



Fitness-for-Work Assessment of Train Drivers of Yazd Railway, Central Iran

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Abstract

Background: National Transport Commission (NTC) classifies train driving as a high-level safety critical job.

Objective: To assess fitness-for-work among train drivers in Yazd, central Iran.

Methods: We evaluated 152 train drivers for their fitness for duty. The results were then compared with NTC guidelines.

Results: 63.8% of subjects were fit for duty, 34.2% fit subject to review, and 2.0% were temporarily unfit. The most common reason for fit subject to review was a Kessler score >19. The prevalence of overweight and obesity was 48.0% and 15.0%, respectively. The prevalence of dyslipidemia was 69.7%, diabetes 10.0%, impaired fasting glucose 36.0%, and hypertension was 19.0%, respectively.

Conclusion: Most studied train drivers can continue their work safely. The prevalence of some risk factors such as overweight and dyslipidemia were high among train drivers. This warrants further evaluation and establishment of control programs.

Keywords: Railroads; Work; Occupational diseases; Sleep disorders; Depression; Anxiety; Myocardial ischemia; Coronary artery disease; Diabetes mellitus; Spirometry

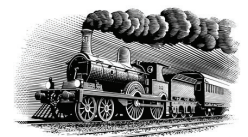
Introduction

National Transport Commission (NTC) is an independent Australian body created to develop regulatory and operational reform for road, rail and intermodal transport. The NTC standards provide a practical guideline for accredited rail organization to meet their legal obligation under rail safety legislation. NTC classifies train driving as a high-level safety critical job. Safety critical workers are defined as those whose action or inaction, due to ill-health, may di-

rectly lead to a serious incident affecting the public or the rail network. The health and fitness of these workers, especially their vigilance and attentiveness to their job is of paramount importance.

High-level safety critical tasks are those in which a serious incident affecting the public or the network could result from sudden worker incapacity such as heart attack or loss of consciousness.¹ A train driver should be educated well for performing his or her duties, although a healthy mental and physical condition is more important. Train driving is

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a demanding job with a high level of responsibility. Shift work causes an added workload for train drivers. The physical hazards such as noise and vibration and exposure to uncomfortable cab environment increase the workload. The train drivers require a high level of concentration and alertness.² Train drivers are exposed to several noxious agents such as magnetic field, whole body vibration, sitting for a long time, noise and diesel engine exhaust that may lead to various diseases. Train driving needs complex skills; therefore, determination of the medical aspects of fitness-for-work among train drivers is very difficult.³ The primary purpose of a fitness-for-work evaluation is to make sure that an individual can perform the tasks involved in his or her job effectively and without risk to his or her own or others health and safety.⁴

Studies that assess fitness-for-work of train drivers are limited. In one study conducted in Australia, it was found that 65.1% of train drivers were fit for duty,

22.5% were fit subject to review, and 12.4% were temporarily unfit.⁵

Halvani, *et al*, in a study on Yazd railway workers, found that 32.1% of them suffered from various degrees of hearing loss which had increased with years of employment.⁶

In another study, cardiovascular risk factors and diseases were the most common reasons for fit subject to review, temporarily unfit, and permanently unfit.⁵ Some of the cardiovascular risk factors reported were more prevalent than those in Australian general population. In a cross-sectional study conducted in Yazd urban population, the prevalence of some of the risk factors of coronary artery disease was evaluated. It was found that overweight, obesity; dyslipidemia and hypertension were the most prevalent risk factors in this province.⁷

Because there are few studies on fitness-for-work in train drivers in Iran, we conducted this study to assess the medical fitness among train drivers of Yazd railway in 2012.

TAKE-HOME MESSAGE

- Train drivers are exposed to several noxious agents such as magnetic field, whole body vibration, sitting for a long time, noise and diesel engine exhaust that may lead to various diseases. Shift work causes an added workload for train drivers.
- Mental health and physical condition is important in train drivers.
- A train driver should be educated well for performing his or her duties.
- Train driving needs complex skills; therefore, determination of the medical aspects of fitness-for-work among train drivers is difficult.
- Cardiovascular risk factors and diseases are the most common reasons for fit subject to review, temporarily unfit, and permanently unfit.

Materials and Methods

This study was approved by Ethics Committee of Shahid Sadoughi University of Medical Sciences. In this cross-sectional study we examined 152 train drivers referred to Yazd occupational medicine clinic from April to June 2012 for periodic evaluations. All Yazd railway train drivers entered the study by census. An informed written consent was obtained from each participant. Medical and occupational history was obtained from each subject. The participants were also asked to complete two standard questionnaires—Persian version of Epworth Sleepiness Scale (ESS)⁸ and Kessler Psychological Distress Scale (K10)⁹.

ESS questionnaire determines the likelihood that a subject fall asleep in different

situations. It consists of eight questions each of which is rated on a scale of 0–3; a total score >10 is considered positive for excessive daytime sleepiness (EDS). Persian version of ESS was validated by Sadeghnia Haghighi, *et al.*¹⁰

K10 is a screening tool for the detection of severe cases of anxiety or depression.⁹ The questionnaire consists of 10 questions, each of which has five possible responses ranging from “none of the time” to “all of the time” and scored from 1 to 5. A total score of <20 is considered normal. The Persian version of K10 showed a good reliability in a pilot study (Cronbach's α = 0.81).

For each participant, blood pressure was measured twice at five minute interval using a mercury sphygmomanometer (Riester, Germany); visual acuity was assessed by Snellen chart, and visual field by a vision screener (Visio Test ϕ C8 3004, USA); and color vision was tested by Ishihara pseudo-isochromatic plates (37 plates, Japan).

Train drivers were asked about the amount of their physical activity. We defined optimal physical activity as regular exercise for 30 minutes per day, five days a week.¹¹

From each participant, a blood sample was taken for biochemical tests after 12 hours of fasting. Complete blood count (CBC), serum triglyceride, cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), blood urea nitrogen (BUN), creatinine (Cr), and fasting plasma glucose (FPG) were measured in blood. Urinalysis (U/A) and electrocardiography (Kenze ECG 110 class I, Japan) were also performed.

Spirometry was performed (Spirolab III, MIR Co, Italy) according to ATS/ERS guidelines.¹² Audiometry was performed by an AC40 audiometer (Interacoustic, Denmark; Ear phone: TDH39) in an acoustic chamber. The average of hear-

ing thresholds at high frequencies (3000, 4000, 6000 Hz) and low frequencies (500, 1000, 2000 Hz) were calculated.

Cardiac risk factors were assessed according to the American Heart Association.¹ The cardiac risk score was then calculated based on age, smoking status, systolic blood pressure, total cholesterol level, HDL, FBS and presence of left ventricular hypertrophy in EKG (The Sokolow-Lyon criterion for LVH is met if the amplitude of the S wave in V_1 + the amplitude of the R wave in V_5 is >35 mm).¹ Dyslipidemia was considered if triglycerides was >150 mg/dL and/or cholesterol > 200 mg/dL and/or LDL >160 mg/dL and/or HDL <40 mg/dL and/or history of taking anti-hyperlipidemic drugs.⁷ Impaired fasting glucose (IFG) was defined as a FPG between 100 and 125 mg/dL; FPG \geq 126 mg/dL in two occasions was considered diabetes.¹⁴

Obstructive pattern of respiratory disorders was defined as FEV₁/FVC < lower limit of normal (LLN); Restrictive pattern was defined as FVC < LLN and FEV₁/FVC > LLN; mixed pattern was defined as FVC < LLN and FEV₁/FVC < LLN.¹⁴

Participant were considered to have hypertension if they were receiving anti-hypertensive drugs or had a systolic blood pressure \geq 140 mm Hg or diastolic blood pressure \geq 90 mm Hg. Train drivers were classified according to their BMI to normal (<25.0 kg/m²), overweight (25.0–29.9 kg/m²) and obese (\geq 30.0 kg/m²).

For each of the studied train drivers the results were compared with NTC guidelines and medical fitness for driving was assessed. Data were analyzed by SPSS® for Windows® ver. 18 using *Student's t* test, and χ^2 test. A p value <0.05 was considered statistically significant.

Results

The mean \pm SD age of workers was 36 \pm 8.8

Table 1: Fitness-for-work among Yazd railway train drivers

Status	Number of drivers (%)
Fit for duty	97 (63.8)
Fit subject to review	52 (34.2)
Temporarily unfit	3 (2)
Permanently unfit	0 (0)

years. The median (IQR) work experience was 8 (8) years. Seventeen (11.2%) train drivers were smokers. Level of fitness-for-work of drivers is summarized in Table 1.

Reasons for being classified as “fit subject to review” are listed in Table 2. The number of workers who were “fit to work” significantly ($p < 0.001$) decreased with increasing age and years of employment (Table 3).

During this study, we diagnosed 13 new cases of diabetes, 20 hypertension, 2 ischemic heart disease, and 55 cases of IFG. Prevalence of some coronary artery disease (CAD) risk factors among studied train drivers is shown in Table 4. Of 152 studied drivers, 133 (88%) did not have optimal physical activity; 24 (15.8%) suffered from high-frequency hearing loss, and 5 (3.3%) had low-frequency hearing loss. The average hearing threshold at 6000 Hz was worse than other frequencies.

The prevalence of obstructive and restrictive respiratory pattern among stud-

ied drivers was 6.7% and 3.3%, respectively; only one person had mixed pattern. None of the drivers suffered from severe functional respiratory disorder; therefore, according to NTC criteria, they were not deemed to be “unfit for task.”

Discussion

The present study demonstrated that 98% of the studied train drivers were “fit for duty” or “fit subject to review” (Table 1); and can perform their duties safely. A similar study from Australia conducted on 483 train drivers with a median age of 48 years, reported that 65.1% of the drivers were “fit for duty” which was consistent with our findings, although they found that 22.5% of the drivers were “fit subject to review” and 12.4% were “temporarily unfit.”⁵ This difference could be attributed to older age (range: 25–75) of the Australian drivers. In our study, the number of workers “fit for duty” decreased with increasing age and years of employment. Medical conditions increase with age.¹⁵

Most train drivers work in a rotating shift schedule that is associated with several psychiatric disorders such as depression and other mood disorders.¹⁶ A meta-analysis showed that the risk of accidents among drivers, as a result of depression, is on the rise,¹⁶ however, other researchers could not find such an association.^{18,19}

Sagberg showed an increased risk for accidents in those feeling depressed and anxious.²⁰ Being involved in an accident where another person is killed or seriously injured is a common situation for train drivers that may lead to anxiety disorders.²¹

In our study, the most common reason for “fit subject to review” was inappropriate results of Kessler test and cardiovascular diseases (Table 2). The aforementioned Australian study,⁵ however, found that cardiovascular risk factors and CAD

Table 2: Main causes of “fit subject to review”

Cause	Frequency (%)
Kessler test score >19	24 (15.8)
Cardiovascular problem	16 (10.7)
Hypertension	7 (4.7)
Visual impairment	5 (3.3)
Daytime sleepiness (ESS>10)	2 (1.3)

Table 3: Distribution of job-suitability-for-employment stratified by age and years of employment in the studied train drivers.

Parameter		Fit for duty n (%)	Fit subject to review n (%)	Temporarily unfit n (%)	p value
Age group (year)	25–34	68 (77)	19 (22)	1 (1)	<0.001
	35–44	21 (70)	9 (30)	0 (0)	
	45–54	8 (24)	24 (71)	2 (6)	
Work duration (year)	≤10	69 (74)	23 (25)	1 (1)	<0.001
	11–20	21 (66)	10 (31)	1 (3)	
	>20	7 (26)	19 (70)	1 (4)	

were the most common reason for “fit subject to review” and “temporarily unfit.” This discrepancy could be explained as well considering the higher mean age of Australian train drivers.

We assessed cardiovascular risk factors in train drivers. They had a prevalence of overweight higher than the general population of Yazd.⁷ This might be due to the low physical activity of our train drivers. Nonetheless, the study on general population of Yazd, we used as our reference, was conducted in 2004 and the observed difference might be attributed to the change in the lifestyle during these years. But, the Australian study also reported a higher prevalence of obesity in train drivers compared to general population.⁵

In the present study 88% of train drivers did not have optimal physical activity. Excess weight is associated with increased risk of CAD. The prevalence of dyslipidemia was also higher than the general population of Yazd.⁷ In a case-control study conducted in Romania, the prevalence of dyslipidemia in train drivers was 57.4%—higher than that in the control group which was in keeping with our findings.²² Dyslipidemia is associated with shift work.^{23,24} the observed high prevalence of dyslipidemia among train drivers may be due to both shift work and

low physical activity.

In our study, the prevalence of HTN among train drivers (19%) was lower than the general population of Yazd (25.6%).⁷ This is contrast to some reports that reported that the drivers were more frequently hypertensive compared to general population.⁵ This discrepancy can be due to different age of the study populations.

Prevalence of diabetes in the present study was almost the same as that reported among males in general population of Yazd;⁷ however, IFG was more prevalent among train drivers than general population. This is probably due to the different IFG definitions the two studies used. Furthermore, shift work may cause glucose intolerance and insulin resistance.²⁵ Considering that 25% of people with IFG or

Table 4: Prevalence of some CAD risk factors in Yazd railway studied train drivers.

Risk factor	Frequency (%)
Dyslipidemia	106 (69.7)
Diabetes	15 (10.0)
Impaired fasting glucose	55 (36.0)
Smoking	17 (11.0)
Obesity	23 (15.0)
Hypertension	29 (19.0)

IGT may develop diabetes mellitus within next 3–5 years, our observation is important.²⁶

Based on NTC criteria, in our study no train drivers was deemed unfit because of hearing loss, but, 15% of them had high-frequency sensorineural hearing loss. The highest mean hearing threshold in both ears was recorded at 6000 Hz. Considering the exposure of train drivers to loud noise levels (97 dB) and their age in our study, this hearing loss can be considered noise-induced hearing loss. The mean hearing threshold was higher in left ear than right ear which was in agreement with the results of Nageris, *et al*, who found that noise-induced hearing loss was more prominent in the left ear, regardless of demographic and noise exposure characteristics, acoustic reflex measures, or handedness.²⁷ In addition, the driver's seat in the train cabin is located so that the left ear is closer to the engine.

Our study had some limitations. We could not assess the prevalence of substance abuse. Probably, we encountered reporting bias in evaluation of smoking. We could also not measure blood pressure in more than one occasion.

In conclusion, we found that most train drivers can continue their work safely; that the prevalence of some CAD risk factors such as overweight and dyslipidemia, was higher among them that warrants further evaluations and control programs; and that most causes of “fit subject to review” was depression and anxiety. Since depression and anxiety increase the risk of crash taking into account psychiatric disorders in screening programs are important.

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Conflicts of Interest: None declared.

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