MEDICAL EXAMINATIONS FOR PUBLIC SAFETY*

BY

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From the London Transport Executive

(RECEIVED FOR PUBLICATION SEPTEMBER 9, 1958)

Driving buses in London is an occupation in which the standards of fitness have been defined and in which the frequency of, and clinical reason for, exclusion from the occupation have been recorded.

The criteria of fitness to drive a passenger vehicle are physical capability to handle controls (including good eyesight) and absence of conditions liable to cause sudden collapse or excessive fatigue with consequent liability to accidents. Some factors which may be overlooked as causes of collapse are idiopathic epilepsy which may first appear in middle life, carcinoma of the bronchus which commonly metastasizes in the brain and may cause fits, and laryngeal vertigo (cough syncope) which is much commoner in chronic bronchitics than is often realized.

When medical standards to maintain public safety and the man's own health were applied to applicants to drive London's buses, 5.3% of the applicants were rejected on general medical grounds and a further 13.3% were rejected for sub-standard vision and colour vision. All the applicants had experience of driving heavy vehicles and were otherwise acceptable as drivers.

Continued surveillance during working life, especially after sickness absence, of those involved in public safety is essential. During 1956, 23% of the examinations of bus drivers, who had been off sick for 28 days or more or for certain specified conditions, resulted in temporary or permanent exclusion from driving. This compares with 1.5% of examinations for licence renewal and 5.7% at age 65 and above.

Cardiovascular disorders accounted for 26% of the causes of rejection during 1956, one-third of these being due to hypertension and one-half to coronary heart disease. No one who has had clinical coronary heart disease is allowed to drive London Transport buses because of the known increased chance of recurrence. Periodic examinations revealed a number of hypertensives but the majority of the "coronary cases" were revealed by sickness absence. Electrocardiography at periodic examinations does not, at the present, enable those who will have coronary heart disease to be recognized.

Experience shows that the standards adopted are practicable and effective so far as bus drivers are concerned, and that careful assessment of fitness after sickness is as important as routine medical examination in maintaining public safety.

In order to judge the value of medical examinations in maintaining the safety of the public (or of a group of people working together) it is necessary to have two sets of information. The first is, what medical standards are adopted in determining the fitness of a man to enter into, or to continue in, an occupation in which public safety is involved. The second is, what clinical conditions most frequently render a man unfit to be employed in such an

occupation in the judgment of those responsible for this decision, and on what occasions are these conditions recognized.

There is one occupation, driving buses in London, in which the standards of fitness adopted have been defined and in which the frequency of and clinical reasons for exclusion from the occupation have been recorded. In this paper, therefore, the medical standards for bus driving in London are briefly restated and some preliminary information is presented on the clinical conditions most frequently recorded as the reason for exclusion from driving, as determined by the doctors working in London Transport.

*A paper delivered in the symposium "The Assessment of the Value of Routine Medical Examinations in Industry" in the Occupational Health Section of the British Medical Association Annual Meeting on July 16, 1958.

Medical Standards

The British Medical Association (1954) and the World Health Organization (1956) published memoranda on medical standards for transport drivers.

Norman (1954) cites three criteria for safety which must be satisfied before a man can be considered fit to drive a passenger vehicle:—

(1) The driver must be physically capable of handling the controls of the vehicle for prolonged periods; all except minor physical abnormalities must be absent. His eyesight must reach a safe standard.

(2) He must not be suffering from any condition which is liable to cause sudden loss of consciousness or to interfere with the safe handling of the vehicle.

(3) He must not be suffering from any condition which is liable to cause excessive fatigue at the end of the working day, with consequent liability to accidents.

Fyfe (1958) has written of the practical aspects of carrying out medical examinations for public safety. Norman (1954 and 1958) lists the following conditions which may cause sudden loss of consciousness while driving:—Falling asleep at the wheel, epilepsy (idiopathic and other types), laryngeal vertigo (syncope caused by coughing), aural vertigo, hypertension, hypotension, coronary thrombosis, cerebral anaemia, aortic valvular disease, auricular fibrillation, pulmonary embolism, cerebral accidents, hypoglycaemia, and drugs.

There are three points about this list which are worth making because they tend to be forgotten (Norman, 1958). Idiopathic epilepsy may show itself for the first time in middle life. An epileptiform fit may be the first manifestation of a carcinoma of the bronchus; these tumours commonly metastasize in the brain and anyone who has been treated for a bronchial neoplasm should not be responsible for public safety. Laryngeal vertigo, or syncope due to coughing, occurs much more frequently than is generally realized; many chronic bronchitics, when closely questioned, will admit to having noticed the early stages of faintness during their morning bouts of coughing.

Pre-employment Medical Examinations

These medical standards, which experience has shown to be effective, have been applied for many years to the occupation of bus driving in London. It would be interesting to know how many applicants for employment as drivers failed to reach these standards on grounds of public safety alone. It is not possible to obtain this information because any such figures must include some instances where the reason for rejection is for the benefit of the appli-

cant's own health as well as (or rather than) for the safety of the public. With this reservation, Table 1 shows the results of clinical pre-employment examinations of 18,003 applicants for driving buses or trolleybuses in London Transport during the years 1950-57.

TABLE 1
APPLICANTS FOR BUS DRIVING REJECTED ON MEDICAL GROUNDS BY LONDON TRANSPORT MEDICAL SERVICE 1950-57

<i>Eyes</i>						
Visual acuity ..	..	..	..	..	..	1,680
Colour vision ..	..	..	..	..	..	641
Pathological defects ..	..	..	..	..	..	36
<i>Chest</i>						
Lungs ..	..	..	..	..	..	112
Heart ..	..	..	..	..	..	245
<i>Abdomen</i>						
Gastric ..	..	..	..	..	..	52
Renal ..	..	..	..	..	..	21
Herniae ..	..	..	..	..	..	48
<i>Nervous system</i>						
Psychological ..	..	..	..	..	..	34
Neurological ..	..	..	..	..	..	34
<i>Skin</i>						
Dermatitis (industrial)	..	..	..	..	..	6
Other skin lesions ..	..	..	..	..	..	16
<i>Limb defects</i>						
Upper limbs ..	..	..	..	..	..	31
Lower limbs ..	..	..	..	..	..	26
Varicose veins ..	..	..	..	..	..	27
<i>Rheumatism</i> (including fibrositis and rheumatoid arthritis)	..	..	..	..	..	9
<i>General diseases</i> (diabetes—glandular diseases, etc.)	..	..	..	..	..	86
<i>Ears</i>						
Hearing ..	..	..	..	..	..	100
Pathological ..	..	..	..	..	..	149
<i>Physique</i> ..	..	..	..	..	..	14
Rejected ..						3,367
Total examined ..						18,003

All the men examined had satisfied an experienced lay interviewer that they were suitable for employment as a driver, were 24 years of age or more, and had recent heavy goods or passenger vehicle driving experience. It will be seen that 3,367 (18.6%) were rejected, but that 2,321 (71%) of the rejections were due to sub-standard vision or colour vision. One thousand and forty-six (5.3%) of the applicants were considered unsuitable for driving passenger vehicles on general medical grounds, especially public safety. A further 405 (2.3%), not included in Table 1, were temporarily deferred for investigation or treatment. The applicants were a highly selected sample of the population. They were self-selected by inclination to be a driver and subsequently a bus driver in London, and self-selected in the knowledge that a medical examination to a public safety standard was involved; and selected by interview and by previous driving experience as being suitable as bus drivers, yet there were 245 (1.4%) men with cardiovascular disorders warranting rejection. The disorders were mainly valvular lesions and hypertension. That there were also 149 (0.8%) men, many of them driving heavy vehicles for a living, with

pathological conditions of the ears, mainly chronic otitis media with its possibilities of aural vertigo, suggests that patients or doctors consider suppurative middle ear conditions to be of little importance.

The results shown in Table 1 are an argument for reintroducing the medical examination, which before 1940, was required before a heavy goods vehicle driving licence could be issued.

Routine Medical Examinations

The pre-employment medical examination is only one method by which doctors can help to maintain and increase the safety of the public. Because increasing age brings increasing prevalence of pathological conditions which may affect public safety, the continued surveillance of public service drivers is essential. This is recognized by the Licensing Authority in London which requires medical certificates of fitness at the renewal of Public Service Vehicle driving licences nearest the 50th, 56th, and 62nd birthdays, and annually from the age of 65. In addition to these statutory examinations and routine eyesight examinations, the London bus driver is required to be medically examined on the following occasions: Before return to work after absence due to sickness lasting more than 28 days, or accident lasting more than three days; after any sickness causing him to fail to complete a work shift; when he has been certified by his own doctor as suffering from vertigo, heart disease, epilepsy, or tuberculosis; and at any time at the request of the management. In addition, drivers are examined at their own request or at the request of their own doctors.

Results of Routine Examinations.—Table 2 gives the outcome of the medical examination of London Transport bus and trolleybus drivers during one year and shows the striking difference in the result of the examinations depending on the reason for which they were undertaken. During 1956 there were 5,416 examinations among the 17,153 drivers of

all ages employed. Five hundred and two (9.2%) of these examinations resulted in the driver being temporarily or permanently taken off driving, either because of public safety or for the benefit of his health.

Of the examinations on return from sickness, 23.6%, and 21.4% of the re-examinations of those drivers under routine surveillance for some clinical condition observed on a previous occasion resulted in exclusion from driving compared with only 1.5% of the licence renewal examinations and 5.7% of the examinations of the highly self-selected group who decided to go on driving after the age of 65. The miscellaneous group of examinations contains those cases seen at the request of the employee, his doctor, or his employer. The high rejection rate found in this group is because many of the patients, on good grounds, had requested, or had been advised by their own doctor, a change from driving. This table shows that routine examinations at fixed intervals may result in diagnosis of conditions which have not yet taken the patient to his doctor, but that careful assessment after sickness is very important in promoting public safety and the health of a group of workers.

In carrying out all these examinations, and especially at the periodic examinations, it is often very valuable to study the patient's sickness-absence experience which is usually entered in his record of service. There may be recorded short spells of sickness absence of significance which have not previously occasioned medical examination.

Analysis of the cases found unfit demonstrates, not unexpectedly, the importance of disease of the cardiovascular system as a cause of exclusion from driving. In Table 3 the rejected cases from Table 2 (excluding those rejected at routine eyesight examination and at re-examination) are classified into broad diagnostic groups.

Functional Nervous Disorders.—The only diagnostic group, apart from cardiovascular disorders, which contains more than 10% of the rejected cases, is that of functional nervous disorders. It is significant that this group contains an appreciable number under the miscellaneous category of reason for examination. Some of these were drivers who had lost confidence in driving and, wishing to change their job, had requested a medical examination.

Organic Nervous Disorders.—The comparatively high figure of 8.1% of rejections for organic nervous disorders results from the inclusion of cerebrovascular accidents in this group. In fact, in order to complete the picture of the importance of the cardiovascular system as a cause of unfitness, 12 of

TABLE 2
CASES FOUND UNFIT FOR DRIVING AT ROUTINE
MEDICAL EXAMINATIONS OF DRIVERS IN 1956

Reason for Medical Examination	Total Examined	No. Unfit
Vision	2,144	9 (0.4%)
Return from sickness absence	1,224	289 (23.6%)
Following accident	410	15 (3.6%)
Re-examinations*	577	124 (21.4%)
P.S.V. licence renewal	448	7 (1.5%)
Aged 65 and over	454	25 (5.7%)
Miscellaneous†	71	33 (46.4%)
Promotion to non-driving grades	88	—
Totals	5,416	502 (9.2%)

*At request of London Transport doctors.

†Mainly at request of the employee, his doctor, or his employer.

TABLE 3
REASON FOR EXAMINATION AND CAUSES OF REJECTION OF CASES FOUND UNFIT IN 1956

Broad Diagnostic Group No. *	Resuming after Sickness and Accident	Routine at Age 65 and Over	Public Service Vehicle Licence Renewal	Miscellaneous	Total	% of Cases Unfit
1. Tuberculosis	4	—	—	—	4	1.1
3. Neoplasms	19	1	—	—	20	5.4
4. Functional nervous disorders	33	1	1	13	48	13.0
5. Organic nervous disorders	28	1	—	1	30	8.1
6. Diseases of the eye	12	—	1	—	13	3.5
7. Diseases of the ear	10	—	1	2	13	3.5
8. Diseases of the circulatory system	75	12	4	6	97	26.3
9. Colds and influenza	4	—	—	—	4	1.1
10. Bronchitis	26	1	—	3	30	8.1
11. Other respiratory diseases	4	—	—	—	4	1.1
12. Diseases of stomach and duodenum	16	—	—	4	20	5.4
13. Hernia of abdominal cavity	1	—	—	—	1	0.3
14. Other diseases of the digestive system	4	—	—	—	4	1.1
16. Diseases of the skin	2	—	—	—	2	0.5
17. Diseases of bones and organs of movement	26	—	—	2	28	7.6
18. Accidents on duty	6	—	—	—	6	1.6
19. Accidents off duty	9	—	—	—	9	2.5
20. Miscellaneous	25	9	—	2	36	9.8
Totals	304	25	7	33	369	100

*For the International Statistical Classification code numbers included in the broad diagnostic groups see "Health in Industry: A Contribution to the Study of Sickness Absence: Experience in London Transport", 1956, Butterworth, London.
There were no cases in broad diagnostic group, No. 2, infective and parasitic diseases.

TABLE 4
REASON FOR EXAMINATION AND DIAGNOSIS OF CASES FOUND UNFIT BECAUSE OF DISEASES OF CIRCULATORY SYSTEM IN 1956

	Resuming after Sickness	Routine at Age 65 and Over	Public Service Vehicle Licence Renewal	Miscellaneous	Total
Angina pectoris	10	—	1	—	11
Coronary thrombosis	36	—	—	3	39
Hypertension	16	10	3	2	31
Miscellaneous	13	2	—	1	16
Totals	75	12	4	6	97

the cases, or a further 3.3%, should be transferred from this group to the cardiovascular group. This transfer has not been made because it would involve a major departure from the International Statistical Classification of Diseases, Accidents, and Causes of Death.

Bronchitis.—Laryngeal vertigo does not account for more than an important few of the rejections attributed to bronchitis. Anoxia, as manifested by cyanosis, and dyspnoea and tachycardia on slight exercise, is a much more important reason for exclusion from driving because of the possibility of slow reaction time and confusion brought about by diminished oxygen supply to the brain.

Diabetes.—The miscellaneous broad diagnostic group contains only one previously undiagnosed diabetic out of 902 routine age or licence renewal examinations. This driver was allowed to continue driving under regular medical surveillance, because his diabetes was controlled by diet alone. Men needing insulin are not considered safe to continue driving a bus.

Diseases of the Circulatory System.—Cardiovascular disorders, which accounted for more than a quarter of all the rejections, comprised 97 cases which are analysed by diagnosis in Table 4.

This shows that routine age and licence renewal examinations are valuable in ascertaining those with hypertension of a degree which makes it unsafe for them to continue driving. Only one of the 50 cases rejected on account of coronary heart disease was diagnosed at a periodic examination. This one case must not, of course, be scorned because he might just have been the driver who had a sudden disabling coronary thrombosis while driving.

Hypertension.—In this series, of the 31 cases found unfit for driving on account of hypertension, 13 (42%) were discovered at periodic examination but the majority were confirmed at examination following sickness absence (the two miscellaneous cases were referred to London Transport doctors by general practitioners).

When hypertension or its complications have caused sickness absence it is only occasionally that

the patient can be considered fit to drive again, even though hypotensive drugs have eliminated symptoms and reduced the blood pressure. These drugs depress cerebral activity and any patient taking them should be excluded from driving as an occupation. Hypertension discovered at routine medical examination often presents a difficult clinical problem and each case needs careful assessment. The men rejected in this series had either a blood pressure persistently above 200/100 mm. Hg at rest or some of the following: Symptoms (headache, dyspnoea, palpitations, claudication), cyanosis, tachycardia at rest, clinical or radiological cardiac enlargement, valvular lesion (especially aortic), pulmonary congestion, thickened peripheral vessels, diminished dorsalis pedis pulsation, hepatic enlargement, oedema, obesity, or albuminuria. Some of those rejected had blood pressures below 200/100 mm. Hg, but such symptoms and signs that they were considered unsafe for driving.

Coronary Heart Disease.—Coronary heart disease accounted for 13% of all the rejections for driving (Tables 3 and 4), and this excludes those 20 drivers who are known to have died, without resuming work, from this condition during 1956. (There were another 50 deaths from other causes.) Two questions often asked about coronary heart disease in relation to public safety are, Should a man who had had an overt "coronary thrombosis" continue in work involving public safety, and is it possible to predict at periodic examinations which of a group of men will develop coronary heart disease? A man who has had a "coronary thrombosis" is more likely to have another attack (as evidenced by sickness absence for this cause) than a man who has never had coronary thrombosis is to have his first attack. Morris, Heady, and Barley (1952 and 1957) and Morris (1958) showed, in their study of doctors, that those who have recovered from their first coronary episode may be as much as 10 times more likely to have a further attack than doctors who have never had coronary heart disease are to develop their first attack. There is some evidence that bus drivers are more likely to die in a subsequent attack than bus conductors. Morris and Raffle (1954) showed that the drivers' mortality from this condition up to three days and three months from the onset was twice that of the conductors. When those who survived three months were traced for three years, proportionately more former drivers than former conductors were found to have died from a subsequent attack. London Transport accepts the view that, in the interests of safety of the travelling public, a driver who has had clinical coronary heart disease should no longer drive.

The answer to the second question, Whether it is possible to pick out the future sufferer, is that in the absence of disclosed anginal symptoms, cardiac arrhythmias, or obvious peripheral or retinal arterial changes, there is no certain method of recognizing the patient who will develop clinical coronary heart disease. Heady, Morris, Lloyd, and Raffle (1954) showed that there was no significant difference in the previous sickness-absence experience of coronary and control groups. Electrocardiography is a useful confirmatory investigation when the clinical findings are suggestive. Routine electrocardiography at periodic examinations detects a few individuals who have had "silent coronaries", but the significance of minor changes in the electrocardiogram after exercise, in otherwise normal men, is unknown. Acheson (1957), for instance, found changes after exercise, usually considered indicative of coronary heart disease, in 5.3% of fit, symptomless R.A.F. personnel aged 19 to 39, and in 15.4% in those aged 40 to 54. What cannot be known without following these men up for many years is whether this type of change indicates a predisposition to future overt "coronary thrombosis". There is a great deal of research being done on this aspect of medical examinations for public safety. It is only when the results are available that it will be possible to assess the value of electrocardiography at periodic examinations in preventing collapses which might be dangerous to the public.

Master, Dock, and Jaffe (1939) among other authors, showed that the time of onset of coronary thrombosis was evenly spread over the 24 hours of the day. It is of interest that the occasion of onset of suddenly disabling coronary heart disease in 89 drivers in five years, all dying on the day of onset, also shows a random distribution (Table 5).

TABLE 5
OCCASION OF ONSET OF SUDDENLY DISABLING
CORONARY HEART DISEASE IN 1953-57*

Onset while						
At wheel	..	..	11	} at work 28	} Total 89	
Otherwise on duty	..	..	8			
Going to or from duty	..	..	9			
At home	..	..	40	} not at work 61		
Known to be in bed	..	..	11			
On holiday or rest day	..	..	10			
(Men aged 35 to 64).						

*All died during day of onset.

One-third of the cases occurred in the (roughly) third of a driver's life spent at the wheel, otherwise on duty or near his garage going to or from duty. No reliance can, therefore, be placed on the probability of fatal collapses occurring off duty.

In only five of the 11 episodes occurring at the wheel did the driver not have sufficient warning of

the attack to stop the vehicle, in only three instances did the bus collide with another object and nobody was injured in these incidents (Norman, 1958).

Conclusion

In considering those conditions which render a man unfit for a job involving public safety, cardiovascular conditions have been stressed because experience shows that these are the conditions which cause more unfitness than any other for one occupation involving public safety—bus driving in London. When it comes to assessing the value of routine medical examinations for public safety, much reliance must be placed upon the experience of those organizations which are frequently involved in this work. Probably the only certain method of assessment would be to accept into employment all those rejected on present standards and to compare their safety and sickness records with matched control groups doing the same work. Not the most enthusiastic searcher after truth would dare suggest this! Reliance must therefore be placed on what experience has shown to be practicable and effective

in many organizations which have a reputation for maintaining public safety, that is, important as the routine periodic examination is in maintaining public safety, equally important and probably more important, is the careful assessment of the patient's fitness to resume his occupation after a spell of sickness.

I am grateful to friends and colleagues, especially Dr. L. G. Norman, Dr. J. N. Morris, and Mr. F. H. Spratling, for much constructive criticism and encouragement in the preparation of this paper.

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