police, which at the Fifth Congress (Villetorte, 1967) recognized the need for periodic renewal of driving permits, and that the periodicity of such renewal should be fixed by medical experts, taking into account the changes that take place in the average individual in respect of the physical and psychological faculties involved in driving.

6. Many studies on various aspects of medical fitness for driving have thus been published since 1930 and references are given here to some of them, of major importance, but complete references to the literature are not possible here. The commoner conditions are dealt with here, omitting discussion of conditions that occur only rarely. In such cases an opinion as to fitness for driving would, no doubt, be obtained from a specialist who deals with the particular condition under consideration.

7. In this document, drivers of motor vehicles are generally considered in two categories:

(a) drivers of light motor vehicles;

(b) drivers of heavy motor vehicles.

Light motor vehicles include motor vehicles mentioned in the categories A and B given in Annexes 9 and 10 of the Convention on Road Traffic concluded at Geneva, 19 September 1949 which are as follows:

A. Motor-cycles with or without a side-car, invalid carriages and three-wheeled motor vehicles with an unladen weight not exceeding 400 kg (900 lb.).[1]

B. Motor vehicles used for the transport of passengers and comprising, in addition to the driver's seat, at most eight seats, or those used for the transport of goods and having a permissible maximum weight not exceeding 3500 kg (7700 lb.). Vehicles in this category may be coupled with a light trailer.

Heavy motor vehicles include those motor vehicles indicated in the categories C, D and E in Annexes 9 and 10 of the Convention on Road Traffic referred to above which are as follows:

C. Motor vehicles used for the transport of goods and of which the permissible maximum weight exceeds 3500 kg (7700 lb.). Vehicles in this category may be coupled with a light trailer.

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[1] Motor scooter drivers should, from a physiological point of view, be considered as drivers of light motor vehicles and therefore be licensed in the same way.

D. Motor vehicles used for the transport of passengers and comprising, in addition to the driver's seat, more than eight seats. Vehicles in this category may be coupled with a light trailer.

E. Motor vehicles of categories B, C and D with other than a light trailer.

In general, the medical requirements for heavy motor vehicle drivers, particularly those responsible for passenger transport, should be more strict than those for light motor vehicle drivers, in view of their responsibility for passengers and the fact that the former are usually on the road for many hours each day. The length of their exposure to accidents is normally greater than that of light motor vehicle drivers, although the experience and skill of heavy motor vehicle drivers are usually greater and their accidents therefore less.

METHOD OF EXAMINATION

8. The person who is to be examined should be completely undressed, as it is possible to overlook important physical defects unless this is done. The examination should be undertaken in a good light and facilities should be provided at least for eyesight tests, ophthalmoscopic examination (where indicated), urine tests for sugar and protein, auriscope examination, and measurement of blood pressure. Special examinations which are sometimes required include the electrocardiogram, chest or other radiograph, blood sugar estimation and electroencephalogram. Some authorities consider that routine electrocardiograms should be taken of all applicants for heavy vehicle driving, irrespective of age, in order to provide a baseline to compare with the results of future examinations. Drivers of heavy vehicles who are over the age of 60 should have electrocardiograms taken annually, but care is needed in interpretation regarding their fitness for driving. Thus, abnormal electocardiograms were found in 67% of apparently normal drivers in a German study (First International Conference on Accidents and Traffic Medicine, 1963).

9. Examiners who undertake considerable numbers of clinical examinations of drivers generally find it useful to carry out the examination procedures according to a routine. For example, the eyesight and hearing may be examined first, followed by the chest, upper limbs, lower limbs, abdomen, blood pressure and urine tests in that order. A full account of a suggested routine method of examination is given in paragraph 95.

10. Applicants for a permit to drive light or heavy motor vehicles should be assessed medically according to the following criteria:

(i) Is the applicant physically and mentally able to manipulate the controls and maintain such work for long periods?

(ii) Has the applicant a safe standard of vision? (and hearing, for heavy vehicle drivers).

(iii) Is there any risk of sudden loss of consciousness while driving?

(iv) Is there a likelihood of severe fatigue towards the end of the day, with consequent increased danger of accident?

If the answer to these four questions is satisfactory the applicant may safely be permitted to drive but if there is any disease or disability present which may become chronic or progressive he should be kept under regular observation or he may be given a permit of which the validity is especially limited. The standard required for driving heavy vehicles should be higher than that required for light vehicle driving.

EYESIGHT TESTING AND STANDARDS

11. The importance of good eyesight for driving motor vehicles needs no emphasis but the contribution of defective vision to the causation of road accidents is not known. Although there is no accurate information or statistics which relate visual acuity to the occurrence of accidents, some information has been collected by the Road Safety Information Centre of the World Touring and Automobile Association, London. Evidence on this question collected in California in 1936 and 1938 revealed that more than half of the motor vehicle drivers who had been

arrested for "cutting in" had one eye with subnormal acuity. The Californian enquiry also showed that motor vehicle drivers with accident-free records had better visual acuity than those with bad driving records; in a number of cases in which the driver involved had defective vision in one eye, he had collided with a vehicle or pedestrian approaching on the side of his weak eye. These drivers were unaware that they had any defect of eyesight. An investigation of 103 fatal accidents occurring at road intersections showed that 71 had involved motor vehicle drivers with defective vision in one eye; in 61 of these cases the driver had collided with a vehicle approaching on the side of the weak eye. A useful summary of these findings, with discussion of the problems involved, is given by Fletcher (1948). It was also found in an enquiry in Michigan that accident-free motor vehicle drivers were significantly superior to accident-repeaters with regard to visual acuity (Eno Foundation, 1948).

A person who has had a cataract removed from both eyes will not notice any visual impairment if he wears contact lenses. Contact lenses sooner or later cause irritation and drivers of heavy vehicles should not be permitted to wear them. The straight ahead vision will be clear if spectacles are worn by a person who has had cataracts removed, but there will be some defect of peripheral vision due to prismatic aberration. This may cause particular difficulty in reversing a vehicle. Plastic implants are now sometimes inserted following cataract operations. Persons with these implants may be permitted to drive light vehicles, but they should be examined at regular and frequent intervals, as the implants sometimes become displaced.

12. In all cases where the visual acuity is below normal the eyes should be examined for the presence of any ocular disease which may have affected the acuity. An insiduous deterioration of vision may occur during the progressive evolution of a cataract or another ocular disease, and the driver concerned may be unaware that his eyesight is becoming worse; sometimes also he may persist in driving

although he knows that his vision is poor. For these reasons, tests of visual functions should be required for all categories of drivers.

Periodicity of Eyesight Examinations

13. In the interests of safety it is desirable that drivers of heavy motor vehicles should have their eyesight tested at least every six years and preferably every three years up to the age of 65 and then annually for the renewal of their permits. Periodical medical checks of the vision of drivers of light motor vehicles cannot usually be arranged on account of the large number of drivers concerned. Where eyesight tests are required by the licensing authority before granting a permit, the medical examiner should be empowered to require periodic tests to be carried out at more frequent intervals in cases in which, in his opinion, such additional examinations should be undertaken.

Visual Requirements of (i) Heavy Motor Vehicles Drivers

14. Visual Acuity

The visual acuity of heavy motor vehicle drivers should always be tested by a physician and any cases in which there is doubt as to whether a permit should be granted should be referred to an ophthalmolcgist. The visual acuity for heavy vehicle drivers should be at least 6/12 (0.5) in one eye and 6/36 (0.17) in the other, with glasses if necessary.[1] There is no objection to the use of

[1] For comparative purposes the equivalent standards on different notations are as follows:

Decimal Notation	American Notation	English Notation	German Notation
0.1	20/200	6/60 6/36 (0.17)	5/50 5/40 (0.125) 5/30 (0.17)
0.2	20/100 20/80 (0.25) 20/70 (0.28)	6/30 6/24 (0.25)	5/25 5/20 (0.25)
0.3	20/60 (0.33)	6/18 (0.33)	5/15 (0.33)
0.4	20/50		
0.5	20/40	6/12	5/10
0.6	20/30 (0.66)	6/9 (0.66)	5/7.5 (0.66)
0.7			
0.8	20/25		
0.9			
1.0	20/20	6/6	5/5

bi-focal lenses for driving by light or heavy vehicle drivers. Persons with sight only in one eye should not drive when using contact lenses.

15. If the visual acuity without glasses is less than 6/12 (0.5) in one eye and 6/36 (0.17) in the other it is essential that the driver should always wear glasses when he is driving, and this should be recorded on the driver's permit. In this case also a spare pair must be carried. Spectacle frames with thick side pieces obscure the lateral vision and should not be worn. In order to detect the development of a cataract, or other disease affecting visual acuity, all persons should be given an eyesight examination on first application for a heavy motor vehicle driving permit; subsequent eyesight examinations should be carried out periodically as described in the previous paragraphs.

16. Visual fields

Good lateral vision on both sides is an obvious necessity for safe driving. Occasional cases of severely restricted visual fields occur (tubular vision) and these severe cases should not be permitted to drive any form of motor vehicle. A rough measurement of the lateral visual fields may be undertaken by means of a simple perimeter. This is a practical routine test for the examination of large numbers of drivers. A practical and convenient test is the "confrontation test" in which the medical examiner faces the examinee, covering each of the examinee's eyes in turn and requesting the examinee to look at the examiner's nose with the open eye. A movement of the fingers at the peripheral edge of the visual field should then be equally detected by both the examiner and the examinee, provided the examiner knows that his own visual fields are normal. Any definite restriction of the visual field detected by the "confrontation test" should cause the case to be referred to an ophthalmologist for a further opinion.

17. Colour vision

Experience has shown that colour discrimination is unnecessary for motor vehicle drivers. No colour vision tests are therefore recommended.

18. Diplopia

If there is definite diplopia a driver's permit should not be granted for light or heavy vehicles.

19. Stereoscopic perception, ocular muscle balance and night vision

Tests of binocular vision, stereoscopic perception, ocular muscle balance and night vision are not essential for the standard eyesight examination of heavy motor vehicle drivers, but these tests may be undertaken by an ophthalmologist in particular cases where doubt has arisen as to visual efficiency.

Visual Requirements of (ii) Light Motor Vehicle Drivers

20. All applicants should have their visual acuity tested by the non-medical examiner using the Snellen or similar method. A visual acuity of at least 0.4 in the better eye should be required, with glasses if necessary. Persons with sight only in one eye may drive light vehicles. Border line or difficult cases should be referred to an ophthalmologist.

EAR CONDITIONS

21. Diminution of hearing

For practical purposes, the hearing of applicants for a motor vehicle driver's permit may be tested by the following method: the examiner stands behind the applicant and covers each ear in turn. The applicant is requested to repeat a series of numbers chosen at random which are spoken and then whispered by the examiner. In this way the distance at which conversational voice (C.V.) and whispered voice (W.V.) is heard may be recorded for each ear separately. It is sometimes said that this test loses its value because examiners vary considerably in the loudness of their voice production, but this is not quite correct; each examiner develops, with experience of testing large numbers of cases, an acute appreciation of any variation in an applicant's hearing. A similar practical test may be given using the ticking of a watch as the auditory

signal, but in both the watch test and the whispered voice test it is mainly the higher frequencies which are under examination. Tests by means of an audiometer are not usually carried out as a routine. There may be considerable variation from day to day in an individual's degree of deafness and for this reason also a practical test is to be preferred to the more refined audiometry.

22. There are no generally accepted standards of hearing for motor vehicle drivers and there is a surprising lack of information in regard to the safety or otherwise of deaf drivers. Enquiries made of insurance companies in Great Britain ("Rex" 1953) revealed that some companies do not accept insurances from deaf drivers, but the majority adopt the non-committal line of indicating that each case depends on its individual merits. The same paper refers to a scientific study in which the conclusion was reached that there was little difference between the accident-proneness of a deaf person and that of a person with normal hearing; in fact, the investigation showed a slight balance in favour of the deaf. It was concluded that the reason for this is that deaf persons are particularly conscious of their handicap and that they therefore exercise extra care. An interesting discussion on the importance of hearing to automobile drivers is given by Macfarlan (1937) who considers that the deaf are generally safe drivers; they are cautious and on the alert because they know the risk they are taking. While good hearing is an undoubted asset to a driver, it is by no means essential. Hearing in some cases is more acute in the noise of traffic than in a quiet room; it is doubtful whether driving safety is materially enhanced by the possession of high degrees of auditory perception such as are required to hear a whispered voice in a still room at a considerable distance. In order to hear overtaking vehicles it is sometimes thought that hearing in the left ear is more important in countries where vehicles are driven on the right side of the road, but the importance of this should not be exaggerated, for whichever side the defect, unilateral deafness causes difficulty in the location

of a sound. It is unlikely that moderate impairment of hearing in a competent and experienced driver will constitute a danger or detract seriously from his driving ability.

23. Persons who apply for the first time for a permit to drive heavy motor vehicles should not be permitted to undertake this work if they suffer from more than a minor degree of deafness. Trained experienced drivers who develop deafness may, however, be permitted to drive unless the degree of deafness is so severe as to interfere with the performance of the work, e.g. a bus driver who is unable to hear the emergency signal. No benefit is to be expected from the use of hearing aids in driving, because of extraneous noises, variability and mechanical defects which may develop in the instruments, and the difficulty in locating the position of a sound. Hearing aids should not be permitted while driving heavy vehicles.

Persons who are hard of hearing, or completely deaf, may drive light motor vehicles.

24. Vertigo and labyrinthine conditions

In cases where there are sudden attacks of vertigo, for example in Menière's Syndrome with tinnitus, deafness and vertigo, persons should not be permitted to drive a motor vehicle. Cases of labyrinthitis (vestibular neuronitis) occur which necessitate a temporary cessation of driving any type of vehicle, but usually after some weeks of recovery from this condition, driving may be resumed. In doubtful cases, where the presence of vertigo or labyrinthine disease is suspected the patient should be referred to an otologist for his opinion.

GENERAL PHYSIQUE

25. Applicants for permits as drivers of heavy motor vehicles should be of good general physique. The physical requirements depend to a large extent on the nature of the vehicle concerned; most modern types of vehicle do not require much

actual physical strength to manipulate the controls, but the changing of a wheel, the changing of a tyre, turning the hand starter, loading and unloading which may be required in some cases, may suddenly call for a considerable physical effort.

The ergonomic design of heavy vehicle cabins and of light vehicle driving positions based on anthropometric studies have been much improved by some manufacturers in recent years. Further improvements will no doubt continue. (McFarland, Ross A., et al. 1955).

26. Upper limbs

In heavy motor vehicle drivers, the shoulders, elbows, wrists and finger joint movements should be examined and any muscular wasting observed. Fixation of a shoulder joint, if painless, need not be any handicap in driving. Ankylosis of an elbow joint may, however, be a considerable handicap, and persons with this disability should not be permitted to drive heavy motor vehicles in the first instance. Where this disability develops in one elbow in a trained and experienced driver he may sometimes be permitted to drive, provided that the angle of fixation is suitable, i.e. around 135° and midway between pronation and supination. New applicants for driving should have full pronation and supination movements and a good range of flexion and extension of the wrist joints. Ankylosis of finger joints is usually no barrier to driving, but where one or more fingers are amputated the degree of grip obtainable should be measured in relation to the ability to secure adequate handling of the controls of a motor vehicle. Muscular wasting, if not progressive, need not bar a person from taking up driving, provided there is sufficient strength for manipulation of the controls.

27. In light motor vehicle drivers, who will usually be examined as patients of the medical practitioner rather than at the request of a vehicle licensing authority, any physical disabilities in the arms should be assessed in relation to the physical requirements of driving a light motor vehicle.

28. Lower limbs

Applicants to drive heavy motor vehicles should have free and painless movements of the hips, knees and ankles without severe muscle wasting and with good muscular power in each limb. Persons with an ankylosed knee joint should not be permitted to drive a heavy motor vehicle. Medical practitioners should advise drivers of light motor vehicles to declare any disability affecting the lower limbs to the licensing authority. The degree of disability, where a joint is ankylosed, varies with the position in which the joint is fixed, and it may be possible for the driver to continue driving his car with safety. The alternative of using a car with specially adapted controls should, however, be considered. For example, cars can be obtained which are fitted with a main braking system which is operated by means of a hand control on the steering column instead of by a foot pedal.

29. Spinal column

In cases where there is active spinal disease, such as tuberculosis or ankylosing spondylitis, applicants should not be permitted to drive heavy motor vehicles so long as the condition remains active. When spinal diseases of this type become quiescent and provided there is no serious physical disability or deformity, driving of both heavy and light motor vehicles may be permitted with safety. Driving is an occupation which requires less physical effort than many manual tasks.

30. Persons suffering from prolapsed intervertebral disc are usually able to drive a heavy or light motor vehicle, even though they may be encased in a plaster of Paris jacket or fitted with a spinal brace. Such persons, once they have been fitted with the plaster jacket or corset, usually feel more comfortable when driving than previously. In this connexion, the design of the driver's seat is important; the back rest should be low down so as to accommodate comfortably the normal lumbar curvature of the spine, and the seat should be adjustable forwards, backwards, up and down, for the comfort of the particular driver.

31. In the above paragraphs on general physique, the disabilities which are likely to be met with are not usually such as to cause a sudden loss of consciousness of the individual concerned while he is driving a motor vehicle. The assessment of physical disability should rather be based on mechanical considerations, that is, whether the disability or deformity is likely to interfere with the efficient and rapid manoeuvring and handling of controls under all driving conditions, including emergency action, for prolonged periods.

32. Physical Disabilities

Persons with marked physical disabilities, such as amputation of a foot or more than three fingers should not be permitted in the first instance to drive heavy motor vehicles. Where there is a definite disability of this kind, trained and experienced drivers of heavy vechiles should discontinue driving, and a careful assessment of the disability in relation to the requirements of driving should therefore be made.

33. In some countries light motor vehicles are available which can be specially adapted to suit the requirements of a disabled driver. For example, a private car operated entirely by hand controls is suitable for paraplegic drivers. In cases of doubt the licensing authority is sometimes able to arrange for a practical test of a person's driving abilities to be undertaken before he is permitted to drive on the road. These special arrangements apply only to light motor vehicle drivers and driving of heavy motor vehicles should not be permitted if the applicants suffer from such disabilities. Light motor vehicle drivers who are disabled should be required to obtain an annual permit to drive, in order that their case may be kept under observation by the licensing authority. Before the first driving permit is issued to any person, he should be required to give particulars of any physical defect from which he is suffering. The responsibility for these arrangements rests mainly with the licensing authority concerned, but the medical practitioner is sometimes asked to advise in individual cases of difficulty and doubt as to whether a person is physically fit to drive.

CARDIAC CONDITIONS

Ischaemic Heart Disease

34. Heart attacks are the commonest cause of sudden death while driving. At the same time, heart attacks in drivers are not commonly associated with serious accidents, but occasional such incidents do occur. Sudden death while driving has been the subject of a number of studies. Thus, Peterson and Petty (1962) found that vascular diseases affecting the heart, aorta or brain were the cause of death in all but one of 81 cases, ischaemic heart disease being responsible in three-quarters of them. Accidents occurred in 36 of the 81 deaths, but they were minor in degree, causing little damage to property and no serious injury to pedestrians, passengers or other drivers. Myerburg and Davis (1964) studied 52 deaths at the wheel of private cars; 32 drivers were able to stop and so avoid an accident. Minor accidents involved the remainder but none of them caused bodily injury. Thirteen long drivers died at the wheel; no accident, or at most a trivial one, followed. The experience of many cardiologists is that persons who develop severe and even fatal coronary attacks while driving usually have sufficient warning and presence of mind to slow down or stop before losing consciousness. Tragic exceptions occasionally occur, however, such as the case reported by Levy et al. (1963) in which a bus left the road and plunged into a river in New York and seven persons were killed; the driver, who died, had a history of ischaemic heart disease and this was confirmed at autopsy.

35. It is recommended that persons with a history of any form of ischaemic heart disease, i.e. coronary infarction, thrombosis, insufficiency or angina

pectoris should not be permitted to drive heavy motor vehicles. Persons so affected may drive light motor vehicles, but should be kept under regular observation; they should be advised to discontinue driving if congestive cardiac failure or frequent anginal attacks develop, particularly if anginal attacks are brought on by emotion. Where the anginal attacks are caused through exertion only it is usually safe for a driver of a light motor vehicle to continue driving until the attacks become frequent. After a cardiac infarction, a driver should not drive for three months and should only resume light vehicle driving when advised by the cardiologist that it is safe to do so.

Arrhythmias

36. Sudden arrhythmias (or dysrrhythmias) are commonly present when coronary attacks involve sudden loss of consciousness. Paroxysmal tachycardia, a common condition, is a most unusual cause of syncopel attacks. The condition does not affect fitness to drive any type of vehicle. Atrial fibrillation should prevent a person driving heavy vehicles, but he may drive light vehicles unless complications develop.

Aortic Valve Disease

37. Syncope is one of the symptoms of severe aortic stenosis. It is usually provoked by effort and is very uncommon when the patient is at rest and seated. Occasionally syncope may be induced by emotion and attacks have rarely occurred while driving. Because of the rarity of such instances in this common disease, aortic stenosis and incompetence should not be a bar to driving light vehicles. Drivers of heavy vehicles should be excluded from driving if they suffer from aortic valve disease.

Heart Block

38. A person with partial or complete heart block should not be permitted to drive heavy vehicles. Light vehicle drivers with partial heart block may continue to drive, subject to regular medical review. Complete heart block may cause impaired blood supply to the brain, and if blurred vision, drowsiness or Stokes-Adams attacks occur, the patient should be advised not to drive. Treatment by drugs which increase the heart rate is unpredictable and unreliable. Artificial pace-makers are also unreliable and the decision at present must be against allowing patients with pace-makers to drive even light vehicles.

Other Cardiac Conditions

39. Patients with valvular prosthesis, if their general condition is good, may be permitted to drive light vehicles, but not heavy vehicles. After mitral valvotomy and other cardiac operations, it is probably wiser not to allow a patient to drive heavy vehicles. In rheumatic heart disease, the patient may drive light vehicles, but because of the small risk of atrial fibrillation and consequent embolism, it is wise to advise him not to drive heavy vehicles.

HYPERTENSION

40. No studies have been made of the relationship between blood pressure and accident rates in drivers. The presence of a raised blood pressure in itself, whatever the cause, does not prevent a person from driving light motor vehicles. Complications of hypertension may result in disability which should prevent the driving of light vehicles; such complications include damage to the eyes, brain and heart, and each case should be judged according to the extent of the complication.

41. A higher standard is recommended for drivers of heavy motor vehicles. The clinical examination of drivers is directed towards prediction of the occurrence of such conditions as cerebral haemorrhage or thrombosis, coronary infarction, dissection of the aorta, Stokes-Adams attacks, vertigo or fainting. Above certain levels of systolic or diastolic blood pressure, the risk of cerebro-vascular accidents becomes definite (Morris et al., 1966). The blood pressure is said to be raised by apprehension - as may occur during driving, but the experimental evidence for the effect of emotion on blood pressure is inconclusive.

42. The borderline case of fitness to drive heavy vehicles is that of a man aged 55, with systolic B.P. 210 mms. mercury or diastolic B.P. 105 mms. mercury, who is symptomless and who has no physical signs of cardiac failure or central nervous system damage. In assessing his fitness to continue driving heavy vehicles, the following factors should be considered: age, stature, obesity, family history, cigarette smoking, symptoms, xanthelasma palpebrum, arcus senilis, peripheral pulses, cardiac rhythm, fundus oculi, proteinuria, glycosuria,

electrocardiograph, chest radiograph and blood lipids. These factors do not all have the same weight but preferably all should be assessed when judging the fitness of a driver of heavy vehicles to continue this work when he has a raised blood pressure. In general, their effect is more than additive; thus the adverse effect of a number of adverse factors is greater than the sum of their individual effects. On the other hand negative findings in most of the factors might outweigh positive findings in two or three less important ones.

43. A wide range of hypotensive drugs is now available. Drivers of light vehicles may continue to drive while on such medication, subject to regular review by the physician. Heavy vehicle drivers should not be allowed to continue to drive when they are receiving drugs which may cause postural hypotensia, giddiness or faintness. It is probably safer to advise a heavy vehicle driver to discontinue driving if he is in receipt of any but the very mildest hypotensive agent.

ENDOCRINE DISORDERS

Diabetes

44. The number of road accidents due directly to diabetes or its treatment is small, but such cases occur every year and are generally due to hypoglycaemia following insulin treatment.

From the point of view of driving safety diabetics fall into three groups:-

(a) Diabetics controlled by diet alone: These have no risk of hypoglycaemia; symptoms of diabetic coma come on so slowly that they can be ignored for driving safety, except perhaps for long-distance coach and lorry drivers. They may drive light and heavy vehicles.

(b) Diabetics controlled by diet and tablets (oral hypogycaemic agents): These have a small risk of prolonged hypogycaemia. Drivers should be made aware of this risk. They may drive light and heavy vehicles, but long-distance heavy vehicle drivers should not be permitted to drive.

(c) Diabetics controlled by diet and insulin: These may in certain circumstances become hypoglycaemic. The symptoms of this effect of insulin are mainly cerebral and there may be impairment of judgement, defective muscular control, and, rarely, sudden unconsciousness. Hypoglycaemic attacks may occur at any time, unexpectedly, and drivers should always carry sugar. Diabetics of this group may drive light vehicles except for occasional cases of "brittle" or uncontrolled diabetics who should discontinue driving. Drivers of heavy vehicles who are receiving insulin should not be permitted to continue driving.

45. In addition to hypoglycaemic symptoms, which may occur unexpectedly after weeks or months of "normality", some diabetics of all three types may

have complications such as impaired vision, cardio-vascular conditions and peripheral neuritis. Each of these complications must be considered on its own merit in relation to fitness to drive in a driver-diabetic.

Other Endocrine Disorders

46. Thyrotoxicosis. Under modern treatment the symptoms are normally controlled and the driving of light motor vehicles may be permitted, subject to medical review at, say, intervals of three months. A higher standard is required for heavy vehicle drivers, and unless the condition is controlled and there are no symptoms of mental disturbance, cardiac arrhythmia or visual disturbance, the driver should be prohibited from driving heavy vehicles.

47. Myxoedema. In severe cases of myxoedema there is an obvious slowness of reaction time, and persons should not be permitted to drive any motor vehicles. Where this condition is adequately controlled by medication, such a person may continue to drive a light motor vehicle provided he is kept under regular observation and there is no gross slowing of the reactions or other symptoms liable to interfere with the safe conduct of a motor vehicle. The driving of heavy vehicles should be prohibited if definite signs of myxoedema are present.

48. Addison's disease, pituitary or parathyroid disease. Modern treatment has greatly alleviated these conditions. Each case must be judged on its individual merits as to whether there is any disturbance of the central co-ordinating and locomotor functions which is liable to interfere with the safe driving of a motor vehicle. Persons suffering from these conditions, when well controlled, may drive light motor vehicles, but the driving of heavy vehicles should be prohibited.

DISORDERS OF THE NERVOUS SYSTEM

79. Epilepsy. This section refers to the typical grand mal and petit mal "idiopathic" epilepsy. The prevalence of epilepsy in adult life is probably about four per 1000. In many cases the ability to drive a car is an economic necessity. The number of accidents due to epilepsy is notoriously difficult to determine. Hiscoe (1960) reported 77 cases of accidents due to epilepsy, the great majority minor ones, and he suggested that most patients have sufficient warning to stop or at least apply the brake of the vehicle. Elliott (1965) reported that less than one in 1000 accidents leading to casualties were caused by epilepsy. Hemer (1965) found that about three out of 10 000 traffic accidents reported to the police were caused by epilepsy. However, these accidents appeared to be more serious than the accidents caused by other diseases. Most of the accidents appear to be caused by initial attacks, or by attacks in insufficiently treated epileptics, often driving illegally, and only about half of them could theoretically have been prevented by better medico-legal control.

80. The problem of control is mainly of practical importance in men rather than women - in the older ones because driving may be necessary to a job, and in the younger ones (especially late teenagers) because of the present day immense prestige of car or motor-cycle driving. Stringent regulations are likely only to drive the problem underground and thus actually to increase the risks. The extent to which epilepsy is already concealed was shown by Webb (1955) who found a history of epilepsy in five out of 1200 professional drivers.

51. Present knowledge of the natural history of patients with epileptic attacks for many years is fragmentary, especially as regards those patients who have very infrequent seizures that are naturally the main concern to those responsible for the issue of driving permits. Differences of opinion and practice in different countries were clearly brought out at the International Neurological Congress in Vienna (1963), the Report of which gives in detail the present views concerning epilepsy and driving. Most countries allow epileptics under certain conditions to drive light vehicles, whether the patient-driver is on drugs or not. It is important that epileptics should remain on drugs; about half the patients whose anti-convulsant drugs are stopped, because they have been free from fits for two years, begin to have attacks again. (Juul Jensen, 1964)

52. The present view, more literal than that of the past, is that the epileptic whose fits are controlled by drugs, should be permitted to drive light motor vehicles. Experience in Europe and America suggests that where a liberal policy has been adopted towards the controlled epileptic driver, the results in road safety have been satisfactory. Most authorities accept the rule that an epileptic must be completely free of attacks, major or minor, for at least two years before he is safe to drive. Patients with nocturnal seizures only, or with a distinct warning aura before an attack, should still be covered by the same two-year rule.

53. In arriving at a decision in an individual case, the following considerations are essential: a fully documented report from the patient's own physician is of value, but the final recommendation should come from a neurologist, who is an expert in epilepsy. The electroencephalograph (EEG) may be of importance in evaluation, but its prognostic value is limited. A reliable history of freedom

from attacks, corroborated by close relatives, is important. Alcohol must be avoided. The anti-seizure medication which has controlled the attacks must be continued without interruption, so long as it is indicated on medical grounds. Most authorities require medical reports at 6 or 12 month intervals.

54. The above recommendations are based on those of the International Neurological Congress (1965).

55. There is general agreement that no-one with a history of epilepsy, in any form, or however brief, should be permitted to drive heavy vehicles.

Strokes

56. Transient impairment of consciousness or awareness may be due to ischaemia resulting cerebral or brain stem vascular insufficiency. Recurrent transient cerebral symptoms may precede or herald a major stroke and these should be regarded as a warning so that driving is stopped at this stage. After recovery from the acute stroke, some patients may be capable of driving, provided that there are no residual defects of higher cerebral mechanisms or hemianopia. Such defects must be looked for specifically, as they are not always recognized by the patient, who may be lacking in insight or judgement. Driving light vehicles may be possible and safe with a hemiparesis, provided that the controls of the vehicle are suitably rearranged or modified, or a special type of vehicle provided. Such persons should remain under regular medical supervision. The driving of heavy vehicles should not be permitted.

57. Diseases of the brain

In cases of senile dementia, where the condition is sufficiently evident to be diagnosed with certainty, the applicant should not be permitted to drive a motor vehicle, light or heavy.

58. Where dementia paralytica (general paralysis of the insane) is diagnosed, the driving of heavy motor vehicles should not be permitted; the driving of light motor vehicles should only be allowed if there is an apparently good response to treatment with absence of mental or locomotor signs and the person should be kept under regular observation.

59. If there is evidence of the sequelae of encephalitis, such as rigidity of the arms or legs or loss of emotional control, of sufficient degree for the diagnosis to be made with certainty, the applicant should not be permitted to drive a light or heavy motor vehicle.

After one year of recovery from sub arachnoid haemorrhage, a person may be permitted to drive a light, but not a heavy, motor vehicle.

60. The operation of pre-frontal or transorbital leucotomy or lobotomy or topectomy (frontal lobectomy) does not usually of itself render a person unsafe to drive a motor vehicle, but it should be remembered that rather more than 10 per cent. of these persons have epileptic fits after the operation. The underlying condition for which any of these operations was performed and the effect of the operation upon it should be assessed in relation to the responsibility of driving. In general, persons should not be permitted to drive heavy motor vehicles if they have been subjected to any of these operations and it will usually be found advisable to remove experienced drivers who have had such operations from driving this type of motor vehicle.

61. Diseases of the spinal cord

Persons who have suffered a traumatic lesion with damage to the spinal cord

and resulting paraplegia may sometimes drive a light motor vehicle which is fitted with specially adapted controls so that driving is undertaken by the use of the hands alone. Driving of heavy motor vehicles should not be permitted. Persons suffering from any degree of certain organic diseases of the spinal cord, such as disseminated sclerosis, syringomyelia, amyotrophic lateral sclerosis, severe poliomyelitic sequelae and tabes dorsalis, should not be permitted to drive in the first instance or to continue driving heavy motor vehicles. In some cases trained and experienced drivers may continue to drive in the earliest minimal stages of these diseases, but usually, if the condition is severe enough to be definitely diagnosed, it is best in the interests of safety to remove the driver from his duties of driving heavy motor vehicles. Certain of the signs present in these diseases may be of particular danger in connexion with driving such as anaesthesia of the feet and loss of proprioceptive position sense in tabes dorsalis; the occurrence of ataxia or spasticity of the leg muscles in disseminated sclerosis may be highly dangerous in a driver. Where definite signs of these diseases are present, especially when there is loss of muscular co-ordination or definite diminution of muscular power, the driving of any motor vehicle should not be permitted.

62. Other organic nervous diseases

Where conditions such as progressive muscular atrophy and congenital myotonic disorders are sufficiently severe as to be diagnosed with certainty, such persons should not be permitted to drive in the first instance or to continue driving heavy motor vehicles. Light motor vehicle drivers should be advised against driving if the condition is sufficiently severe as to interfere with the muscular co-ordination necessary for the safe handling of the motor vehicle.

63. Migraine is not a barrier to driving any type of motor vehicle. Trigeminal neuralgia and various forms of tics do not normally prevent a person from driving any type of motor vehicle.

64. Persons suffering from myasthenia gravis should not drive heavy motor vehicles; except in mild cases it is advisable for sufferers from this condition not to drive light motor vehicles, but cases which respond well to medication may sometimes drive if they avoid doing so for long distances and are kept under regular and frequent observation.

65. Affections of the peripheral nervous system, such as neuritis or palsy of individual nerves should be judged in relation to driving motor vehicles on the degree of impairment of function caused by the lesion. If there is any possibility of progression of the condition a person should be kept under frequent observation. Minor degrees of these conditions should not prevent a trained and experienced driver from continuing to operate heavy motor vehicles. Where there is a lesion of, or traumatic severance of individual nerves, the degree of resulting disability should be assessed in relation to the ability to manipulate the controls of a motor vehicle for long periods.

66. Psychosis

Where there is a definite diagnosis of psychosis in the active phase by a psychiatrist, whether schizophrenia, manic-depressive, paranoia, involutional melancholia, or mixed types, such persons should not drive any motor vehicle. Psychotic conditions vary in their severity and patients may at times be permitted to drive light vehicles. Persons with a history of any of these conditions should not be permitted to drive heavy motor vehicles.

When a definite diagnosis of psychosis has been made a driving permit should only be issued upon certification of fitness by a psychiatrist.

67. Mental defectives are not usually able to concentrate their attention for long periods and are therefore unsuitable for driving motor vehicles. It may be difficult to recognize the high-grade mental defective, but the previous employment history may give a useful indication of the applicant's capacities. Where mental defect is recognized, even if of minor degree, permission to drive heavy motor vehicles is not recommended. Low-grade mental defectives should not be permitted to drive any motor vehicle. Illiterates who cannot read but who are not mentally defective should not be disqualified from driving light or heavy vehicles.

68. Psychoneurosis

This is one of the most difficult fields in which the physician may be called upon to express his opinion. Emotional disturbances are probably frequently associated with accidents; they also frequently occur in "normal" people. A loss of confidence in driving is a not infrequent occurrence among men who have been driving motor vehicles for many years, and it is important in the prevention of accidents that there should be no hesitation in removing such drivers temporarily or permanently from their driving duties. Drivers suffering from these conditions sometimes complain of quite irrelevant symptoms such as pain in a knee or foot and when no signs are found on examination it becomes clear that such a person is really suffering from a loss of confidence. The usual symptoms of insomnia, inability to concentrate, depression and unreasoned fears tend to be present in varying degrees also, and such cases usually benefit from being placed for a period of six or twelve months on work which does not involve driving a motor vehicle. Persons who have suffered at any time from conversion hysteria should not be permitted to drive heavy motor

PSYCHOLOGY OF DRIVING AND PSYCHO-PHYSICAL APTITUDE TESTS IN THE SELECTION OF DRIVERS

Most accidents are believed to be due to human faults, that is to say, carelessness inattention and wandering concentration. The mental aspects of the task of driving - and upon the skill of the driver rests many lives - involve (a) concentration of the visual (and to a lesser extent auditory) processes, it may be for many hours at a time; (b) concentration of the mental processes so as to maintain a close link with visual and auditory perceptive mechanisms; and (c) resistance to distraction. No really satisfactory tests of these processes have yet been devised and applied on a large scale. There may also be a difference in the driving skill of different personality types, but no investigation has yet been undertaken of the relationship between personality type and accident rate. The value of psycho-physical aptitude tests in the selection of drivers has not yet been proved and no such tests are recommended for routine use.

ACUTE INFECTIOUS DISEASES

Persons suffering from most acute infectious diseases are generally unfit for work temporarily and their own condition prevents them from driving a motor vehicle; they should not be issued with a driving permit until they have recovered.

DISEASES OF THE BLOOD

69. Blood diseases are not likely to interfere with safe driving unless there is present a severe degree of anaemia. In severe anaemia a permit to drive a light or heavy motor vehicle should not be granted. However, even minor degrees of anaemia are characterized by increased fatigue which is an important factor in driving and may lead to slow reactions of the driver, particularly of heavy vehicles, towards the end of his working day. If therefore the symptoms and signs suggest that an applicant for a driving permit is suffering from anaemia, a blood haemoglobin estimation should be carried out and the applicant should be temporarily rejected pending the result of investigation and treatment. In trained and experienced drivers of heavy motor vehicles it is not usually necessary to advise exclusion from work unless the haemoglobin falls to less than about 60-70 per cent.; investigation and treatment often result in a rapid improvement and return to duty. Where the condition is likely to recur, regular periodic medical examinations should be advised.

70. Leukaemia and other blood dyscrasias should be judged on their individual merits as regards the person's fitness to drive, bearing in mind the tendency to fatigue and associated anaemia, fatigue in the latter part of the day's work being a potentially dangerous hazard in the occupation of driving heavy vehicles. Applicants suffering from blood disorders of this type should not be permitted to drive heavy motor vehicles in the first instance. Those who are already driving heavy vehicles may be permitted to continue if the condition is not of severe degree and fatigue and other danger symptoms and signs are absent. If there is a history or evidence of haemophilia the applicant should not be permitted to drive heavy motor vehicles.

DISEASES OF THE SKIN

71. Most skin diseases are not likely to interfere with the safe handling of

a motor vehicle, but in certain cases where the skin is inelastic, thickened or scarred, movements of the limbs may be restricted. There is a close developmental connexion between the skin and the central nervous system and certain skin diseases tend to be associated with neuroses and psychopathic personalities of various forms. The existence of a skin disease, such as some cases of severe seborrhoeic dermatitis may suggest the presence of a neurotic condition. If so, this condition should be explored in the light of paragrapns 66-68. It is not generally necessary to advise the removal of a driver from driving heavy vehicles on account of these skin conditions alone.

DISEASES OF THE RESPIRATORY SYSTEM

72. Inactive pulmonary tuberculosis does not make a person unfit for safe driving but a careful assessment of such a person's condition may be necessary in relation to the particular duties of his work as a driver. It is not recommended that applicants who have active tuberculosis of the lungs and those who have suffered from tuberculosis of the lungs within the preceding twelve months should be permitted to drive heavy motor vehicles in the first instance.

73. Modern drug therapy of tuberculosis enables most patients to resume driving light and heavy vehicles after recovery from the active phase. Where a trained and experienced driver of heavy vehicles wishes to return to work after an absence due to pulmonary tuberculosis, his case should be carefully assessed in relation to the work required. In such cases the driver should be required to attend for medical examination at regular intervals of three to six months at first and a chest X-ray should be made on each occasion.

74. Applicants who have signs of severe chronic bronchitis should not be permitted to drive heavy motor vehicles in the first instance. It is usually

necessary to prohibit heavy vehicle driving in plethoric thick-set men who have chronic bronchitis because of the risk of cough syncope (laryngeal vertigo).

DISEASES OF THE GASTRO-INTESTINAL SYSTEM

75. Peptic ulceration and other digestive disturbances[1]

Applicants who have a history of peptic ulceration, ulcer-type pain, or any severe dyspepsia should not be permitted in the first instance to drive heavy motor vehicles, on account of the shift work, long hours and irregular meals which are sometimes unavoidable in this occupation. A person who has had a modern operation for peptic ulcer may, usually, be permitted to drive heavy vehicles if he has been free from symptoms for at least six months. Those who are already trained and experienced drivers are often able to continue at work if care is paid to diet and medication, but the driver's own condition, rather than considerations of safety, sometimes necessitates his transfer to alternative employment with regular hours of duty.

76. A history of duodenal ulcer or of some types of functional dyspepsia may be associated with a tense anxious personality, and these two conditions together may render an applicant unsuitable to drive heavy motor vehicles. Acute gastro-intestinal conditions may render a person temporarily unfit to drive.

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[1] It is commonly supposed that motor vehicle drivers and other transport workers suffer from peptic ulcers with greater frequency and severity than workers in most other occupations. This suggestion was made, for example, at an enquiry into the health of London central busmen in 1937 (Ministry of Labour, 1939). An investigation into the sickness experience of London Transport workers with special reference to digestive disturbances failed to show with certainty any difference in the sickness experience of transport workers as regards gastric conditions (Hill, A. B., 1937). A recent investigation showed that drivers and other transport workers did not suffer any more or less from peptic ulceration than other types of workers (Doll, R. & Avery Jones, 1951).

77. Hernia

A hernia which is painless does not prevent a person from driving light or heavy vehicles.

VENEREAL DISEASES

78. There is generally no reason, from the safety point of view, why drivers of heavy and light motor vehicles should not continue to drive when suffering from these conditions but they should be kept under observation in order to ensure that adequate treatment has been carried out. These conditions will generally be viewed from the angle of treatment of the patient and the possibility of infecting others, but late sequelae, such as tabo-paresis, may be dangerous conditions in a driver, and any case where such a condition may develop should be kept under regular observation. A definite diagnosis of tabes dorsalis or dementia paralytica should usually exclude a sufferer from driving a heavy motor vehicle (but see paragraphs 57-61).

DISEASES OF THE GENITO-URINARY SYSTEM

79. Diseases of the urinary tract are not commonly associated with any lack of safety in driving a motor vehicle, but the possibility of chronic infection, resulting in undue fatigue, or of uraemia, should be considered. Vesical calculi, enlarged prostate, or urinary infections may result in frequency of micturition with consequent interference with the efficient and safe driving of a heavy motor vehicle.

ALCOHOL

80. Alcohol has a deleterious effect on driving performance. Drivers of heavy vehicles should take no alcohol while driving and this should be a condition of their employment. Even very small amounts of alcohol may impair the capacity of a person to drive with the maximum skill and care of which he is capable. Thus, laboratory experiments designed to test skills resembling driving were carried out by Drew et al. (1958) using a dummy car with conventional controls for steering, accelerating and braking. A continuous road picture was projected before the eyes of the person undergoing the test. In 40 volunteers, Drew et al. (1958) found that the mean error in performance showed an increase of about 16 per cent. at blood alcohol concentrations of 80 mg./100 ml. Laver (1939) in a similar study of four subjects found that a noticeable effect on behaviour occurred at blood alcohol levels between 35 and 65 mg./100 ml. Loomis and West (1958), in ten subjects, demonstrated a direct relationship between the blood alcohol concentration and impairment of function, a view which is now generally accepted. They found that some impairment of ability to perform the driving test could be detected when the blood alcohol concentration was as low as 30 mg./100 ml. These experiments are sometimes criticised on the grounds that they do not utilise actual driving performance, but only a simulated situation.

81. Four series of experiments to study the effect of alcohol on actual driving performance have therefore been made. Cohen et al. (1958) studied the effect of alcohol on the ability of experienced bus drivers to drive between posts. They found that performance was affected by very small amounts of alcohol (as low as 20 mg./100 ml.) and that performance deteriorated as the amount of alcohol taken was increased. Somewhat similar experiments and results were obtained

by Bjerver and Goldberg (1951), Gelia and Wretmark (1951) and Coldwell et al. (1958). The evidence of these studies of actual driving performance shows that amounts of blood alcohol as low as 20-30 mg./100 ml. may increase the number of mistakes made and adversely affect driving performance.

82. There is much statistical evidence of the relation of alcohol to road accidents. The first controlled survey of this type was conducted in Evanston (U.S.A.) by Holcomb (1938). The concentrations of alcohol in the urine of 270 drivers involved in traffic accidents seen at hospital were compared with those of 1750 drivers chosen at random. It was found that as the alcohol concentration increased beyond 50 mg./100 ml. the number of drivers in the accident group increased out of all proportion to those in the control group. A controlled study in Toronto, undertaken by Lucas et al. (1955) compared the blood alcohol concentrations of 433 drivers involved in accidents with 2015 other drivers. The danger of accidents became significant when the blood alcohol level was greater than 100 mg./100 ml., and when it rose above 150 mg./100 ml., the hazard was approximately ten times greater than when the concentration was below 50 mg./100 ml. Freimuth et al. (1957) showed that, in Baltimore, U.S.A., in 500 consecutive highway fatalities to drivers, passengers and pedestrians, about a third were associated with blood alcohol levels greater than 150 mg./100 ml. and about half with levels greater than 50 mg./100 ml. These figures agree very well with those reported in a similar survey carried out in Perth, Western Australia, by Pearson (1957). A controlled study of drinking drivers involved in accidents was carried out by Vomosi (1963) in Bratislava, Czechoslovakia. The results showed the increase in accident hazard as the level of blood alcohol rose, and that the chances of

involvement in a traffic accident were 124 times greater for a person with a blood alcohol level of over 150 mg./100 ml. than they were for a person with only 30 mg./100 ml.

83. The dangers of alcohol consumption by drivers have thus been clearly demonstrated on many occasions; but it is not the driver alone who is concerned. A controlled study of pedestrian fatalities (Haddon et al., 1960) showed that 47 per cent. of those killed had a blood alcohol level of 50 mg./100 ml. or above, a much higher proportion than in the control group of pedestrians not involved in accidents. The pedestrians fatally injured consisted largely of a group of middle-aged people who had been drinking heavily.

84. It is recommended that publicity in all forms should be used, in order to develop a social climate of opinion in which people will not drive after the consumption of any alcohol. The studies quoted above suggest that about 25-50 per cent. of road traffic accidents would be prevented in this way. This may at present be regarded as idealistic, but nevertheless publicity material should lead in this direction. At present, many countries have attempted to reduce alcohol consumption by drivers by making it an offence to drive with more than a certain level of alcohol in the blood. These countries, and the concentration of blood alcohol which is accepted by courts of law as evidence of impairment, are given in the Table below. The biochemical tests necessary to establish the blood alcohol concentration may be permissive (i.e. with the driver's consent) or mandatory and this is also indicated in the Table. (Adapted from "Relation of Alcohol to Road Accidents, 1960).

Country	Concentration of Blood Alcohol Accepted as Evidence of Impairment. Expressed as mg./100 ml.	Subjection to Biochemical Tests Permissive or Mandatory
Australia South Australia	Adopted in practice if person consents. No level stated.	-
Victoria	50 mg. or less, evidence that not under influence. More than 50 mg. admitted as evidence to be considered with other evidence.	Permissive
Western Australia	50 mg. or less, evidence that not under influence. 50-150 mg. admitted as evidence to be considered with other evidence. Over 150 mg. evidence that under influence.	Permissive
Austria	150 mg. accepted in practice.	Permissive
Belgium	150 mg.	Mandatory
Canada	No prescribed level.	Permissive
Denmark	No prescribed level. 100 mg. adopted in practice.	Permissive
Finland	75-100 mg. adopted in practice.	Mandatory
France	No prescribed level.	Permissive
Germany (Western)	Motor cars, 150 mg. Motor cycles, 130 mg.	Mandatory
Iceland	50-120 mg. evidence of impairment; over 120 mg. evidence of complete inability.	Mandatory
Ireland (Republic of)	No prescribed level.	-

Country	Concentration of Blood Alcohol Accepted as Evidence of Impairment. Expressed as mg./100 ml.	Subjection to Biochemical Tests Permissive or Mandatory
Israel	No prescribed level adopted.	Permissive
Luxembourg	In practice up to 150 mg. evidence that under influence; over 150 mg. evidence of intoxication.	Permissive
Netherlands	No prescribed level.	-
Norway	50 mg. Driver may not taste alcohol for six hours after ceasing to drive if he has reason to believe that his driving may be subject to police investigation.	Mandatory
Peru	No prescribed level.	Mandatory
Philippines	No prescribed level.	-
El Salvador	No prescribed level.	-
South Africa	No prescribed level.	Mandatory in case of persons under arrest
Sweden	50 mg.	Mandatory
Switzerland	No prescribed level. 100 mg. adopted in practice.	Mandatory
United Kingdom	Legislation proposed - 80 mg. (June 1967)	Mandatory proposed
United States of America	Under 50 mg. evidence that not under influence. 50-150 mg. admitted as evidence with other evidence. 150 mg. or over evidence that under influence.	Mandatory in some States, permissive in others.

85. The deterrent effect of legislation on the individual is marked as soon as it becomes generally realised that there is a considerable likelihood that the driving of a car following an intake of a certain amount of alcohol will lead to conviction. Experience has shown that the introduction of such legislation has led to a reduction in traffic accidents. For example, in Tennessee, which recently introduced mandatory blood alcohol tests for drivers associated with surprise highway checks by police, there were 16 per cent. fewer fatalities in 1956 than in 1955. During the same period 40 other States showed an increase in traffic fatalities. (Relation of Alcohol to Road Accidents, 1960).

86. The chief problem remaining for those countries which have not yet adopted legislation based on biochemical tests is the decision as to what concentration of alcohol in the blood shall attract legislative penalties. The consensus of medical opinion today is that the level should be in the region of 50 mg./100 ml. For example, the Expert Committee on Alcohol of the World Health Organization reported in 1954 that, "Taking into consideration (1) the investigations performed in recent years on the effect of alcohol on different functions in laboratory experiments, (2) the results of statistically designed practical tests on drivers, air pilots, etc., and (3) the statistical evidence from the few adequate studies existing on alcohol and road accidents, the inference cannot be avoided that at a blood alcohol concentration of about 50 mg./100 ml. a statistically significant impairment of performance is observed in more than half of the cases examined." Since 1954 a considerable amount of work has been carried out which strengthens and supports this view.

DRUGS

87. No studies have been made that are comparable to those made regarding alcohol driving. The great variety of drugs available renders such investigations difficult to undertake. Many drugs are potentiated by alcohol, that is, the combined effect is greater than that of the drug or the alcohol alone. Drivers of heavy vehicles should be particularly careful to ask their doctors whether any prescribed drug may affect their driving safety. All doctors before issuing medicaments or a prescription should ask adult patients whether they drive motor vehicles and should consider whether special advice in this respect is necessary or advisable.

88. All types of road users, including pedestrians, will be rendered unsafe if they use the roads after consuming narcotic or hypnotic drugs in sufficient amounts. Drug addicts, at least during the active phase of their addiction, should not drive motor vehicles. In addition, performance as a driver of a motor vehicle may be adversely affected by many drugs which are in common use today, many of them obtainable without a doctor's prescription. The extent to which the consumption of drugs contributes, if at all, to the causation of road accidents is not known. Accidents in which a road user was noticeably under the influence of a drug are certainly uncommon, but the desirable clinical effect of mild sedation or the attempt to secure peace of mind by chemical means may be accompanied by adverse effects on an individual's driving ability.

89. The fullest account yet available regarding psychoactive drugs and road safety was prepared as a duplicated pamphlet by the World Health Organization (1965). This describes the nature, significance and extent of the problem, the factors which modify the effects of psychoactive drugs on driving performance

and studies the particular effects on driving performance of sedatives and stimulants, barbiturates and allied substances, tranquillising agents, and of the combined effect of sedatives and alcohol. This paper gives 137 references. It is concluded, inter alia, that "the administration of psychoactive drugs should be under full medical supervision and these drugs should be available on prescription only; and that doctors prescribing psychoactive (including narcotic) drugs should warn their patients not to drive". This implies that such drugs should not be prescribed for a professional heavy vehicle driver if he is to remain at work. The W.H.O. Report also concludes that manufacturers should mention clearly in labels and promotional literature a warning against driving while under the influence of certain psychoactive drugs, and that the public education campaign concerning alcohol and traffic accidents should be expanded to cover psychoactive drugs.

90. Hypnotics, sedatives and tranquillisers should be prescribed with caution for light vehicle drivers and probably not at all for heavy vehicle drivers. The side-effects of antihistamines vary considerably and Miller (1957) suggests that patients who take these drugs should not drive until they have established by trial that they do not experience side-effects. Useful examples of particular drugs in relation to driving are given by Norman (1964).

PERMISSIBLE HOURS OF DRIVING

91. If a physician is called upon to advise upon maximum hours of driving, reference may be made to the agreed suggestions adopted for guidance by the Inland Transport Committee of the International Labour Organisation. According to these, the driver of a heavy motor vehicle should have a break of at least half an hour between the fourth and the sixth hour of driving. The total driving hours should not exceed 10 in every period of 24 hours. Every driver should, as a rule, have an average rest period of not less than 11 hours, which may, in certain cases, be reduced to 8 hours.[1]

PERIODICAL MEDICAL EXAMINATIONS

92. In some countries the renewal of a permit to drive a passenger transport vehicle is required at intervals prescribed by the licensing authorities.

93. Drivers of heavy motor vehicles should be medically examined at intervals of three years after the age of 40 and annually after the age of 60. These examinations may also be required, for example, on resumption of duty after illness lasting more than three or four weeks, or after accidents which prevent the driver working for three days or more, or in any case where the supervisor considers that the driver should be medically examined in the interests of safety. The eyesight of drivers of heavy motor vehicles should be examined at least every six years and preferably every three years up to the age of 65 and annually thereafter (see paragraph 13). It is also necessary to examine drivers who suffer from or who have been certified as suffering from, vertigo, fainting, epilepsy, or heart disease, or indeed any condition which is likely to affect the driver's appreciation of danger, to cloud his judgement or to

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[1] Memorandum No. 51 concerning conditions of employment in road transport in International Labour Office, Official Bulletin Vol. XXXVII, No. 2, page 33.

render him suddenly unconscious; examinations in these cases should be undertaken whether the driver has been absent from work or not.

94. Following an important illness or a serious accident a medical examination should be required before a driver is permitted to return to work.

OUTLINE SCHEME FOR ROUTINE MEDICAL AND EYESIGHT EXAMINATION OF DRIVERS

95. Most medical practitioners who examine large numbers of applicants for motor vehicle driving permits or who conduct other examinations of drivers find it convenient to carry out the various procedures required according to a routine. In this way the inadvertent omission of any important part of the medical examination is minimised. The time required to complete the examination varies greatly, but on an average approximately 15 to 20 minutes may be allowed for each examination. In order to ensure that an adequate examination may be carried out, the examinee should be fully undressed. The following procedure is suggested:

It is important to take an adequate medical history. The applicant should complete a form containing as a minimum the following questions:

Have you ever suffered from the following?

(1) Fainting attacks; epileptic fits, "blackouts" or "nerves"

(2) Heart disease or disorder

(3) Tuberculosis

(4) Asthma or chronic bronchitis

(5) Nervous or mental disorders

(6) Skin diseases

(7) Rupture. If "Yes", do you wear a support?

(8) Digestive disorders

(9) Diabetes

(10) Rheumatism or joint trouble

(11) Any other illness

(12) Any accident or injury

Have you ever been hospitalized or undergone an operation? If so, give particulars and date

Have you ever been rejected or invalided from the Armed Forces or any public service?

96. The answers to these questions provide a guide to a detailed medical history which will be taken if any of the answers are unsatisfactory. Evidence of drug taking or other addictions may be obtained from the history, and the medical examination should include observation for any clinical evidence of these conditions. The medical history is always confidential, and the written replies to the above questions and the notes of the medical examination itself should be retained by the medical practitioner. For the same reason applicants should be examined privately and not as a group together.

97. The following routine is suggested for the medical examination itself;

(a) Eyesight examination, including pupil reaction to light (paragraphs 11-20).

(b) Note any abnormality of the mouth, throat, nose and neck.

(c) Standing behind the applicant, test the hearing of each ear separately with conversational and whispered voice; examine the external auditory meatus and drum with aural speculum (paragraphs 21-24).

(d) Examine articulations and muscular condition of upper limbs (paragraph 26).

(e) Examine the chest, front and back; inspection and auscultation of heart and lungs, with X-ray and other special examinations as indicated (paragraph 34 et seq).

(f) Measure and record the systolic and diastolic blood pressure (paragraphs 40-43).

(g) Examine the abdomen; examine for hernia (paragraph 77).

(h) Test knee and ankle reflexes (paragraphs 49-56).

(i) Examine articulations and muscular condition of spine and lower limbs (paragraphs 28 & 29).

(j) Romberg test.

(k) Test urine for the presence of sugar and protein (paragraphs 44, 45 & 79).

98. The result of these examinations and tests will suggest any further more detailed examinations which need to be carried out.

99. It is recommended that the blood group of the applicant be tested and should a permit be granted the blood group of the holder should be recorded in his driving permit in order that rapid aid may be obtained, if needed, in case of an accident.

CONCLUSION

100. An account has been given of the present views regarding certain commoner medical conditions in relation to safety in driving. The various procedures required for the medical examination of applicants for motor vehicle driving permits have also been described. If these requirements are satisfied, the applicant may safely be permitted to drive, so far as medical considerations are concerned.

101. Since the previous W.H.O. Report was published in 1960 ("Guiding Principles in the Medical Examination of Applicants for Motor Vehicle Driving Permits") many studies of this subject have been published and an attempt has been made here to summarize the major contributions in this area. There has been a trend, since 1960, for a more liberal view to be taken regarding medical conditions as they affect the driving of private cars. It is still considered, however, that higher standards should be required for drivers of public passenger transport vehicles and heavy goods vehicles.

102. Constant vigilance by medical practitioners will help to reduce the number of road traffic accidents if those of their patients who are medically unfit drivers and those whose vision is seriously defective are advised not to drive.

103. The drivers of public passenger and heavy motor vehicles need to maintain a high standard of physical and mental fitness of which they are justly proud, and this in turn promotes the confidence of the travelling public. The maintenance of a reasonable standard of fitness, including eyesight and the avoidance of alcohol and drugs while driving, by drivers of all types of motor vehicle is desirable. Medical practitioners are in a good position to

encourage this in their day-to-day work with those of their patients who drive vehicles. Authorities who are responsible for the issue of driving permits should also require reasonable standards of physical and mental fitness, including eyesight, and suggestions have been made in this document as to the standards that should be required.

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