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Voice Complaints among Public Transport Workers in the Metropolitan Region of Belo Horizonte, Brazil

Ada Assunção Renata Jardim Adriane de Medeiros

Universidade Federal de Minas Gerais, Belo Horizonte, Brazil



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Key Words

Voice complaints · Working conditions · Urban transport · Workers' health

Abstract

Objective: To investigate the prevalence of voice complaints among bus transport workers in a metropolitan area in Brazil and examine whether sociodemographic and occupational factors were associated with this outcome. This study is part of a larger study that investigated the working conditions and health of drivers and conductors of urban transportation. Methods: The sample size (1,607 participants) was calculated by means of quotas and was stratified according to occupation (drivers and conductors) in the bus companies of Belo Horizonte, Betim and Contagem. Face-to-face interviews were facilitated by means of a digital questionnaire, applied by the interviewer using a netbook. The outcome variable was constructed from combining the responses to the following two questions: (1) Over the last two weeks, have you felt tired when speaking? (no/sometimes/every day). (2) Over the last two weeks, have you noticed any worsening of your voice quality? (no/sometimes/every day). Sociodemographic, lifestyle, occupational characteristic and health situation data were gathered. Results: The prevalence found was 29% overall: 24% for drivers and 34% for

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conductors. Attention was drawn to positive associations with the function of conductor and with reports of exposure to vibration and thermal discomfort. Among the individual factors, only female gender reached statistical significance. **Conclusion:** Risk factors exist that justify interventions to promote voice health within the urban transport sector under study. It would be appropriate to investigate whether vibration of the whole body would influence the functioning and morphology of the larynx. © 2014 S. Karger AG, Basel

Introduction

Voice complaints reflect problems in producing the voice that relate to disturbance or loss of laryngeal function. Tiredness when speaking, pain, hoarseness and aphonia are voice complaints that teachers, singers, actors, aerobic gymnastic instructors, supporters' group leaders, call center attendants and soldiers often report [1-3].

Approximately 25% of the individuals in the workforce depend on their voices to carry out their main tasks [4, 5]. Since they have a need to use their voices to perform their professional functions, they become vulnerable to the effects of voice overload. In such situations, ede-

Ada Assunção Universidade Federal de Minas Gerais Av. Alfredo Balena 190, sala 705 30130-100 Belo Horizonte (Brazil) E-Mail adavila@medicina.ufmg.br

ma may occur in the tissues of the vocal folds, with negative repercussions on the fundamental frequency. The morphology and function of the vocal cords are affected both by voice overload and by agents in the environment [6, 7]. Reduction or loss of the capacity to produce the voice may cause difficulty in or impede oral communication, thereby leading to consequences for the individual's personal, social or professional life.

Among the general population of the United States, it was found that 7% reported a voice disorder at the time of the interview and 30% said that they had had at least one episode over the courses of their lives [8]. Worldwide, several professions have been targeted by researchers interested in comprehending the magnitude of and factors associated with voice disorders [5]. In Brazil, at healthcare clinics, teachers have been compared with other occupational groups such as secretaries, engineers, administrators, lawyers, doctors, singers, actors and call center attendants, among others. The prevalence of self-reports of voice problems was 12% for teachers and 8% for nonteachers [9]. The variability in the prevalence of voice disorders is due to using different criteria and symptoms to define the presence of vocal alterations, in addition to variations in the composition of the populations studied (age, gender, origin, working schedule and profession, among others) [10].

Nonetheless, it has not been possible to identify the magnitude of the occupational problem over the entire workforce for a variety of reasons. These reasons include the diversity of information systems, which vary according to the type of employment linkage among the subjects (public servant, self-employed worker, worker in private company or informal employment).

Improvement of the conditions under which people and goods are moved forms part of the platform of actions that relate to better quality of urban life. Use of public transport to solve the known problems and diminish environmental pollution (gases and noise) and traffic accidents has been stimulated [11]. In 2009, in the city of Belo Horizonte, Brazil, 245,341 passengers per day were being transported by bus [12]. Buses account for 84% of public transport movements in the urban areas of municipalities with more than 60,000 inhabitants in Brazil [13]. However, it is rare for policies directed towards urban mobility to highlight the well-being of bus workers.

The present study investigated the prevalence of voice complaints among bus drivers and conductors in a metropolitan area in Brazil and examined whether sociodemographic and occupational factors were associated with this outcome. **Table 1.** Relative and absolute distribution of sociodemographic variables of 1,607 workers in urban public transportation in the cities of Belo Horizonte, Betim and Contagem, MG, Brazil, 2012

Characteristics	Driver	Drivers		Conductors	
	n	%	n	%	
Sex					
Men	838	98	562	75	
Women	15	02	192	25	
Age, years					
18-34	299	35	478	63	
35-44	291	34	170	23	
45-59	242	28	100	13	
60-75	21	03	06	01	
Average age, years		39		32	
Schooling, years					
0-4	59	07	20	03	
5-7	163	19	55	07	
8 or more	631	74	679	90	
Total	853	100.0	754	100.0	

Methodology

Study Design and Population

This occupational epidemiological study of cross-sectional nature was preceded by an exploratory phase that included the following procedures: interviews with leaders of the workers' union, employers' representatives and officials from the public attorneys' office; analysis of the specific literature; qualitative study on production of metropolitan transport services (not presented here), and preparation and testing of an instrument for face-to-face data gathering. This study is part of a larger study that aimed to investigate the working conditions and health of drivers and conductors of urban transportation. Thus, the participants were required to answer a much longer questionnaire than what is presented here.

A quota proportional to the total number of professionals in Belo Horizonte, Betim and Contagem was selected. The sample sizes were estimated taking into account prevalence studies and the association between the outcome and independent variables. The calculation took into consideration a sampling error of 4%, confidence interval of 95% and prevalence of 50%, which were taken to represent the range of outcomes of interest. Based on the total numbers of drivers and conductors in the companies established in these three cities, the sample distribution was as follows: 72% of the drivers and 80% of the conductors were in Belo Horizonte; 8 and 6% in Betim, and 20 and 14% in Contagem. Taking into account these estimates and the criteria presented above, a sample of 565 drivers and 561 conductors was determined (table 1).

The face-to-face data gathering was done with the aid of netbooks and took place between April and June 2012, during morning and afternoon shifts. The test-retest reliability was estimated for 12% of the total number of participants – the same respondents complete a part of the survey (one question about each dimension of the questionnaire) at two different moments to see how stable the responses were. The kappa values varied from moderate to excellent.

The study received prior approval from the Research Ethics Committee of UFMG (CAAE 02705012.4.0000.5149).

Variable of Interest

Two questions gave rise to the variable of interest: (1) Over the last two weeks, have you felt tired when speaking? (no/sometimes/ every day). (2) Over the last two weeks, have you noticed any worsening of your voice quality? (no/sometimes/every day). Both of the questions were taken into consideration in order to construct the response variable: the workers who answered 'no' to both questions were classified in the group without voice complaints; while the workers who responded positively to at least one of the two questions (sometimes or every day) were classified in the group with voice complaints.

The classical question for self-assessment of health was used: In general, would you say that your health is: (very good, good, regular, poor, very poor)? Time off work due to health problems over the last 12 months was investigated.

The independent variables were organized into dimensions, respecting a hierarchical model of relationships between the variables: (a) sociodemographic characteristics: sex, age, schooling, marital status, number of children and monthly family income; (b) lifestyle: sociocultural activities (visits to friends, parties, bars, cinemas, theaters and fairs), smoking and problematic use of alcohol; (c) occupational characteristics: job, number of years working in the job and in the present company, alteration of working hours, other remunerated work, doing double work shifts, working conditions (body vibration and internal temperature in the bus), breaks during working hours, noise inside and outside the bus, threats to personal safety during working hours, violent acts during working hours (episodes of aggression during working hours over the last 12 months, and desire to change work location because of the episodes of violence experienced); (d) health-related factors: absence from work during the last 12 months due to health problems and self-assessment of health.

Analysis Procedures

Firstly, a descriptive analysis of the variables was conducted. The factors associated with dysphonia were then analyzed according to each block. In the first stage, bivariate analysis was performed taking into consideration the explanatory variables of each block. Following this, in the intermediary analysis, all variables associated with dysphonia at the level of p < 0.20 were tested, taking into consideration only the variables belonging to the same dimension. This procedure had the aim of avoiding exclusion of potentially important variables.

The variables that remained statistically associated with dysphonia at the level of p < 0.05 were kept in the final model. This analysis was performed in two stages, using Poisson regression. The magnitude of the association was measured using prevalence ratios (PR) with robust confidence intervals, and the statistical significance taken was the 95% confidence interval. The software used for the statistical analyses was SPSS 17.0 and STATA 11.0. The Poisson regression model is generally used in epidemiology to analyze longitudinal studies in which the response is the number of episodes of an event occurring over a given time. In cross-sectional studies, a value of 1 can be attributed to each participant's followup time as a strategy to obtain PR point estimates, since there is no real follow-up for the participants in this type of epidemiological study. However, when the Poisson regression is applied to binomial data, the error for the relative risk is overestimated, because the variance of the Poisson distribution increases progressively, while the variance of the binomial distribution has a maximum value when the prevalence is 0.5. This problem can be corrected by using a robust variance procedure [14]. We preferred to use Poisson's regression with robust error variance estimation because of the high frequency of the outcome of voice complaints (29%) in the sample: odds ratios could have overestimated the strength of association and thus were considered to be inappropriate [15, 16].

Results

Table 1 presents the composition of the sample of urban public transport drivers and conductors in the cities of Belo Horizonte, Betim and Contagem, according to occupation. The population was essentially male (87%) and young: 77% were not more than 44 years of age (86 and 69%, for conductors and drivers, respectively). Most of them were married or in stable relationships, with 1 or 2 children. The drivers were significantly older than the conductors. In relation to the drivers, the conductors more frequently reported experiencing tiredness when speaking over the last 15 days (28 vs. 18%) and worsening of voice quality over the same reference period (17 vs. 12%).

Voice complaints were reported by 29% of the workers investigated (34 and 24% of the conductors and drivers, respectively) and these complaints showed statistically significant associations in univariate analyses with the following: female gender, lower family income, fewer sociocultural activities, suspected abusive use of alcohol, the occupation of conductor, reports of vibration of the whole body, thermal discomfort inside the bus, high noise levels inside and outside the bus, fewer breaks, violent acts, time off work due to health-related problems over the last 12 months and negative self-assessment of health (data not shown here). The intermediate models maintained the same associations as seen in the univariate analyses, and only the noise outside the bus lost its statistical significance.

In the final model, women and conductors had a greater likelihood of reporting voice complaints than did men and drivers (PR = 1.28 and PR = 1.33, respectively). Workers who reported experiencing thermal discomfort, whole-body vibrations or aggression or threats while working over the preceding 12 months, or were thinking of changing their work location for such reasons also presented a greater likelihood of having voice complaints. Likewise, individuals who had had time off work during the preceding 12 months due to health problems and **Table 2.** Adjusted PR of vocal disorders among workers in the urban public transportation in the cities of Belo Horizonte, Betim and Contagem, MG, Brazil, 2012 (final model)

Characteristics	Adjusted PR	CI 95%	p value		
Sociodemographic					
Sex					
Men	1	106 156	0.010		
Women	1.28	1.06-1.56	0.012		
Occupational characteristics Job					
Driver	1				
Conductor	1.33	1.12 - 1.57	0.001		
Perception of body vibration					
Never/rarely	1				
Sometimes	1.49	1.19–1.87	< 0.001		
Almost always/always	1.41	1.14-1.73	0.001		
Perception of the internal tem	perature in th	ne bus			
Tolerable	1				
Slightly uncomfortable	0.91	0.71 - 1.17	0.468		
Very uncomfortable	1.20	0.96 - 1.49	0.110		
Intolerable	1.39	1.06 - 1.81	0.017		
Violence					
Episodes of aggression during	working hou	rs (last 12 m	onths)		
No	1				
Once	1.20	0.94-1.52	0.135		
More than once	1.40	1.16-1.68	< 0.001		
Desire to change work location because of the episodes of					
violence experienced					
No	1	1 05 1 51	0 00 -		
Yes	1.2/	1.0/-1.51	0.007		
Health					
Absence from work due to hea	alth problems	(last 12 mor	nths)		
No	1				
Yes	1.33	1.13-1.56	0.001		
Self-assessment of health					
Very good	1				
Good	1.50	1.17 - 1.94	0.001		
Regular/poor/very poor	1.99	1.52 - 2.60	< 0.001		

those with worse self-assessed health (fair, poor or very poor) also presented a greater chance of reporting voice complaints (table 2).

Discussion

The prevalence found (29% overall; 24% for drivers and 34% for conductors) was similar to the records for other professional groups that have been studied in the same region, such as teachers (32%) [17], but was higher than what has been recorded among singers (23%) [1].

Attention can be drawn to the positive associations with the conductor's function and with reports of exposure to vibrations and thermal discomfort. These strengthen the reflections regarding the relevance of environmental factors for triggering and worsening voice complaints. Also among the results obtained, the weakness of individual and lifestyle risk factors for voice complaints deserves to be highlighted, since female gender was the only one of these factors to be associated with the event of interest, in the final model.

We did not find any results in the literature relating to voice complaints among urban transport workers.

The conductors reported voice complaints more frequently than the drivers. The voice overload that would explain this result might be related to the constant contact with passengers asking for information and so on, and it is far from unlikely that the background noise contributed towards exacerbating the demands on the vocal folds. On urban roads, noise pollution is a problem that has already been recognized [18]. On the other hand, surprisingly, although the association between voice complaints and noise was confirmed in the intermediate analyses, it did not reach statistical significance. To ensure communication and thus overcome the high noise levels in the working environment, greater vocal intensity is required, which may imply a risk to health [4].

Environmental conditions such as failure of the acoustic design, air pollution and low humidity have negative effects on voice functioning. These factors affect the frequency, type and intensity of phonation. Thus, soldiers are more vulnerable to voice problems than office workers, probably because soldiers are at a disadvantage regarding exposure to noise pollution and to aerosol dispersants, gases, dust and vapor [3].

High temperature was also shown to be associated with the outcome. With exposure to high temperatures, fluid replacement is necessary, but there are many barriers preventing adequate hydration among bus drivers and conductors during their work journeys. A physiopathological explanation for this association can be raised. Systemic and body surface dehydration, due to high temperatures, may increase vocal fold tissue viscosity, thereby increasing the phonation threshold pressure and contributing towards decreased efficiency of vocal fold oscillation and worsened voice quality. In this situation, the vocal folds would be functioning under nonoptimal conditions and thus would be impaired [19].

Excessive vibration of the vocal fold tissues may occur due to intense and prolonged use of the voice. Such vibrations deform the tissue in a cyclic manner at rapid rates. There have been indications that silent pauses while using the voice help the vocal fold tissues to recover from the acceleration stress [20]. It is possible that the subjects are exposed to a combination of factors (noise, vibration and others), which would explain the general overloading on the organism, with repercussions on phonatory function. Vibration of the entire body while seated is due to a set of localized vibrations that have an overall influence on several segments of the body (spine, feet, back, gluteal muscles, upper limbs and hamstrings), thereby resulting in disturbed balance. In addition to localized alterations, vibration of the whole body may change the sensory, oculomotor and vestibular structures [21].

Vibration of the whole body was a problem frequently reported by the bus drivers and conductors: 69% of the drivers studied reported experiencing discomfort due to misalignment of the pieces that support the gears of the engine and due to irregularities on the roads [22]. These occurrences of transferred vibration of the whole body to the laryngeal structures, in addition to the tension-based voice problems related to vibratory muscle stress, suggest that there is a need for further research.

Acts of aggression against transport workers are related to the face-to-face service provided and the solitude in which the tasks are performed (as drivers in one-manoperated buses or at most as driver/conductor pairs) [23]. In Africa, a study in Mozambique examined the prevalence of violent acts affecting minibus and bus drivers and found rates of 61.8 and 70.8%, respectively, across a preceding 12-month period [24]. It is likely that a web of relationships may explain our result, given that on the one hand, men working in occupations with high prevalence of violent acts are at higher risk (50%) of stress-related disorders [25] while on the other hand, relationships between voice complaints and stress are known. Among teachers in Belo Horizonte, reports of acts of violence in schools were shown to be associated with taking sick leave due to voice disorders [26].

Sick leave taken during the preceding 12 months and worse self-assessment of health were respectively 33 and 100% greater in the group that reported experiencing voice disorders, compared with the group without reports of this outcome. It is possible that individuals who are less healthy and thus marked by reports of taking sick leave during the preceding year and negative self-assessments of health are at higher risk of voice disorders. Although problematic use of alcohol and absence of social leisure activities were associated with voice disorders in the first stages of the analysis, they lost their significance in the subsequent analyses. Smoking was not associated with the event at any of the stages [6, 27, 28].

Out of all the individual factors (sociodemographic and lifestyle factors), only female gender reached statistical significance. Women are more vulnerable than men to the risks of voice overload because of the specific anatomical and morphological features of their larynges [29]. The higher frequency of voice disorders among women seems to be explained by the smaller size of their larynx and their lower vocal power [6, 30]; it has also been noticed that males produce 50% less vibrations in total than females. Although women are increasingly being absorbed into the transport sector, the organization of the work (working conditions, infrastructure, local culture and ergonomics) is still strongly male-centered, such that women are disadvantaged regarding adaptations to their needs [23].

The prevalence encountered indicates that there is a need for interventions, given the possibility of social and economic costs, since voice disorders have been associated with sick leave taken in other occupations [26].

The data in the literature still do not allow any conclusions to be reached regarding the prevalence of voice complaints identified in populations or population groups, because of the large numbers of factors that influence the perception of the problem. Moreover, there is no consensus regarding the terminology used and a variety of study designs have been used. It is possible that deficiencies in defining the outcome and in the approach taken to the exposure might explain the weak institutional manifestation relating to recognition of the occupational nature of voice complaints [2]. Nonetheless, the associations demonstrated indicate that risk factors exist that would justify interventions to promote voice health within the urban transport sector in the region studied. For the future, it would be appropriate to investigate whether vibration of the whole body would influence the functioning and morphology of the larynx.

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