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Assessment and Relationship of Work Ability and the Level of Physical Activity Among Professional Bus Drivers

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ABSTRACT

Numerous studies have shown that city bus drivers suffer from three key categories of health disorders: cardiovascular diseases, gastrointestinal disorders and musculoskeletal system issues, affecting the individual's ability to work. The aim of this research was to assess the working ability of bus drivers and to determine the connection between the level of physical activity and the work ability in professional bus drivers. The study protocol included an assessment of participants' work ability using the Work Ability Index (WAI) Questionnaire on a sample of 115 bus drivers. A statistical analysis was performed using the SAS System software package (SAS Institute Inc., North Carolina, USA). The questionnaire for determining the work ability index indicated good or excellent work ability in 78 (67.8%) of bus drivers. Moderate work ability that needed to be improved was recorded in 27 (23.5%) of drivers, and poor work ability that needed to be restored in 10 (8.7%). The results of the regression analysis show that increasing the average number of steps per day by a 1,000 increases the WAI score by 0.8. The obtained data should serve as an important argument for the design of future public health and kinesiology interventions to improve the work ability in professional bus drivers.

KEYWORDS

work ability index; driver's workplace; physical activity

1. INTRODUCTION AND LITERATURE REVIEW

Transport of goods and passengers is an extremely important economic branch, and the profession of a driver and their work ability have become the subject of many studies across the world. As early as 40 years ago, Backman [1] established three key categories of health disorders among bus drivers, namely: cardiovascular diseases, gastrointestinal disorders and musculoskeletal system issues, affecting the individual's ability to work.

The authors in [2] state that the driver's workplace leads to health impairment, as it includes a small and narrow work space with minimal and repetitive movements. Additional mental and physical effort is represented by constant exposure to noise, vibrations and shift and night work. Research related to the possible impact of health on an individual's ability to work is the subject of numerous studies today, because preserving work ability has become a social interest. It is stated that the promotion of working ability results in a better health condition, which can directly affect the quality of life [3].

According to the definition, work ability refers to the individual ability of workers to efficiently perform their work, taking into account specific work requirements, health ability and psychological capabilities of workers [4]. That is why experts around the world use work ability as a tool to promote health and prevent diseases and injuries [5], which eventually leads to increased safety of all road users.

In their research aimed at finding factors that directly lead to reduced work ability [6], the authors stated that age, obesity, physical work, smoking and various diseases can cause long-term sick leaves (longer than 12

weeks), loss of workplace and earlier retirement, and that the need to restore work ability is important for the individual and society.

It should certainly be taken into account that work ability changes during a person's working life. The authors in [7] showed that work ability decreases with aging and the decline of psychophysical characteristics, and the time required to receive information, process it, decide on a reaction and perform an action at the workplace increases.

As work ability and the psychophysical status have a significant impact on the work and life of individuals, the need arises to examine the factors that can contribute to improved work ability of professional drivers throughout their working life. Physical activity is mentioned in some studies as one of the factors supporting and restoring work ability, while some studies refute this thesis.

The authors in [8] and [9] proved that those employees who stated that they were involved in some form of physical activity also had higher health levels. Also, several studies have shown that insufficient physical activity can lead to impairment of individual's health with reduced work performance, which ultimately leads to an increase in the risk of long-term illness and early retirement due to disability [10–12].

Previous studies have shown a strong positive association between low levels of physical activity and poor WAI [13]. A study conducted on middle-aged employed persons in physically demanding jobs revealed a connection between physical activity and better work ability [14].

Although physical activity is mentioned as a prevention measure, the authors in [15] conducted an extensive literature search on the level of health and work ability in which physical activity was the dependent variable. They applied logistic regression analysis on a group of 2,030 respondents, with the aim of assessing the connection between different occupations, physical activity and health. Out of a total of 39 observed studies, only some showed a correlation between physical activity, level of health and work ability. In the end, the authors concluded that further research is needed regarding physical activities, health and work ability.

There is a question of which physical activity program and in what volume it can contribute to the impact on health and work ability. Until now, many studies that compared the relationship between physical activity and work ability focused on examining physical activity through questionnaires that provided simple statements on whether an individual was engaged in physical activity or not. Physical activity is not only running, football, swimming, but, according to the World Health Organization, it includes all movements in everyday life, such as in work, recreation and sports, and is categorised according to intensity level from low and moderate to strong or high intensity [16]. Therefore, it is necessary to investigate whether there is a connection between the daily level of physical activity and work ability.

The data on necessary levels of daily movement, which takes place by walking or running for the purpose of improving and preserving health for certain age groups, are presented in the review study [17]. The authors indicate that healthy adults usually take between 4,000 and 18,000 steps per day, and that for the age group of 20–64 years the optimal number of steps to maintain health is between 7,500 and 8,500, while noting that a greater number of steps than shown is always more effective for health.

In the study [18], the level of physical activity among professional bus drivers was measured using a pedometer, an objective measure for determining the level of physical activity, which recorded the number of steps they took during the entire measurement period. The results showed that the average number of steps per day was 5,091, while the maximum number of steps was 18,331.3, and the minimum was 965.0. This is still below the recommended level, which is 7,000–8,500 steps for the population between 20 and 65 years of age [17].

Research is needed to answer whether a certain level of physical activity through walking or running can be one of the factors for establishing, maintaining or retaining the work ability of professional bus drivers.

This research provides an overview of the work ability of professional bus drivers.

The entire work is organised as follows: the first section consists of an introduction and review of literature; Section 2 presents the data collection procedure; Section 3 covers the research results, and the last section presents possible explanations and a conclusion.

2. METHODOLOGY

This cross-sectional study was conducted with a sample of professional bus drivers, employees of the Zagreb Electrical Tram (ZET), a public city transportation service of the Croatian capital. For the purpose of the assessment of work ability in this research, the Work Ability Index Questionnaire was used.

1.1 Participants

The study included male drivers with a minimum of 15 years of bus driving experience at ZET, excluding those under 40 or over 55 years of age. All drivers were permanent employees and capable of performing the bus driver job. The participants of the study were selected by systemic random selection. Each bus driver was equally likely to be selected if they met the predefined research criteria: male bus drivers between 40 and 55 years of age, with a minimum of 15 years of bus driving experience. Using an internal list of all the drivers who were eligible for sampling, every third was selected. From a total of 400 bus drivers, by selecting every third one, 120 respondents were obtained. The analysis was performed on data collected from 115 bus drivers. All the respondents signed an informed consent, participated in the research voluntarily and anonymously, and they could withdraw from the survey at any time. All the participants in this research were selected through systemic random selection.

1.2 Procedures

In this research, the Work Ability Index Questionnaire (further in the text: WAI questionnaire) was used to assess the work ability. The WAI questionnaire is widely used in different countries of the world to determine various risk factors that can lead to a decrease in work ability. Based on the obtained results of the WAI questionnaire, it is possible to remove or reduce the effect of risk factors with appropriate activities in later interventions [19].

To assess the work ability, WAI values are grouped into the following four categories: excellent work ability (need to maintain work ability), good work ability (need to support work ability), moderate work ability (need to improve work ability) and poor work ability (it is necessary to restore working ability).

1.3 Statistical analysis

Due to the nature of WAI data (i.e. summated scale scores) and following similar research [20], the linear regression model was considered appropriate for data analysis. Regression analysis for the WAI index estimation was performed on the original values of WAI variable since Box-Cox test [21] did not indicate the need or the suitability of performing the logarithmic transformation. The normality of the distribution of the residual of the regression model was tested with the Kolmogorov-Smirnov test ($p>0.150$) accompanied by the measures of skewness (-1.029) and kurtosis (2.064).

The suitability of the model was analysed using the coefficient of determination (R2). The coefficient of determination (R2) explains the share of the variance of the dependent variable explained by the independent variables. When calculating, the corrected coefficient of determination, the number of independent variables in the model was also taken into account.

Table 1 – Box-Cox test results

LAMBDA	LOGLIK	RMSE	AIC	SBC
1.00	-384.96	47.26	781.92	798.39
0.75	-389.25	47.30	790.49	806.96
0.50	-394.80	47.45	801.60	818.07
0.25	-401.88	47.68	815.75	832.22
0.00	-410.74	48.02	833.48	849.95

LOGLIK = log likelihood; RMSE = root mean square error, AIC = Akaike information criterion; SBC = Schwarz information criterion

P-values lower than or equal to 0.05 were considered statistically significant. Statistical analysis was performed using the SAS System software package (SAS Institute Inc., North Carolina, USA).

3. RESULTS

The WAI value for each subject was calculated as the aggregate value of the answers to the questions in the questionnaire, as follows: W1: credits correspond to a rounded number, W2: credits correspond to a rounded number (when evaluating combined physical and mental work), W3: credits correspond to a rounded number (in evaluating combined physical and mental work), W4: add up the number of diseases diagnosed by a doctor, W5: credits correspond to the rounded number or the mean value of two answers (in case of multiple answers), W6: credits correspond to a rounded number, W7: credits correspond to a rounded number, W8, W9 and W10: the credits from all three questions are added up. The scores of all responses are summed to obtain a WAI score for an individual respondent [22].

The majority of drivers rated their current work ability as good. One quarter of the respondents rated their current work ability with grade 7.0 or higher (with a maximum score of 10.0 indicating the best possible work ability) (*Table 2*: column Q1). They generally rated their current work ability as good in relation to the physical and psychological demands of the job. Most often they had no problems with performing the usual daily activities (81.7% could often or quite often perform usual daily activities), and most were (quite) often active and attentive (78.3%). Most of them were constantly or quite often full of hope for the future (80.0%).

Illnesses did not disturb most of the drivers, 60 of them, i.e. 52.2%, in performing the work or they were not ill, whereas 35 drivers (30.4%) were capable of working, but work caused them some symptoms (*Table 3*).

Table 2 – Self-assessment of work ability

Variable			SD	Med	Q1	Q3	Min	Max
W1	Work ability (WA) [a]	8.1	2.2	8.0	7.0	10.0	0.0	10.0
W2	WA acc. to physical requirements [b]	4.1	0.9	4.0	4.0	5.0	1.0	5.0
W3	WA acc. to mental requirements [b]	4.1	0.9	4.0	4.0	5.0	1.0	5.0
W8	Usual activities ok [c]	3.2	0.9	3.0	3.0	4.0	1.0	4.0
W9	Full of attention [c]	3.1	0.8	3.0	3.0	4.0	1.0	4.0
W10	Full of hope [c]	3.2	0.8	3.0	3.0	4.0	1.0	4.0

[a] Measured on a scale from 0="Currently incapable of working" to 10="Best possible work ability",
[b] Measured on a scale from 1="Very poor" to 10="Very good", [c] Measured on a scale from 0="Never" to 4="Often"

Table 3 – Disease and work ability

Variable		*n*	%
W5 Illness disturbs in job	Does not disturb / I am not sick	60	52.2
	I am capable of doing my job, but it causes some symptoms	35	30.4
	I must sometimes slow down the work, or change the work methods	14	12.2
	I must often slow down the work or change the work method	5	4.4
	Due to my illness, I feel that I am capable of working only for half the working time	-	-
	In my opinion, I am completely incapable for work	1	0.9
W6 Days of absence from work (in the previous year)	None	43	37.4
	Maximum 9 days	26	22.6
	10–24 days	33	28.7
	25–99 days	8	7.0
	100–365 days	5	4.4
W7 Work ability in 2 years	It is unlikely that I will be capable of doing my current job	3	2.6
	I am not sure that I will be capable of performing my current job	38	33.0
	I am relatively sure that I will be capable of performing my current job	74	64.4

Table 4 – Diagnosed current diseases (W4)

Variable		*N*	%
Injuries due to accident	Back	24	20.9
	Hand/fist	9	7.8
	Leg/foot	12	10.4
	Other body part	11	9.6
Diseases of the musculoskeletal system	Difficulties of the upper back or cervical spine, recurring pain	39	33.9
	Lower back difficulties, recurring pain	60	52.2
	Pulsating pain from the back into the leg	22	19.1
	Musculoskeletal disorder affecting the limbs (hands, feet), recurring pain	12	10.4
	Rheumatoid arthritis	6	5.2
	Other musculoskeletal disorders	22	19.1
Diseases of the heart and circulatory system	High blood pressure	29	25.2
	Coronary heart diseases, chest pain during exercise (*angina pectoris*)	3	2.6
	Coronary thrombosis, heart attack	0	0.0
	Heart failure	0	0.0
	Other diseases of heart and blood vessels	7	6.1
Diseases of the respiratory system	Repeated inflammation of the respiratory tract (tonsillitis, acute sinusitis, acute bronchitis)	12	10.4
	Chronic bronchitis	1	0.9
	Chronic inflammation of the sinuses	7	6.1
	Bronchial asthma	2	1.7
	Emphysema	0	0.0
	Pulmonary tuberculosis	0	0.0
	Other diseases of the respiratory system	3	2.6
Mental disorders	Mental illness or serious mental health problem (severe depression, mental disorder)	0	0.0
	Milder psychological disorder or problem (milder depression, tension, anxiety, insomnia)	10	8.7
Neurological and sensory diseases	Hearing problems or injury	10	8.7
	Eye disease or injury (except myopia, farsightedness, and astigmatism)	7	6.1
	Neurological disease (stroke, neuralgia, migraine, epilepsy)	0	0.0
	Other neurological or sensory diseases	2	1.7
Diseases of the digestive system	Gallstone or bile diseases	1	0.9
	Diseases of the liver or pancreas	3	2.6
	Stomach or duodenal ulcer	0	0.0
	Gastritis or inflammation of the duodenum or intestine	7	6.1
	Colon inflammation, colitis	2	1.7
	Other diseases of the digestive system	8	7.0
Diseases of the urinary system	Urinary tract inflammation	6	5.2
	Kidney diseases	5	4.4
	Genital diseases (inflammation of fallopian tube in women or prostate in men)	2	1.7
	Other diseases of the urinary system	4	3.5
Skin diseases	Allergic rash / eczema	6	5.2
	Other rash, which?	2	1.7
	Other skin diseases, which?	2	1.7
Tumours	Benign tumour	2	1.7
	Malignant tumour (cancer), where?	0	0.0
Endocrine diseases and metabolic diseases	Obesity	16	13.9
	Diabetes	2	1.8
	Goitre or other thyroid diseases	1	0.9
	Other endocrine or metabolic diseases	5	4.4
Blood diseases and other diseases	Anaemia	1	0.9
	Other blood disorders	0	0.0
	Birth defect	0	0.0
	Other disorders and diseases	0	0.0

There are 19 (16.6%) of them who sometimes or often had to slow down their working tempo or change their work methods due to an illness. Somewhat more than a third (43 drivers, i.e. 37.4%) had not been absent from work due to health problems in the previous year, and 59 drivers (51.3%) had been absent from work for 24 days or less. Most of the drivers (74 of them, i.e. 64.4%) were relatively sure that they would be able to perform their current job in two years, every third (38 drivers) was not sure, and three (3%) considered this unlikely.

Current diseases diagnosed by the competent physicians point to issues in the lower back, representing the primary disease in 60 (52.2 %) bus drivers (*Table 4*). Every third driver (a total of 39), had issues in the upper back or cervical spine, and 29 (25.2%) drivers had high blood pressure issues. There are 24 (20.9%) drivers who hurt their backs in accidents. A pulsating ache from the back into a leg was present in 22 (19.1%) drivers, and 16 (13.9%) had obesity issues. Only one diagnosed disease was present in 28 drivers (24.4%), nineteen (16.5%) suffered from two diagnosed diseases, 15 (13.0%) drivers had three, 24 (20.9%) four, while 29 (25.2%) drivers suffered from 5 and more diagnosed diseases.

The WAI questionnaire indicated good or excellent work ability in 78 (67.8%) bus drivers (*Table 5*). Moderate work ability that needed to be improved was recorded in 27 (23.5%) drivers, and poor work ability that needed to be restored in 10 (8.7%).

The average number of steps per day, driver's age and number of children are significantly related to the work ability measured by the WAI questionnaire. The influence of other socio-demographic variables was not significant, so they were excluded from the model. An increase in the average number of steps per day by 1000 increases the WAI result by 0.8 on average (with other variables included in the model being constant), which means that the level of physical activity is positively related to the work ability of professional bus drivers. A negative relation was found between the work ability and the driver's age or the number of children. Increasing driver's age by one year leads to a reduction of WAI results by 0.4 on average, while an increase in the number of children leads to a reduction of the WAI index by 1.2. Using independent variables, i.e. average number of daily steps, driver's age and the number of children, explained 25% of the total variance at the level of work ability measured by the WAI questionnaire (i.e. 23% according to the corrected coefficient of determination R^2) (*Table 6*).

Table 5 – Distribution of categorized WAI index values

Work ability	Work ability index	*N*	%
Poor	WAI<28	10	8.7
Moderate	28≤WAI≤36	27	23.5
Good	37≤WAI≤43	52	45.2
Excellent	WAI>43	26	22.6

Table 6 – Regression model of relation between the work ability and the level of physical activity

Variable	Coefficient	Standard error	p-value	Tolerance	Inflation of variance
Constant	54.570	5.471	< 0.001	.	.
Number of daily steps (in 000)	0.835	0.211	< 0.001	0.999	1.001
Driver's age	-0.399	0.116	0.001	0.947	1.056
Number of children	-1.182	0.585	0.046	0.946	1.057

R2 = 0.251; Corrected R2 = 0.230

4. DISCUSSION

This research has shown that lower back issues represent the primary disease, diagnosed in 52.2% of bus drivers. In the category of heart and circulatory system diseases, the most common was high blood pressure, which was diagnosed in 25.2% of drivers. The endocrine and metabolic disease category was somewhat less

represented, with the primary disease being obesity, namely in 13.9% of bus drivers. Furthermore, 10.4% of bus drivers in the category of respiratory diseases had the most difficulties with recurring inflammations of respiratory paths, whereas 8.7% of bus drivers were diagnosed with milder depression, tension, anxiety and insomnia. Hearing difficulties were present in 8.7%, and diseases or injuries of vision in 6.1%. These results are consistent with the studies that were performed almost 40 years ago, where even then attention was drawn to the most frequent health problems of bus drivers: cardiovascular diseases, gastrointestinal disorders and problems of the musculoskeletal system [1].

This research, however, indicates that some psychical diseases occur in bus drivers as well. A diagnosed milder depression, tension, anxiety and insomnia were recorded in 8.3% of bus drivers (*Table 4*), taking into consideration that professional bus driver workplace is very stressful and could lead to not only physical but also mental diseases that need to be remedied in their earliest stage. Other studies also emphasise that it is precisely the stress, long-term sitting and overtime work that can permanently damage the physical and mental health, causing a lower work ability index in bus drivers [23–25].

The results of this research indicate good or excellent work ability in 67.8% of bus drivers, whereas moderate or poor work ability that needs to be improved or restored was recorded in as many as 32.2% of bus drivers. It can be concluded that drivers from 40 to 55 years of age, with a minimum working experience of 15 years, have this type of work ability.

The fact that 32.2% bus drivers needed interventions to improve their work ability could be explained by their musculoskeletal disorders. Vibrations, ergonomic body postures and working conditions are some of the causes of back pain. The authors in [25] and [26] agree with this, demonstrating in their studies that musculoskeletal diseases are one of the factors that affect the work ability and pointing to the importance of promoting health among bus drivers, especially in terms of musculoskeletal health.

Considering the connection between work ability and the level of physical activity, the results have shown that the level of physical activity is positively related to the work ability of professional bus drivers. These results are consistent with the results of some studies which report that physical activity contributes to better health and greater work ability [27].

However, the results of this research indicate an even more important fact – that the increase in the average number of steps per day by 1000 increases the WAI results by 0.8 on average. It is precisely these results that indicate the volume of physical activity and the extent to which it can contribute to increase in work ability results, which had not been previously studied.

This study used the results of physical activity determined using objective pedometer measurement. This allowed us to avoid subjective assessment on physical activity level, which is one of the advantages of this research.

This research has a limitation that needs to be taken into consideration in generalising the results.

Every eligible respondent had an equal opportunity to participate in the survey, with the eligibility criteria being male gender, at least 15 years in service and age between 40 and 55 years. Since only male bus drivers participated in this study, and female persons also perform these jobs, future research should include professional female bus drivers.

5. CONCLUSIONS

Taking into consideration the results of this research, it is first of all necessary to develop a good strategy for promoting physical activity among bus drivers as one of the possible factors of improving work ability. It is also important to emphasise that the main intervention program should be oriented to musculoskeletal and cardio-vascular health, as these were the categories with the most frequently diagnosed diseases. It is also of crucial importance to focus the intervention programs on mental health, which will primarily lead to a reduction in the level of stress at the workplace.

The development of kinesiology and public health programs that will be aimed at educating bus drivers on proper upper body posture while driving and increasing the level of their physical activity in the form of walking and other kinesiology activities should be the basic guideline for maintaining and restoring work ability.

By introducing such strategies, we can greatly contribute to the preservation of the psychophysical health of younger generations of drivers who are yet to come, and also extend the work ability of experienced drivers.

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Procjena i povezanost radne sposobnosti s razinom tjelesne aktivnosti kod profesionalnih vozača autobusa

Sažetak

Brojna istraživanja pokazala su da vozači gradskih autobusa imaju tri ključne kategorije poremećaja zdravlja i to: kardiovaskularne bolesti, gastrointestinalne poremećaje i probleme mišićno-koštanog sustava koje utječu na radnu sposobnost pojedinca. Cilj ovog istraživanja bio je procijeniti radnu sposobnost vozača autobusa te utvrditi povezanost razine tjelesne aktivnosti i radne sposobnosti kod profesionalnih vozača autobusa. Protokol studije uključivao je procjenu radne sposobnosti sudionika pomoću Upitnika za određivanje indeksa radne sposobnosti (WAI) na uzorku od 115 vozača autobusa. Statistička analiza provedena je pomoću programskog paketa SAS System (SAS Institute Inc., Sjeverna Karolina, SAD). Upitnik za određivanje indeksa radne sposobnosti (WAI), ukazao je na dobru ili odličnu radnu sposobnost kod 78 (67.8 %) vozača autobusa. Umjerena radna sposobnost koju je potrebno poboljšati zabilježena je kod 27 (23.5 %) vozača, a loša radna sposobnost koju je potrebno ponovno uspostaviti kod njih 10 (8.7 %). Rezultati regresijske analize pokazuju da povećanje prosječnog broja koraka u danu za 1000 u prosjeku povećava WAI rezultat za 0.8. Dobiveni podaci trebali bi poslužiti kao važan argument za osmišljavanje budućih javnozdravstvenih i kinezioloških intervencija za poboljšanje radne sposobnosti kod profesionalnih vozača autobusa.

Ključne riječi

indeks radne sposobnosti; radno mjesto vozača; tjelesna aktivnost.