

## Prevalence of depressive disorders in professional drivers – epidemiologic subanalysis of the RACER study

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### Summary

**Introduction.** Professional drivers of the public transportation are one of the occupational groups exposed to very poor working conditions. Factors such as low physical activity, irregular working hours, poor eating habits and excessive stress at work, have a negative impact on cardiovascular risk and promote the development of diseases of the cardiovascular system.

**Aim.** This study aimed to establish the prevalence of depression and work-related stress in a group of drivers from the RACER (Risk of Adverse Cardiovascular Events among professional dRivers in Poland – development of specific cardiovascular preventive program) study population.

**Methods.** The prospective RACER study includes unselected professional drivers and aims to establish prevalence of cardiovascular risk factors in this group. During the enrolment all subjects were asked to fill in the BDI-II. All drivers were also asked about job-related stress and had their history taken for cardiovascular risk factors.

**Results.** Out of the subjects included into the RACER study drivers employed in the public bus transportation were selected. Analysis covered 292 consecutive drivers of public transportation buses as well as drivers of international coaches (96.6% male, mean age  $48.2 \pm 10.7$  years). Following the BDI-II scoring subjects were categorized according to symptoms. Symptoms of depression were found in 5.8% of subjects. There were no differences in populations with and without depression in terms of age and body mass index ( $p > 0.05$ ). All subjects were asked “Do you find your job stressful?” The answer was affirmative in 205 (70.2%) drivers. No significant differences were found in the prevalence of depression in drivers who found their job stressful or not, or between the drivers of international coaches and city buses.

**Conclusions.** In professional drivers prevalence of depressive symptoms and work-related stress is relatively high. There are no clinical factors predictive of high risk for depressive disorders development. This along with cardiovascular risk associated with depression is a reason for routine, psychological screening of professional drivers.

**Key words:** depression, cardiovascular disease, occupational exposure

## Introduction

Depression is now one of the most frequently diagnosed mental illnesses. Mood disorders are more and more common in patients treated by psychiatrists, as well as many patients who are under the care of doctors of other specialties. This forces the necessity for continuous education in the field of early detection and proper treatment of patients of general practitioners, internal medicine specialists, but also doctors of other specialists. Educational and social campaigns focused on spreading the knowledge of the clinical picture and relatively clearly expressed symptoms contribute to an increased recognition of this mood disorder [1]. The result is that we are seeing an increased rate of diagnosis of depression in the general population, which translates to faster implementation and proper management of the treatment.

Depression has obvious negative impact on all spheres of human life – from emotional sphere, through physical fitness and cognitive function to social relations [2]. What is particularly important, depression is also a significant risk factor for other diseases. The relationship of mood disorders with diseases of the cardiovascular system has been especially accurately described. Numerous publications and meta-analyses have shown that the prevalence of depression in patients with established cardiovascular disease is a risk factor for cardiovascular death and total mortality [3, 4]. However, despite the fact that depression is seen more and more widely – doctors and patients are not aware of its association with the risk of diseases such as myocardial infarction, coronary artery disease, stroke, and heart failure. Screening targeted towards early detection and treatment of depression, scheduled because of the negative impact of depression on the cardiovascular risk are still not common. The importance of this type of intervention is the greatest in patients with increased cardiovascular risk. This kind of patients includes professional drivers. Stress, irregular working hours or lack of physical activity are some of the factors negatively affecting both the state of the cardiovascular system, as well mood disorders.

## Aim

This study aims to describe the epidemiology of depression in a group of professional drivers.

## Material and methods

The results of the present study are a subanalysis of the RACER study (Risk of Adverse Cardiovascular Events among professional dRivers in Poland – development of specific preventive cardiovascular program). In short, RACER is a nationwide study focused on establishing the prevalence of cardiovascular risk factors in a group of professional drivers representative of both the country and geographical region. Objectives of the program include screening of the health of professional drivers, including the drivers of public transport, buses, trucks and taxis. The study is designed to determine the prevalence of classical and non-classical cardiovascular risk factors. The RACER program was initiated under the auspices of the 1<sup>st</sup> Department of Cardiology, Medical University of Warsaw, the Polish Cardiac Society and the Polish Chief Inspectorate of Road Transport. The aim of the program is to draw attention to the health situation of professional drivers in Poland, as well as to develop a specific program of prevention of cardiovascular disease addressed to professional drivers. The study was approved by the Bioethics Committee at the Medical University of Warsaw, and it was conducted in accordance with the objectives of the Declaration of Helsinki.

The present subanalysis comprises bus drivers employed in the urban public transport system employed in various Polish cities, and bus drivers operating on the international routes. Recruitment of patients took place at the 1<sup>st</sup> Department of Cardiology, Medical University of Warsaw, as well as in other places during campaigns organized by the 1<sup>st</sup> Department of Cardiology team, among others, at the premises of transport companies and at public automotive fairs. In each case the participation of the drivers in the study was voluntary. The study included consecutive, unselected drivers that meet the following criteria: giving a written informed consent to participate in the study, age  $\geq 18$  years and current employment as a bus driver in a city transportation system or on international routes. The main exclusion criteria of the study were: a lack of informed consent to participate in the study, concomitant disease with the survival prognosis of  $< 6$  months, receiving a medication with can potentially cause depression. The enrolled subjects were not selected according to the level of education, socio-economic status, lifestyle habits (not related to the profession) or any other socio-demographic parameters.

## Methods of risk assessment

All drivers enrolled into the study, as part of the RACER study protocol, had their history taken and underwent physical examination to determine the prevalence of classical cardiovascular risk factors such as hypertension, obesity or cigarette smoking. Subjects had the anthropometric measurements (height, weight, circumference of the neck, chest, waist and hips) taken, and had blood pressure measurements performed in a manner consistent with the guidelines of the European Society of Cardiology (ESC)

and the European Society of Hypertension (ESH) in order to determine the mean blood pressure levels in the study population [5].

The incidence of depressive disorders was established based on a questionnaire designed for this purpose – Beck Depression Inventory II (BDI-II) [6]. BDI-II consists of 21 questions aiming to evaluate the incidence of subjective symptoms of depression. Questions are evaluated on a point scale, with the maximum of 63 points suggesting a very strong probability of depression, while 0 shows the lack of subjective symptoms of depression. Both high sensitivity and specificity of the scale were extensively described in the literature, confirming the value of the BDI-II in the diagnosis of mood disorders [6]. All enrolled drivers completed the BDI-II in calm conditions, adapted to the situation, which ensured comfort and discretion. The filled questionnaires were scored by researchers assuring the anonymity of subjects' data.

Another parameter analyzed in the study was the stress associated with drivers' profession and its impact on the incidence of depressive disorders. In order to determine if the drivers were asked the question: "Do you find your job stressful?". Expected answer: YES/NO.

### Statistical analysis

Data were tested for normality using the Kolmogorov-Smirnov test. Continuous data are presented as mean and 95% confidence intervals (CI), with statistical comparisons performed with the Mann–Whitney U test or Student's t-test. For categorical variables comparison was made using either the Chi-square test or Fisher exact tests. A *p* value of less than 0.05 was considered statistically significant. All statistical calculations were performed using commercially available SAS statistical software version 9.4 (SAS Institute, Inc., Cary, NC, USA).

### Results

Of the population of the RACER study we selected drivers working as professional bus drivers operating on international routes and those included in the city transport system. The study group consisted of 292 consecutive subjects, of whom 96.6% were male. The average age of enrolled patients was  $48.2 \pm 10.7$  years. Analysis of the prevalence of cardiovascular risk factors revealed that 57 (19.5%) subjects were previously diagnosed with hypertension. Mean systolic blood pressure obtained from measurements taken during the study was  $144.5 \pm 16.3$  mmHg, while diastolic blood pressure was  $87.7 \pm 11.4$  mmHg. Blood pressure values exceeding the threshold of 140/90 mmHg were found in 65.4% of patients. With regard to overweight and obesity the criteria based on body mass index (BMI) were adapted. Overweight ( $BMI > 25$  to  $< 30 \text{ kg/m}^2$ ) was found in 131 (44.9%) drivers, while obesity ( $BMI \geq 30 \text{ kg/m}^2$ ) in 109 (37.3%) subjects. Obesity based on waist circumference ( $> 94$  cm in men and  $> 80$

cm in women) was diagnosed in 70.2% of drivers. Other classical cardiovascular risk factors: diabetes mellitus, smoking, a family history of cardiovascular disease were found in 2.1%, 37.3% and 17.1% of subjects respectively. The mean BDI-II score in the study population was  $4.0 \pm 5.4$  points. In accordance with the principles of assessment, BDI-II values of 0–13 points – were classified as normal; 14–19 – as mild depression symptoms; 20–28 – as moderate depression symptoms and  $\geq 29$  as severe depression symptoms. 5.8% of patients met the criteria for the diagnosis of depression symptoms. The answer to the question “Do you find your job stressful?” was affirmative in 205 (70.2%) of drivers (Table 1).

Table 1. Characteristics of the study population

Study population (n = 292)	
Parameter	n(%) or mean $\pm$ standard deviation
Male sex	282 (96.6%)
Age (years)	$48.2 \pm 10.7$
Previously diagnosed hypertension	57 (19.5%)
SBP (mmHg)	$144.5 \pm 16.3$
DBP (mmHg)	$87.7 \pm 11.4$
Mean blood pressure >140/90 mmHg	191 (65.4%)
BMI (kg/m <sup>2</sup> )	$29.9 \pm 14.0$
Overweight (BMI > 25 to < 30 kg/m <sup>2</sup> )	131 (44.9%)
Obesity (BMI $\geq$ 30 kg/m <sup>2</sup> )	109 (37.3%)
Mean waist circumference (cm)	$102.1 \pm 11.9$
Waist circumference > 94 cm in men, > 80 cm in women	205 (70.2%)
Diagnosed diabetes mellitus	6 (2.1%)
Current smoking	110 (37.3%)
Family history of cardiovascular disease	50 (17.1%)
Mean BDI-II score	$4.0 \pm 5.5$
Depression symptoms	17 (5.8%)
Subjective stress at work	205 (70.2%)

BMI – body mass index; SBP – systolic blood pressure; DBP – diastolic blood pressure; BDI-II – Beck Depression Inventory-II

The entire study group was divided into drivers working in public city bus transport and those operating on the international routes. It has been shown that drivers of international routes had a significantly lower incidence of cardiovascular risk factors. They were significantly younger ( $46.9 \pm 11.2$  vs.  $49.6 \pm 9.0$  years;  $p = 0.008$ ), less likely to have previously diagnosed hypertension (15.7% vs. 27.4%;

$p = 0.03$ ) had lower mean BMI ( $29.7 \pm 16.6$  vs.  $30.4 \pm 4.7$  kg/m<sup>2</sup>;  $p = 0.006$ ) and waist circumference ( $100.1 \pm 11.0$  vs.  $107.2 \pm 12.5$  cm;  $p < 0.0001$ ), and a lower prevalence of obesity (33.0% vs. 46.3%;  $p = 0.04$ ). With respect to other parameters such as blood pressure and the presence of other cardiovascular risk factors, including diabetes and cigarette smoking, there were no statistically significant differences between groups. Interestingly, the drivers of international routes perceived their job as stressful significantly less often than those who were employed in urban public transport (63.5% vs. 84.2%;  $p = 0.0005$ ). Although the depression symptoms were more common in urban bus drivers, this relationship was not found statistically significant (8.4% vs. 4.6%;  $p = 0.39$ ).

After dividing the population into drivers with and without depressive disorders, both populations were analyzed again for the prevalence of cardiovascular risk factors. It was shown that the two groups did not differ significantly in terms of age – the average values in patients without depression were  $48.1 \pm 10.9$  years, while in the group of subjects with depression symptoms it was  $50.4 \pm 8.3$  years. Also differences in the prevalence of classical risk factors such as previously diagnosed hypertension (19.3% vs. 23.5%;  $p = 0.91$ ), smoking, and family history ( $p > 0.05$ ) were not significantly different in the respective groups. Only the lower prevalence of male sex (97.5% vs. 82.4%;  $p = 0.008$ ) and previously diagnosed diabetes was associated with the presence of depression symptoms (1.5% vs. 11.8%;  $p = 0.04$ ). Similarly, the average BMI and systolic and diastolic blood pressure did not differ significantly between the groups ( $p > 0.05$ ). Detailed data on the prevalence of risk factors according to the depression status are shown in Table 2.

**Table 2. Comparison of clinical characteristics of drivers with and without depression symptoms**

Parameter	Drivers without depression symptoms (n = 275)	Drivers with depression symptoms (n = 17)	p
Male sex	268 (97.5%)	14 (82.4%)	0.008
Age (years)	$48.1 \pm 10.9$	$50.4 \pm 8.3$	0.39
Previously diagnosed hypertension	53 (19.3%)	4 (23.5%)	0.91
SBP (mmHg)	$144.6 \pm 16.5$	$142.6 \pm 12.7$	0.62
DBP (mmHg)	$87.7 \pm 11.5$	$87.2 \pm 10.3$	0.91
Mean blood pressure > 140/90 mmHg	179 (65.1%)	12 (70.6%)	0.84
BMI (kg/m <sup>2</sup> )	$29.9 \pm 14.4$	$30.2 \pm 4.0$	0.11
Overweight (BMI > 25 to < 30 kg/m <sup>2</sup> )	125 (45.5%)	6 (35.3%)	0.57
Obesity (BMI $\geq$ 30 kg/m <sup>2</sup> )	99 (36.0%)	10 (58.8%)	0.10
Mean waist circumference (cm)	$102.0 \pm 11.8$	$103.8 \pm 13.2$	0.41
Waist circumference > 94 cm in men, > 80 cm in women	194 (70.5%)	11 (64.7%)	0.81

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Diagnosed diabetes mellitus	4 (1.5%)	2 (11.8%)	0.04
Current smoking	104 (37.8%)	6 (35.3%)	0.96
Family history of cardiovascular disease	47 (17.1%)	3 (17.6%)	0.79
Subjective stress at work	190 (69.1%)	15 (88.2%)	0.27

BMI – body mass index; SBP – systolic blood pressure; DBP – diastolic blood pressure; BDI-II – Beck Depression Inventory-II

An affirmative answer to the question about the work-related stress was given by 88.2% of subjects with depression symptoms, and 69.1% of subjects without symptoms. The relationship between work-related stress and depressive disorders was not statistically significant ( $p = 0.27$ ).

We also performed division into drivers with and without depression symptoms within both groups: urban bus drivers and drivers operating on the international routes. Detailed results of the analysis are presented in Table 3.

**Table 3. Comparison of clinical characteristics of drivers with and without depression symptoms according to the job status**

Parameter	Drivers of the public transportation system			Drivers of the busses traveling on international routes		
	Drivers without depression symptoms (n = 87)	Drivers with depression symptoms (n = 8)	p	Drivers without depression symptoms (n = 188)	Drivers with depression symptoms (n = 9)	p
Male sex	85 (97.7%)	8 (100%)	0.39	183 (97.3%)	6 (66.7%)	0.0002
Age (years)	50.7 ± 9.2	52.7 ± 8.2	0.49	46.9 ± 11.4	48.1 ± 8.4	0.86
Previously diagnosed hypertension	24 (27.6%)	2 (25.0%)	0.80	29 (15.4%)	2 (22.2%)	0.94
SBP (mmHg)	145.2 ± 18.1	145.6 ± 10.7	0.75	144.4 ± 15.8	140.0 ± 14.3	0.33
DBP (mmHg)	88.7 ± 11.9	87.1 ± 9.3	0.84	87.3 ± 11.4	87.3 ± 11.7	0.97
Mean blood pressure > 140/90 mmHg	55 (63.2%)	7 (87.5%)	0.32	124 (66.0%)	5 (55.6%)	0.78
BMI (kg/m <sup>2</sup> )	30.2 ± 4.8	32.1 ± 3.1	0.13	29.8 ± 17.0	28.6 ± 4.1	0.70
Overweight (BMI > 25 to < 30 kg/m <sup>2</sup> )	34 (39.1%)	2 (25.0%)	0.69	91 (48.4%)	4 (44.4%)	0.91
Obesity (BMI ≥ 30 kg/m <sup>2</sup> )	38 (43.7%)	6 (75.0%)	0.18	61 (32.4%)	4 (44.4%)	0.70
Waist circumference (cm)	106.7 ± 12.7	113.0 ± 8.6	0.11	100.2 ± 11.0	97.7 ± 12.3	0.57
Waist circumference > 94 cm in men, > 80 cm in women	63 (72.4%)	6 (75.0%)	0.80	131 (69.7%)	5 (55.6%)	0.60
Diagnosed diabetes mellitus	0 (0.0%)	2 (25.0%)	0.0006	4 (2.1%)	0 (0.0%)	0.44

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Current smoking	28 (32.2%)	3 (37.5%)	0.93	76 (40.4%)	3 (33.3%)	0.94
Family history of cardiovascular disease	22 (25.3%)	2 (25.0%)	0.69	25 (13.3%)	1 (11.1%)	0.75
Subjective stress at work	73 (83.9%)	8 (100%)	0.95	117 (62.2%)	7 (77.8%)	0.28

BMI – body mass index; SBP – systolic blood pressure; DBP – diastolic blood pressure; BDI-II – Beck Depression Inventory-II

### Discussion of the results

Professional drivers are a group particularly vulnerable to cardiovascular disease. This is due to the many factors mutually exacerbating each other. Work of the drivers, including the group of bus drivers of the city transportation system and those traveling on international routes, has a highly negative impact on their overall health [7]. First of all, it is due to the adverse effect of the work environment. Work schedule of the professional drivers rarely is constant, in most cases they work in shifts. Shift work is related to the necessity of working both in the very early hours in the morning, as well as during the night, which disrupts the circadian rhythm, causing disorders of sleep and hormonal dysregulation, including cortisol dysregulation – hormone responsible for the responses to stress [8].

Disturbances of the circadian rhythm of sleep and wakefulness are often associated with depression. Lack of sleep combined with sleepiness during the day, impairs psychomotor skills, cognitive functions and memory, and what is the most important – causes mood disorders [9]. This is due to disturbances in the serotonergic transmission, which is involved in the regulation of sleep and wakefulness. Serotonergic activity is the greatest during the day and minimal during sleep, serotonin production in the brain occurs during REM (rapid eye movement) phase. Circadian rhythm disorders result in increased risk of mood disorders [10].

Other factors that influence the emotional reactions, including depressed mood, and stress is the very nature of the work associated with high responsibility, but also a number of stressors stimuli. The need for constant attention, stress triggers associated with both the traffic, as well as the behavior of the passengers also have a negative impact. Studies show that in the professional drivers work leads to the changes in the central nervous system. Continuous stimulation of the nervous system associated with the need to focus attention and visual activation caused for example by the lights of other vehicles or traffic lights, causes an on-going cortical activation and hyperreactivity of the cardiovascular system. [11]

Working as a professional driver requires specific psychological predispositions, ability to work under pressure, to adapt to irregular schedule and a low sense of au-

tonomy and independence [12]. Unfortunately, the European rules of occupational medicine examination necessary to qualify for the profession do not include a thorough psychological evaluation. This is a major breach of the healthcare system, not only due to the factors described above, but also in terms of the results of a few – but very important epidemiological studies. Observations relating to train drivers included in the public transport system in Belgium have been published recently [13]. During a routine screening on fundamental cognitive and attention skills, it has been shown that as many as one in 10 drivers requires an extensive psychological work up. Based on further testing, it was found that 1.5% of the study group were unable to continue working. The most common causes of this phenomenon included: sleep disturbances, intolerance of irregular working hours, psychosocial stress and depressive disorders. As described in the present study, drivers had unusually high incidence of work-related stress. The profession was considered stressful by 70.2% of drivers (84.2% in the group of urban bus drivers) it is a huge percentage showing how big of a problem in these subjects is constant emotional tension. Earlier studies have shown that people who consider their work stressful not only are less effective during work, but require a longer rest period before taking another activity after they get home. Moreover, in a study conducted in the population of professional truck drivers, it was observed that the change of their profession for any other than driving was associated with a reduction of perceived work-related stress [14]. However, at present the exact numbers showing the incidence of depression and work-related stress in the professional drivers are not known.

Working as a professional driver is also associated with the risk of somatic diseases – hypertension, dyslipidemia, diabetes mellitus, cancer, obstructive sleep apnea, vascular disease and gastro-intestinal tract diseases, which translate into a worse general health status of the drivers, resulting in an increased risk of traffic accidents and making the work of professional drivers even more dangerous [11]. All of these factors, as well as age, male gender or family history result in an increased cardiovascular risk in the group of professional drivers. Cardiovascular disease is now the leading cause of death in Europe, accounting for 42% of total deaths in men and 51% in women [15]. The highest death rate is attributable to coronary artery disease (including myocardial infarction) and strokes. Significant percentage of this disease can be avoided by proper control of the risk factors. This fact was confirmed by epidemiological studies. In recent years a decline in the total number of deaths from coronary artery disease has been observed. It can be assumed that this was due to better access to invasive treatment and improvement in pharmacotherapy. However, it is not true. The observed decrease in the total number of deaths, in as many as 54% was attributable to the positive change in the control of risk factors [16].

In the present study, differences were observed between the two subgroups of drivers (city transportation and international routes). The observed differences were

associated with a number of factors, primarily different demographics. Work of drivers operating on the longer international routes requires long journeys, sometimes associated with long reside outside the home. Therefore this kind of work requires from the drivers greater physical fitness and better preparation for difficult working conditions, which is why the drivers operating on these routes are significantly younger, which translates into a lower average body mass index, waist circumference, as well as less frequent previous diagnosis of hypertension. Interestingly, international drivers also define their work as less stressful, perhaps due to the different specifics of traffic in the city and on long routes. Although the incidence of depression symptoms in the group of urban bus drivers was higher, the results were not proved to be statistically significant.

Depression is one of the major risk factors for diseases of the cardiovascular system. Epidemiological studies show that the incidence of depression causes a 2-fold increase in the risk of developing cardiovascular disease *de novo* [3]. The INTERHEART study showed that four strongest predictors of development of acute coronary syndrome were the lipids levels, smoking, psychosocial factors (mainly depression and stress) and lastly diabetes mellitus [17]. Also, studies conducted in the Polish population have shown that there is a significant relationship between depression and coronary artery disease [18]. Also in patients with a diagnosed cardiovascular disease incidence of depression is high. Criteria for the diagnosis are met by about 15% of patients with acute coronary syndrome and up to 40% of patients with advanced heart failure [19, 20]. Depression, along with other psychological factors such as personality disorders, coping with stress, subjectively perceived quality of life or psychogenic sexual disorders, is now becoming one of the most important elements in the process of diagnosis and treatment of patients at high cardiovascular risk, including professional drivers [21–23]. The American Heart Association has recently issued a document which was the first to officially define the depression as a cardiovascular risk factor, and to draw attention to the necessity of its extensive diagnostics and treatment [24].

Nevertheless, the mechanisms that link the two diseases are not clear. It seems that the disorders of the autonomic nervous system, function of platelets, coagulation factors, inflammatory markers, cytokines, endothelial function markers, neurohormones or genetic predisposition play an important role in the occurrence of both diseases [4]. Depression contributes negatively to the overall cardiovascular risk in this group of drivers who are exposed to elevated baseline cardiovascular risk due to the nature of the work. Although, basing on its occurrence we cannot determine the frequency of other classical risk factors in this population [25, 26].

Although we will probably never manage to establish a single link between depressive disorders and cardiovascular diseases, one should be aware that, at present, these two groups of diseases are the most common causes of disability in developed countries and it is estimated that by the year 2030 they will also be the most common causes of disability in all countries, regardless of their income [27].

## Conclusions

The present study is the first large-scale epidemiological study focusing on the prevalence of depression in professional drivers. In professional drivers prevalence of depression symptoms and work-related stress is relatively high. There are no clinical factors predictive of high risk for depressive disorders development. There was also no significant association between stress and the occurrence of depression symptoms. This along with cardiovascular risk associated with depression is a reason for routine, psychological screening of professional drivers. This study draws attention to the important problem of inadequate diagnosis of mood disorders in a group of professional drivers, becoming a stimulus to consider whether the existing rules on assessing the eligibility of potential candidates for professional drivers have been developed in an appropriate manner.

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