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RISK FACTORS FOR CARDIOVASCULAR DISEASES IN PROFESSIONAL DRIVERS

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Abstract

Aim of the paper was to determine the presence of risk factors for cardiovascular diseases (CVD) such as arterial hypertension, hyperlipidemia, hyperglycemia, overweight, smoking; and (ii) to analyze the link between the requirements of their job and the resources available to them. Materials and methods: A descriptive and analytical cross-sectional study was conducted involving 210 professional drivers who underwent a medical examination at the Institute for Occupational Health of the Republic of North Macedonia. The examination was done in order to assess their ability to drive a motor vehicle; they were also given a questionnaire to fill in so as to compare the requirements of the job and the resources available to them for doing their job. Results: One third of the respondents had increased levels of triglycerides, glycemia and cholesterol in their blood (33.3%, 28.1%, and 21.4%, respectively); almost half (44.2%) of them were active smokers. One third of the respondents (31.9%) were obese, with BMI >30 (kg/m2). The resources available to the professional drivers for doing their job exceed the requirements of the job and this situation has a protective effect on the occurrence of risk factors for CVD. Conclusion: The high prevalence of risk factors for CVD among professional drivers can lead to development of CVD and increased incidence thereof, which can negatively impact on their ability for safe driving. Hence the need for interventions to prevent these risk factors, including the need to invest in the resources available to professional drivers for doing their job.

ЈАВНО ЗДРАВЈЕ

ФАКТОРИ НА РИЗИК ЗА ПОЈАВА НА КАРДИОВАСКУЛАРНИ БОЛЕСТИ КАЈ ПРОФЕСИОНАЛНИТЕ ВОЗАЧИ

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Извадок

Целта на трудот беше да се детерминира присуството на факторите на ризик за појава на кардиоваскуларни болести (КВБ): артериска хипертензија, хиперлипидемија, хипергликемија, зголемена телесна тежина, пушачки статус, и да се анализира нивната поврзаност со барањата и ресурсите на работното место. Материјал и методи: дескриптивно-аналитичка студија на пресек, во која кај 210 професионални возачи беа анализирани дел од резултатите добиени при здравствениот преглед спроведен во Инситутот за медицина на трудот на РСМ при оценката на способноста за управување со моторно возило и резултатите за барањата и ресурсите на работното место добиени со соодветен прашалник. Резултати: Една третина од испитаниците имаа покачени вредности на триглицеридите во крвта (33,3%); гликемијата беше зголемен кај 28,1%, холестеролот во крвта беше зголемен кај 21,4% и речиси половина (44,2%) од испитуваните професионални возачи беа активни пушачи. Третина (31,9%) од испитаниците беа обезни со BMI >30 (кг/м2). Ресурсите на работното место со кои располагаат испитуваните професионални возачи беа поголеми од барањата на работното место и овој модел има протективно дејство врз појавата на испитуваните фактори на ризик за КВБ. Заклучок: Високата преваленција на факторите на ризик за КВБ кај професионалните возачи може да придонесе за зачестена појава и развој на КВБ што, пак, може да влијае врз нивната способност за безбедно управување со моторно возило. Оттаму, произлегува потребата од интервенции за нивна превенција вклучително и инвестиција во ресурсите на работното место.

Introduction

Human activity in modern living and working conditions cannot be imagined without traffic. The term traffic refers to the transfer of people, goods, news, energy from one place to another[1]. Professional drivers transport material goods or passengers and driving is their primary occupation which provides their livelihood. Pursuant to the Rulebook on the health criteria to be met by drivers of motor vehicles arising from the Law on Traffic Safety and Article 3:

*"**professional driver** is a candidate for driver/driver of a motor vehicle of the categories: B+E, C, C+E, D, D+E as well as categories A, B, F, G and M to whom driving a motor vehicle is his/her primary occupation"*[2].

Road traffic can be freight, passenger and specific traffic. Professional drivers in freight and passenger traffic, in terms of whether they transport material goods or passengers, can be professional truck/heavy truck drivers, bus drivers and taxi drivers.

Several factors, such as continuous time pressure, sitting position of the body during the entire working hours, excessive stimulation from the external environment, problematic interactions with other road users, lack of social support at work and shift work (rotations) 3,4 are defined as stress-related factors that simultaneously increase the occurrence of negative effects on drivers' health, safety and driving performance[5-7].

The working conditions of professional drivers can affect their health and well-being[8,9]. Professional drivers are constantly exposed to environmental impacts (e.g., noise, smog, variable light conditions)[10] and poor ergonomic conditions[5].

In the available literature, the most common health problems faced by professional drivers as a result of exposure to occupational harms at the workplace are: arterialhypertension[11-13], musculoskeletal disorders[14-16], gastrointestinal [17], metabolic disorders[18], chronic fatigue[19,20,] and mental health problems[21,22]. However, the main health conditions that professional drivers suffer from are: cardiovascular diseases, gastrointestinal disorders and musculoskeletal problems[7]. Tse *et al*. found that bus drivers have problems with arterial hypertension and work-related stress[5].

The health of professional drivers is an important aspect related to traffic safety. Cardiovascular diseases are a leading cause of morbidity and mortality in the general population. Most studies indicate that the risk of cardiovascular disease is higher in professional drivers than in the general population [23-27]. Platek, Anna E. *et al*. point out in their study that professional drivers are exposed to many risk factors for cardiovascular diseases due to certain job characteristics such as: working hours, work-related stress, low physical activity and unhealthy dietary habits[28].

There are health conditions that have obvious implications or pose a risk to the safe operation of a motor vehicle. With these health conditions, there is a risk of unexpected

weakness and inability to safely operate a motor vehicle, which confirms the importance of the link between health and traffic safety. Health conditions in which there is a risk of unexpected weakness and inability to safely operate a motor vehicle include: sudden cardiac and cerebrovascular episodes[29], neurological diseases[30], narcolepsy[31], or hypoglycemic episodes of type I or II diabetes[32], disorders of the sensory organs for sight and hearing.

Arterial hypertension, hyperlipidemia, hyperglycemia, increased body weight and smoking status are described in the available literature as significant risk factors for cardiovascular diseases in professional drivers that can affect the ability to safely operate a motor vehicle. The obtained results are a baseline for further research and analysis of the influence of work-related factors (job demands and resources) on the occurrence of risk factors for cardiovascular diseases.

The aim of this paper was to determine the presence of risk factors for cardiovascular diseases, such as: arterial hypertension, hyperlipidemia, hyperglycemia, increased body weight and smoking status, and to analyze their link with the job demands and resources of professional drivers.

Materials and methods

A descriptive and analytical cross-sectional study involving 210 professional drivers was conducted in the Institute for Occupational Healthof the Republic of North Macedonia in the period from June 2020 until October 2021.

The data on the studied risk factors for cardiovascular diseases in professional drivers were obtained using the medical record for evaluation of the psychophysical ability to operate a motor vehicle and the clinical tests (laboratory tests and ECG) as part of the medical examination of the studied group of professional drivers in order to evaluate their ability to operate a motor vehicle, which is carried out in accordance with the "Rulebook on the method of performing medical examination of drivers of motor vehicles, the criteria regarding the staff and the equipment for performing medical examination, as well as the method and procedure for issuing a health certificate for psychophysical ability to operate a motor vehicle"33and the "Rulebook on the health criteria that must be met by candidates for drivers of motor vehicles"2. The data on the studied risk factors for cardiovascular diseases were obtained through medical examination performed by an occupational medicine specialist and refer to the following: anamnestic data on selected health conditions of interest (arterial hypertension, hyperlipidemia, diabetes) diagnosed by a doctor and presentation of positive findings obtained during the examination for the following parameters: laboratory tests (hyperglycemia, increased cholesterol and triglyceride levels in the blood), clinical parameters (ECG findings, blood pressure), habits (smoking status) and with the help of data on body weight, body height and age,

the body mass index was calculated using a calculator.

The following instruments were used to obtain data in the current study: Medical record for evaluation of the psychophysical ability to operate a motor vehicle (medical record) and Questionnaire on job demands and resources.

Electrocardiography – The analysis of the electrocardiogram was performed based on the characteristics of: heart rate, rhythm, QRS axis, signs of left ventricular hypertrophy and signs of coronary disease[34].

Arterial hypertension (HTA) is defined as a blood pressure (BP) with values >140/90 mmHg in population >18 years of age. These values correspond to BP of >135/>85 mmHg in case of home measurement, i.e., average value of >125-130/>80 mmHg in case of ambulatory measurement[35]. Blood pressure was measured in the doctor's office with a mercury sphygmomanometer on the right arm in a sitting position, after a 5-minute rest, and the measurement was repeated after 2 to 5 minutes, with mandatory measurement on the contralateral arm as well. Elevated blood pressure is confirmed if values of >140/90 mmHg are measured at least twice during two or three consecutive visits. According to the 2013 Guidelines for the management of arterial hypertension, the European Society of Arterial hypertension (ESH) and the European Society of Cardiology (ESC) classifies blood pressure: optimal blood pressure (<120/80mmHg), normal blood pressure (120-129/80-84 mmHg), high normal blood pressure (130-139/85/89 mmHg), grade 1 arterial hypertension (140-159/90-99mmHg), grade 2 arterial hypertension (160-179/100-109 mmHg) and grade 3 arterial hypertension (>180/110 mmHg)[36].

Smoking status – the classification of respondents according to smoking status was made according to the WHO recommendations for defining smoking status.Respondents who during the study smoked at least one cigarette per day weredefined as active smokers[37].

Laboratory tests – Cholesterol (reference value <5.2 mmol/L) and triglycerides (reference value <1.9 mmol/L) were examined according to the Chod-PAP-cholesterol peroxidase method[38,39].

Body mass index (BMI) is a tool that shows the relationship between body weight and height, of course, taking into account the age and the gender. It is calculated simply by using a calculator, which provides a certain index that indicates whether the body weight is appropriate in relation to other parameters.

Job demands and resources were analyzed by using the modified Questionnaire for job demands and resources designed on the basis of "Questionnaire on the impact of working conditions on the health of healthcare workers – violence and work-related stress", which refers to the job demands and resources, taken from the School of Occupational Medicine, University of Zaragoza, Spain[40]. This study

used the section with questions referring to the job demands and resources that were modified for the needs of this study. The first part of the questionnaire consists of five questions referring to the job demands to which the respondent provided answers on a Likert scale (never - very often) to the following questions: at work I feel tense, uncomfortable; my job has a negative impact on my physical or mental health; I have a lot of things to finish in an unrealistically short amount of time; the pressure from work affects my family, i.e. private life, and on a Likert scale (easy – very difficult) I tell my opinion to my superiors. The following seven questions refer to job resources to which the respondent had to provide an answer on a Likert scale (never - very often) to the following questions: I am able to completely finish my work duties; I am sufficiently financially rewarded for my work; I have enough advancement opportunities at work; and on a Likert scale (completely false - very true) to the following questions: I can adequately apply my knowledge and skills at work; the workplace is safe; I have enough funds for maintenance of the vehicle and for fuel and the vehicle I drive is roadworthy.

The validation of the questionnaire was performed with the reliability analysis, by measuring the internal consistency of the questionnaire. The analysis determined the following reliability coefficients – Crombach alpha for job demands was 0.704, and for job resources 0.688, which indicated their good and acceptable reliability.

The respondents, i.e., the professional drivers, were informed about the objectives of the study and each respondent signed a written consent for voluntary participation in the study.

Data obtained were statistically processed with the SPSS programme. Continuous variables are expressed as mean values with standard deviation, and nominal variables as absolute numbers and percentages.

Limiting factors in the study can be errors due to no response as a result of professional drivers refusing to answer questions related to their health status or answers not being completely honest and complete and referring to health conditions that can question their ability to operate a motor vehicle. To minimize these errors, before starting to answer the questions, the respondents were informed about the motive, objectives and method of the study, as well as the confidentiality of the obtained data.

Results

Demographic characteristics

The current study included 210 male professional drivers. The average age of professional drivers was 46.31±9.45 years, with a min/max age of 23/67 years. Most of the respondents 164 (78.6%) have completed secondary education.

Table 1. Analysis of the sample according to work experience

Work experience	N	Mean±SD	Min/Max	Median (IQR)	[1]p
Years of services as a professional driver					
Taxi driver	51	12.08±7.44	1/30	10 (6-18)	$X^2(2)=2.019$; p=0.3644
Truck/heavy truck driver	133	14.61±9.05	1/40	12 (7-20)	
Bus driver	26	15.04±12.01	1/38	13.5 (4-26)	
Total	210	14.59±9.08	1/40	12 (7-20)	
Working hours per week					
Taxi driver	51	45.09±8.18	30/70	40 (40-50)	$X^2(2)=4.589$; p=0.1008
Truck/heavy truck driver	133	42.22±5.05	30/70	40 (40-45)	
Bus driver	26	40.23±3.98	30/46	40 (40-40)	
Total	210	42.67±6.03	30/70	40 (40-45)	
[1]Kruskal-Wallis H test *significant by p<0,05					

The representation of taxi drivers in the study was 51 (24.28%) persons with an average of 12.08±7.44 years of service; min/max of 1/30 years and 50% of them with less than 10 years of service for Median IQR =10 (6-18). There were 133 (63.33%) truck/heavy truck drivers with an average of 14.61±9.05 years of service; min/max of 1/40 years and 50% with less than 12 years of service for Median IQR=12 (7-20).The smallest number of professional drivers in the sample were bus drivers, namely 26 (12.38%) with an average of 15.04±12.01 years of service; min/max of 1/38 years and 50% of them with less than 13.5 years of service for Median IQR=13.5 (4-26). For p>0.05, there was no significant difference between the three types of professional drivers regarding the length of service (Kruskal-Wallis H test:$X2_{(2)}$=2,019; p=0,3644 (Table 1).

Years of service – The average total years of service of professional drivers in the sample was 14.59±9.08 years with min/max of 1/40 years and 50% with less than 12 years of service for Median IQR=12 (7-20) (Table 1).

Working hours per week – The average number of working hours per week for the entire sample of respondents was 42.67±6.03 with min/max of 30/70 hours. For 50% of professional drivers, regardless of the type of motor vehicle they drive, the number of working hours per week was less than 40 for Median=40 (Table 1).

The average number of working hours per week for taxi drivers, truck/heavy truck drivers and bus drivers separately was 45.09±8.18 *vs.* 42.22±5.05 *vs.* 40.23±3.98, respectively. The minimum number of working hours per week for all three types of professional drivers was 30 hours and the

maximum number was the smallest for bus drivers and it was 46 hours, and for taxi drivers and truck/heavy truck drivers it was 70 hours each. For p>0.05, there was no significant difference between the three types of professional drivers regarding the number of working hours per week (Kruskal-Wallis test: X2(2)=4.589; p=0.1008 (Table 1).

Table 2. Data on selected risk factors for CVD (anamnestic data on health conditions diagnosed by a doctor: arterial hypertension, hyperlipidemia, diabetes)

Number	**Diseases of interest	N (%)
1	Arterial hypertension – HY	17 (8.09%)
2	Hyperlipidemias – HL	11 (5.24%)
3	Diabetes – DB	18 (8.57%)

Regarding the data related to diseases diagnosed by a doctor for which they receive chronic therapy, professional drivers included in this study with regards to selected risk factors for cardiovascular diseases stated that 8.1% suffered from arterial hypertension, and 8.6% from diabetes. A smaller percentage (5.2%) of the tested professional drivers stated that they had elevated levels of fat in the blood.

Table 3. Data on selected laboratory and clinical parameters

Laboratory and clinical parameters	N (%)
Laboratory parameters	
Glycemia - increased values in the blood	59 (28.09%)
Cholesterol (total) – increased values in the blood	45 (21.43%)
Triglycerides – increased values in the blood	70 (33.33%)
Cardiac parameters	
ECG findings – pathological changes	9 (4.28%)
Blood pressure – high blood pressure measured during the examination by the occupational medicine specialist	28 (13.33%)
Habits – smoking status	
*	

According to the laboratory and clinical tests, the highest percentage (33.3%) of the tested professional drivers had elevated triglycerides levels in the blood. Blood sugar levels were elevated in 59 respondents or 28.09%, while total cholesterol was elevated in 45 respondents or 21.4% of the studied professional drivers.

From the results shown in Table 3, we can see that in 9 (4.3%) respondents pathological changes were found on the ECG, while in 28 (13.3%) respondents the blood pressure was high, i.e., above 140 mmHg for systolic pressure and above 90 mmHg for diastolic pressure.

Regarding the smoking status, 92 respondents stated that they smoked at least one cigarette per day, which was 44.2% of the tested professional drivers.

Table 4. Results for Body Mass Index (BMI)

BMI (kg/м^2)			
<25 (kg/m^2)	N (%)	62 (29.52%)	p=0.0001*
≥25 (kg/m^2)		148 (70.48%)	
WEIGHT STATUS			
Underweight(UW)	N (%)	5 (2.38%)	NW/OB: p=0.198 NW/OW: p=0.004* OW/OB: p=0.104
Normal weight (NW)		55 (26.19%)	
Overweight (OW)		83 (39.52%)	
Obesity (OB)		67 (31.90%)	
[1]Difference test significantly * p<0,05			

The results of the calculated values of BMI showed that more than half of the respondents, as high as 70.5%, wereovernourished and had a BMI greater than 25 (kg/m^2), of which 31.9% were in the obese category with BMI greater than 30 (kg/m^2). Less than one third of the respondents, 26.2%,were normally nourished with a BMI in the interval of 18.5 (kg/m^2) -24.9 (kg/m^2).

Table 5. Results for mean values of job demands and resources (job demands and resources scale)

[1]JRD (domains / questions)	JRD score					
	Number (N)	Mean±SD	Min/ Max	Percentiles		
				25th	50th (Median)	75th
Job demands						
At work I feel tense, uncomfortable	210	0.45±0.76	0/4	0	0	1
I think that my job has a negative impact on my physical/mental health:	210	0.28±0.72	0/4	0	0	0
I have a lot of tasks to complete in an unrealistically short amount of time	210	0.82±0.96	0/4	0	1	1
I tell my opinion about work to the superiors	210	0.42±0.93	0/4	0	0	0
The pressure I feel from work also affects my family and/or private life	210	0.23±0.70	0/4	0	0	0
Average TOTAL score	210	0.44±0.56	0/3.4	0	0.3	0.6

Job resources						
I am able to completely finish my work duties	210	2.99±0.35	1/4	3	3	3
I am sufficiently financially rewarded for my work	210	2.39±1.14	0/4	2	2	3
I have enough advancement opportunities at work	210	2.75±1.06	0/4	2	3	4
I can adequately apply my knowledge and skills at work	210	3.64±0.77	0/4	4	4	4
My work environment is safe (passengers, traffic)	210	3.54±0.99	0/4	4	4	4
I have enough funds for maintenance of the vehicle and for fuel	210	3.78±0.60	0/4	4	4	4
The vehicle I drive is roadworthy	210	3.87±0.42	1/4	4	4	4
Average TOTAL score	210	3.28±0.48	1.3/4	3	3.3	3.6
[1]Job Demand -Resource						

The results presented in the above table show that the respondents (professional drivers) had higher mean values for job resources (mean value on the scale of job resources 3.280 SD 0.482) than the mean values for job demands (mean value on the scale of job demands 0.425 SD 0.546).The greatest job resources pointed out by the respondents were the vehicle's road worthiness (mean value 3.87 SD 0.421), the possibility to maintain the road worthiness of the vehicle and had a sufficient fuel supply (mean value 3.79 SD 0.601), the possibility to adequately apply knowledge and skills (mean value 3.64 SD 0.774), as well as the job safety (mean value 3.55 SD 0.982).Respondents perceived the time pressure as the most stressful factor of the job, while driving a roadworthy vehicle was the most valuable resource of the job, which gave them a sense of safety in the traffic.

Table 6. Analysis of the relationship between the occurrence of risk factors for cardiovascular disease and the mean values of job demands

Risk factors for CVD		Job demands		*t* (p)
		Average	SD	
Arterial hypertension	No	0.436	0.554	*1.032* (0.30)
	Yes	0.294	0.424	
Diabetes	No	0.439	0.556	*1.312* (0.19)
	Yes	0.258	0.379	
Hyperlipidemias	No	0.422	0.541	*-0.297* (0.77)
	Yes	0.472	0.646	
Blood pressure	No abnormality detected:	3.277	0.546	*0.260* (0.79)
	High BP	3.306	0.552	

Glycemia	No abnormality detected:	0.460	0.583	*1.49* (0.14)
	Hyperglycemia	0.334	0.426	
Cholesterol	No abnormality detected:	0.440	0.525	*0.778* (0.43)
	Hypercholesterolemia	0.368	0.617	
Triglycerides	No abnormality detected:	0.411	0.518	*0.496* (0.62)
	Hypertriglyceridemia	0.451	0.600	
Smoking status	Non-smokers	0.422	0.583	*-0.077* (0.93)
	Smokers	0.428	0.498	
Body Mass Index	BMI < 25	0.465	0.605	*0.690* (0.49)
	BMI >25	0.408	0.520	

The analysis of the obtained data regarding the impact of job demands on the occurrence of the studied risk factors for cardiovascular diseases did not show any statistically significant relationship.

Table 7. Analysis of the relationship between the occurrence of risk factors for cardiovascular diseases and the mean values of job resources

Risk factors for CVD		Job demands		*t* (p)
		Average	SD	
Arterial hypertension	No	3.268	0.49	*-1.245* (0.21)
	Yes	3.420	0.26	
Diabetes	No	3.273	0.490	*-0.792* (0.43)
Yes		3.369	0.367	
Hyperlipidemias	No	3.294	0.457	*1.719* (0.08)
	Yes	3.039	0.795	
Blood pressure	No abnormality detected:	3.277	0.485	*-0.297* (0.78)
	High BP	3.306	0.466	
Glycemia	No abnormality detected:	3.301	0.485	*1.01* (0.31)
	Hyperglycemia	3.226	0.472	
Cholesterol	No abnormality detected:	3.286	0.476	*0.323* (0.74)
	Hypercholesterolemia	3.260	0.505	
Triglycerides	No abnormality detected:	3.305	0.410	*1.028* (0.36)
	Hypertriglyceridemia	3.232	0.598	
Smoking status	Non-smokers	3.254	0.511	*-0.872* (0.38)
	Smokers	3.313	0.442	
Body Mass Index	BMI < 25	3.339	0.460	*1.132* (0.25)
	BMI >25	3.256	0.490	

The job resources available to the tested professional drivers were greater than the demands, which contributed to having a commitment to the job, job safety, and they did not have any statistically significant relationship with the occurrence of CVD risk factors.

Discussion

The current study included 210 male professional drivers, at an average age of 46 years and most of them with completed secondary education .These demographic data match the demographic characteristics of professional drivers worldwide who have a distinct set of demographic characteristics and have undergone selective processes regarding their physical, psychological, and educational standards 41.

According to the anamnestic data of the respondents, 17 professional drivers or 8.1% of the respondents suffered from arterial hypertension for which they regularly received therapy. The values obtained from the measured blood pressure showed a greater representation of this phenomenon among professional drivers; in 28 professional drivers measured values were higher than 140 mmHg for systolic pressure or higher than 90 mmHg for diastolic pressure, which was 13.3% of the respondents. This may be the result of a newly discovered condition or a condition that some of the respondents didn't want to share. Similar values regarding the prevalence of arterial hypertension in professional drivers were observed in the study conducted by Nadia Tigha-Bouaziz *et al.* (2016), among 128 male professional drivers with work experience longer than 5 years, where the prevalence of arterial hypertension was 8%. It was established that obesity and prolonged sitting were important risk factors for cardiovascular diseases and 40% of those who had arterial hypertension were in the obese category with a BMI greater than 30[42].

Arterial hypertension is a serious condition that can cause stroke, heart failure, peripheral artery disease and kidney failure. In order to evaluate the ability to drive, the focus must be put on the potential relationship between arterial hypertension and sudden collapse, and the functional disturbances that arterial hypertension can cause that affect visual acuity and brain function.

With regards to the safe operation of a motor vehicle, arterial hypertension may be the reason for the driver's incapacity in the case of malignant arterial hypertension. This condition includes a syndrome of severe elevation of arterial blood pressure (diastolic blood pressure usually > 140 mmHg) with vascular damage, especially retinal hemorrhages, exudates and/or papilledema, which may lead to sudden onset of blurred vision. Malignant arterial hypertension can also be complicated by cerebral hemorrhages that can affect cognitive or physical abilities, restricting these patients from driving. In addition to this extreme condition, grade 3 arterial hypertension according to the ESH/ESC Guidelines – classification of arterial hypertension[36] is strongly and proportionally associated with the occurrence of a stroke which has an annual incidence of over 0.3% when systolic blood pressure is > 180

mmHg. Therefore, professional drivers should not be allowed to drive until their arterial hypertension is under control. According to the same ESH/ESC Guidelines ,grade 1 or grade 2 arterial hypertension can be considered as a cardiovascular risk without immediate consequences on driving safety. It should be treated, but should not be a reason to restrict driving[43].

Professional drivers included in this study with regards to hyperlipidemia provided anamnestic data that 11 of them had elevated blood fat values, or 5.2% of the respondents. However, the laboratory blood tests showed that blood cholesterol was increased in 45 respondents, which was 21.4% of the respondents, while triglycerides in the blood were increased in 70 respondents, or 33.3%. Hyperlipidemia as cardiovascular risk factors was also identified in a study conducted by Hirata RP. *et al.* along with obesity, arterial hypertension, and hyperglycemia in a young male population of professional bus drivers[44].

Hyperglycemia, the increased level of blood sugar in professional drivers is one of the most common findings in the process of evaluating the ability to operate a motor vehicle. Also in the current study, laboratory tests showed increased levels of blood sugar of over 6.1mmol/L in 59 professional drivers, i.e., in 28.1% of the respondents, while 8.6% of the respondents reported that they were suffering from diabetes. Increased blood sugar levels in professional drivers occur due to the sedentary way of work and long-term driving, fast food, reduced physical activity, stressful situations related to other road users, and the increased blood sugar levels are detected during regular medical examinations that are mandatory for professional drivers every 24 months.

Izadi N. *et al.*, in their study of 1903 drivers who applied for a driver's license, found hyperglycemia in 52.1% of the drivers, 9.1% of whom were in the diabetic phase. Overweight was observed in 65.6% of the studied population, 44.8% were diagnosed with overweight and 20.8% with obesity. Obesity among professional drivers can also be noted among professional drivers in the current study in which 71.2% of professional drivers had a BMI over 25 and even 32.2% were in the obese category with a BMI over 30[45].

A study published by Ronna et al. described that in the United States professional drivers must undergo a medical examination in order to become a licensed driver of a commercial motor vehicle. This certificate is valid for up to 24 months; however it can be issued for less than 24 months when monitoring a health condition, such as arterial hypertension. However, medical examinations of professional drivers have shown that drivers have poor overall health and a higher prevalence of risk factors for cardiovascular diseases, especially tobacco use, arterial hypertension, and obesity, compared to the general population[46]. Regarding the smoking status, the percentage of smokers is high and in the current study, as many as 44.2% of respondents were active smokers. Poor health of truck drivers is often attributed to lifestyle including diet, physical inactivity and prolonged sitting.

Analysis of the mean values of job demands and resources showed higher values of job resources compared to the mean values of job demands and the occurrence of risk factors for car-

diovascular diseases. According to job demands and resources model, high values of job resources lead to increased productivity and motivation at work.T his process was demonstrated in the critical review of the Job Demands-Resources Model (JD-R model) presented by Schaufeli *et al.* in 2014, according to which high job demands led to impaired health (health impairment process), while high job resources led to increased motivation and higher productivity (motivational process). This model also explains the relationship between job demands and health disorders that can occur as a result of high job demands, while job resources are associated with motivational processes and work productivity[47].

The high prevalence of overweight, high blood pressure and hyperlipidemia are risk factors for the possible occurrence of cardiovascular diseases in professional drivers, as indicated by the fact that 4.3% of professional drivers were found to have pathological changes in the ECG.

The current study provided data regarding the frequency of occurrence of certain cardiovascular risk factors, which will be further used to analyze the effect of job-related factors on their occurrence and their impact on the safe operation of a motor vehicle by applying the model of an integrated approach to the influence of work environment and health condition of professional drivers on the safe operation of a motor vehicle.

Conclusion

Lifestyle and work through job demands and resources of professional drivers may have an impact on the increased occurrence of risk factors for cardiovascular diseases. The high prevalence of risk factors for cardiovascular diseases in professional drivers may contribute to the frequent occurrence and development of CVD that may affect drivers'ability to safely operate a motor vehicle. Fortunately, risk factors for cardiovascular diseases that have been examined in this study are preventable health conditions and lifestyle habits and it is necessary to create interventions for their timely diagnosis and treatment, with the aim of preventing the occurrence of cardiovascular diseases among professional drivers. One of the preventive approaches, also, includes investing in increased job resources for professional drivers.

The results of the current study showed an increased occurrence of risk factors for cardiovascular diseases in professional drivers. The high prevalence of obesity and the high percentage of smokers among the respondents, together with the occurrence of hyperlipidemia, hyperglycemia, arterial hypertension and diabetes are risk factors for cardiovascular diseases in the studied group of professional drivers. Job demands and resources may influence the occurrence of risk factors for CVD. In the current study, greater job resources compared to job demands had a protective effect on the occurrence of risk factors for CVD. Investing in job resources and in developing a model where job resources will be greater than job demands, as it is the case in the current study, will contribute to the prevention of CVD. In order to improve the ability for operation of a motor vehicle, timely diagnosis and treatment of CVD in professional drivers is required.

It is necessary, by applying the model of integrated approach, to analyze the impact of work environment on the occurrence of risk factors for cardiovascular diseases and their impact on the safe operation of a motor vehicle, in order to propose preventive measures regarding diet, work conditions (working hours, breaks during driving), introduction of regular physical activity for timely prevention of risk factors for cardiovascular diseases.

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