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## Research Article

# Occupational Risk Factors for Arterial Hypertension in Workers of High Speed Railway Line in Italy

## Summary

Few studies have examined the professional risk factors for hypertension, especially in relation to aging of work force. This paper shows which working risk factors represent a major risk factor for arterial hypertension in workers, who work in the construction of the railway line "TAV" (High-speed trains) for the connection between Italy and France.

A population of workers TAV were examined by questionnaires survey Estev, validated in France. Arterial pressure, obtained after about 30 minutes after the end of the work, was measured in clinostatic position, measuring it three times and using the average value obtained. Subjects considered high-blood pressure sufferers presented values of systolic arterial pressure higher than 140 mmHg, and/or a diastolic pressure equal or higher than 90 mmHg, following the criteria indicated by the WHO.

The champion of workers were all male. In more of the half of sample was found high blood pressure. The data analysis showed the highest prevalence of hypertension in the drivers of heavy vehicles. The job that requires prolonged attention was resulted the main occupational risk factor associated with hypertension.

The excess of risk for the over 45 year olds requires corrective interventions of an organizational nature, like for example the alternation of heavier tasks and/or the increase of work breaks, to allow older workers to dilute the amount of work load and reduce the chances of arterial hypertension risk and more in general of risks for the cardiovascular system.

## Introduction

Arterial hypertension is a multicausal disorder [1]. The identification of risk factors is an important task for their prevention and treatment [2]. Few studies have analyzed the relationships between high blood pressure and the level of job strain [3,4]. Some authors have shown that the pressure was only raised if the person's job was characterized by both high demands and low control [5]. This situation becomes even more serious in relation to the aging workforce [6]. However, some work conditions are associated to a risk of developing arterial hypertension independently from age [7,8]. A higher frequency of arterial hypertension has been described in relation to labor factors such as greater antiquity at work [9], time at work -hours in a week (long working hours) [10], psychological stress, and shift work [11].

It was also examined the effect due to work organizational constrictions, especially for prolonged work and risk of acute coronary disease [12].

What are the specific tasks they are implicated in the incidence of high blood pressure are not well understood, especially in their additive factor associated with lifestyle.

The aims of our study was investigated a sample of workers involved in the construction of the railway line TAV (in the Tuscany Region), in order to analyzed which of occupational risk factors are associated with hypertension, because arterial hypertension is considered a very important risk factor for the development of cardio and cerebral-vascular pathologies [13].

## Methods

A champion of TAV workers was investigated by a anonymous questionnaires of ESTEV methodology [14], validated in Italy [15]. We used: a questionnaire on the professional conditions of the workers (to describe the characteristics and constraints of work by categorical variables), a questionnaire on lifestyle and medical questionnaire for the collection of data about the objective health conditions of the workers, in particular the

diseases which were prevalent. The questionnaires were filled in at the end of the work shift, during medical examination.

We considered hypertensive workers all subjects with systolic blood pressure (SBP) values greater than or equal to 140 mmHg, and/or a diastolic blood pressure (DBP) greater than or equal to 90 mmHg, in accordance with guidelines of European Cardiology Association [16]. We also considered hypertensive those who are being treated with antihypertensive drugs, but have normal blood pressure. In accordance with Clinical practice guidelines, blood pressure measurement was taken in the sitting position and reported the average value of 3 measurements. There have been no blood tests (eg. diabetes frequency, hypercholesterolemia, metabolic syndrome, etc.).

In this paper we present the data on working risk factors for arterial hypertension. The data elaboration was conducted by software STATA. Statistical methods used: *Mantel-Haenszel Chi-Square Test* and a the multivariate analysis by *logistic regression*, to determine the strength of the association of risk factors with the presence of arterial hypertension.

## Results

During the construction of the TAV railway line, in the Tuscany region, we examined a sample of 257 workers, all men. The majority of them held the carpenters/welders job (41%), machinery and excavators driver represented 27% of the sample, the Metalworkers and Miners represented the 6% of the sample. The remaining percentage is busy in other activities (eg. Employees, Electricians, Managers, etc). The average age of the workers corresponds to 45 years (DS±8).

About lifestyle, the majority of the workers (71%) doesn't play any sport, only 28% does occasionally physical activity, the 46% of the sample smokes habitually, half of the workers drinks alcohol (49%) with 30% who declares to drink super alcoholics.

The time spent at work is on average 48 hours per week (range 35-70), however 2/3 of the sample (77%) works more than 48 hours a week.

The prevalent pathological condition has resulted as being arterial hypertension, which was found in more than half of the employees, exactly 54% of them.

In Table 1 is possible to see the prevalence of the arterial hypertension in the main professions examined.

The highest prevalence of hypertension was observed in workers driving of heavy vehicles (eg. excavators, cranes, big trucks), more than 2/3 of these workers shows high levels of blood pressure, with statistical significance  $P < 0.05$  *Chi Square Test*.

Furthermore, the hypertension was detected in more than half carpenters/welders and managers (Table 1).

We observed an increase in high blood pressure in relation to aging workers: employees with more than 45 years show a higher risk of arterial hypertension (OR 3.38, CI 95% 2.02-

5.66).

A condition of obesity represents a significant risk factor for hypertension [13], in the sample of workers investigated the value of BMI higher than 25, with a risk estimate nearly triple than those with BMI <25 (OR 2.88, CI 95% 1.7-4.89).

In the Table 2 we present the description of the work risk factors that are statistically significant in the Mantel-Haenszel Test. The data presented in Table 2 show a high significant association in job variables that require: *prolonged attention and concentration* (OR 4.82, CI 1.7-13.4), *shift work* (OR 2.78, CI 1.55-5.0), *irregular sleep* (OR 2.76, CI 1.6-4.8), *irregular eating* (OR 2.62, CI 1.5-4.6), *night shifts* (OR 2.55, CI 1.5-4.5), *cannot detach the eyes from work* (OR 2.5, CI 1.4-4.6), *strain on equipment* (OR 2.46, CI 1.4-4.3), *working under time pressure* (OR 2.16, CI 1.2-3.7).

In relation to the variables that have showed higher

**Table 1:** Prevalence of arterial hypertension Chi Square Test.

PROFESSIONS	N. Workers	Hypertension %	P pearson
Metalworker	17	29	0.04*
Miner	16	56	0.86
Carpenter/welders	106	56	0.67
Machinery and excavators driver	70	67	0.01*
Employee	15	13	0.00*
Warehouse worker	10	40	0.36
Electrician	9	56	0.92
Manager	14	64	0.43

\* P <0.05

**Table 2:** Analysis between arterial hypertension and professional risk factors (Mantel-Haenszel Test).

	OR	CI 95%
Works > 46 Hours/Week	2.04	1.24-3.37
Shift work	2.78	1.55-5.0
Night shifts	2.55	1.45-4.48
Strain on equipment	2.46	1.40-4.32
Exposed to loud noise	2.21	1.18-4.13
Exposed to high temperatures	1.93	1.11-3.36
Exposed to weather conditions	1.28	0.67-2.45
Exposed to dusts and/or smoke	1.51	0.79-2.91
Exposed to a chemical compounds	1.98	1.15-3.42
Working under time pressure	2.16	1.24-3.74
Having to do more things simultaneously	1.98	1.15-3.42
Interrupted during work	1.54	0.86-2.76
Work requires prolonged attention and concentration	4.82	1.73-13.43
Cannot detach the eyes from work	2.50	1.35-4.64
Required to maintain balance during dangerous situations	1.99	1.15-3.45
Often works Saturdays and Sundays	2.32	1.34-4.01
Has to sleep in irregular patterns due to job	2.76	1.60-4.76
Has to eat in irregular patterns due to job	2.62	1.50-4.56

statistical significance in the associations carried out, we proceeded to estimate the risks through multivariate analysis, by logistic regression.

The multivariate analysis is presented in Table 3. The data, adjusted for the age variable, showed a statistically significant risk for some of the variables examined, particularly for what concerns work that requires a *prolonged attention and concentration* (OR 3.71, CI 95% 1.3–10.7).

The risk of high blood pressure is associated also to *shift work* (OR 2.47), *sleeping in irregular patterns* (OR 2.33), *night shifts* (OR 2.24), *eating irregularly* (OR 2.18), *work that requires high attention* (OR 2.0), to *work more than 46 hours/week* (OR 1.96).

## Conclusion

In our sample of worker men, we observed high levels of hypertension prevalence, both in workers performing manual work or highly technological manual jobs, both in managers.

The work situations that require high attention, concentration and precision can cause stress conditions and the prolonged exposure over the years can lead to the condition of hypertension. Also carrying out several tasks simultaneously, eating or sleeping at irregular produce negative effects on the cardiovascular system [17]. The shift-work leads alteration of sleep-rhythms, and if it is repeated every weeks, in based on the literature data [18], is associated to an increase of body mass and obesity.

The main pathological condition observed in workers was arterial hypertension, more present in older workers and in the profession of drivers. This phenomenon has already been described in the literature [19].

The role of age is an important factor for hypertension: indeed in the sample of workers that we have examined the subjects older than 45 years have an increased hypertensive risk 3 fold higher than their younger colleagues.

About the professional characteristics, the data analysis has showed the importance of variables directly related to the organizational aspects of the work, also cognitive factors, such as high concentration and attention seem to have an important role to increase the hypertensive risk.

**Table 3:** Multivariate analysis by logistic regression between arterial hypertension and some work characteristics, adjusted by age.

	OR	CI 95%
Shift work	2.47	1.34-4.54
Works more than 46 hours/week	1.96	1.16-3.31
Work at night	2.24	1.25-4.01
Impossible to detach eyes from work	2.00	1.05-3.81
Work that requires high attention	3.71	1.29-10.68
To eat in irregular patterns due to job	2.18	1.22-3.90
To sleep in irregular patterns due to job	2.33	1.32-4.10

It is important to consider that the “nervous” arterial hypertension may correlate with organic hypertension when occupational stress is maintained over time.

In our work, there are some strengths and weaknesses. Strengths: originality of work, and large sample size. There are very few scientific studies conducted in Italy on working condition and health of workers involved in the construction of railway line, especially on arterial hypertension risks. Among the weaknesses we have not even analyzed the relevant baseline health data (diabetes frequency, hypercholesterolemia, metabolic syndrome, etc.) or respiratory, heart, neurological diseases.

However, our investigation has been an important tool to understand what improvement measures are needed to prevent hypertension in the workplace, eg. turn-over of tasks, increasing work breaks or physical activity during leisure time. The benefits of these interventions would have positive repercussions on short and long term health conditions.

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