

Emotional stress as a risk factor of voice disorders in professional singers*

Marcin Scech

Pomeranian Medical University in Szczecin, Department of Humanities in Medicine, gen. Dezyderego Chtapowskiego 11, 70-103 Szczecin, Poland

ORCID: 0000-0002-5997-4470

✉ mscech@pum.edu.pl

ABSTRACT

Introduction: Opera singers are professionals whose voices are extremely heavily burdened, not only due to repertoire, but also due to the hourly workload of the voice and its unique use resulting from the specificity of the profession. Singers are required to fill very large concert halls with their singing and must deal with immediate feedback from the audience which is associated with a lot of stress. Stage fright, as a type of stress, is a phenomenon that takes place over a period of time and has a triple dimension: pre-concert stage fright during which the musician prepares for a performance, concert stage fright which involves a sense of a lack of control over the performance, and post-concert stage fright, i.e. retrospection of the work and the assessment of whether the quality of the performance met the expectations set by oneself and by others. Although certain personality traits are crucial for coping with stressful situations, they are not taken into account during the recruitment process for vocal studies or applications to work in the opera. Voice disorders may cause problems and have negative economic consequences for professional singers.

The aim of this study was to determine the incidence of voice disorders among people working in professional opera theaters as singers with regard to their temperament and personality traits, and the influence of such disorders on the levels of stress in this professional group.

Materials and methods: The study involved 225 singers, employed in 6 randomly chosen opera theaters in Poland: the Grand Theater of the National Opera in Warsaw, the Grand Theater in Poznań, Opera Nova in Bydgoszcz, the Grand Theater in Łódź, Wrocław, and the Castle Opera in Szczecin. The research instruments were: the Voice Handicap Index (VHI),

the Neuroticism Ekstraversion Openness–Five Factor Inventory (NEO-FFI), the Formal Characteristics of Behavior–Temperament Inventory (FCB-TI), and the author’s questionnaire.

Results: Voice disorders were found in 57.3% of respondents ($n = 129$; $p \leq 0.001$). Significant relationships were observed between voice disorders and noise in the workplace (60.4%; $p = 0.023$). As well as this, the risk of infection in the workplace was an important contributor to voice disorders indicated by 93% of the whole study group and 96.9% of participants with voice disorders ($n = 129$; $p = 0.008$). Singers with voice disorders suffered from chronic sinusitis [$X^2(1) = 5.407$; $p < 0.05$] and bronchial asthma [$X^2(1) = 4.565$; $p < 0.05$] significantly more often. Respondents with voice disorders were characterized by higher neuroticism i.e., the personality trait which increases susceptibility to stress ($n = 129$; $p = 0.012$).

Conclusions: 1. It seems reasonable to create interdisciplinary teams monitoring the process of a professional singers’ education. 2. Neuroticism increased the susceptibility of professional singers to stress, and thus predisposed them to voice disorders. 3. An increased risk of infection as well as noise in the workplace are significant external factors contributing to voice disorders in professional singers. 4. Higher emotional reactivity and perseverance may predispose to an increased incidence of voice disorders among singers. As such, there is a need for a psychologist in an interdisciplinary team dealing with these professionals, both during their education and work. 5. The coexistence of somatic diseases, associated with higher neuroticism translates into increased susceptibility to stress, and thus, a higher incidence of voice disorders.

Keywords: voice disorders; emotional stress; employment; professional singers; classical singing.

INTRODUCTION

In a broad sense, ‘a singer’ may denote a young vocal student, a musically uneducated (amateur) singer, a folk singer, or a famous opera singer. The differences between them include the expectations of the audience, preparation for the performance, and the effects. Professional singers are seen as the elite among all professionals who use their voice to earn a living. Phylant et al. believe that singers could be considered ‘vocal athletes’ because they have to grasp the complex nature of

phonation mechanisms, show physical endurance and agility, and be able to have an exceptional control of the vocal tract [1]. According to Kępińska-Welbel, stage fright is a phenomenon that has a triple dimension: pre-concert stage fright during which the musician prepares for a performance, concert stage fright which involves a sense of a lack of control over the performance, and post-concert stage fright, i.e. retrospection of the work done and an assessment of whether the quality of the performance met the expectations set by oneself and by

* Concise version of a doctoral thesis approved by the Council of the Faculty of Health Sciences, Pomeranian Medical University in Szczecin, Poland. Promotor: Ewa Jaworowska, M.D., D.M.Sc. Hab. Original version comprises: 111 pages, 14 tables, 6 figures, 21 charts, 133 references.

others [2]. This theory shows that the singer is exposed to stress not only during the performance itself, but also before and after it. Although certain personality traits are crucial for coping with stressful situations, they are not taken into account during recruitment for vocal studies or applications to work in the opera [3, 4, 5, 6, 7, 8].

Among the professions that use voice as an occupational instrument, singers have been qualified by the experts of the Union of European Phoniatrics as a group of professionals who require a special quality of voice. Despite the fact that they are considered susceptible to voice disorders, this is not reflected in the literature. It is clear that education on voice physiology and vocal health could save singers from developing voice disorders. As shown by Latham et al., there is still little data on the type and duration of vocal hygiene education during formal vocal studies [9]. Some people see the reasons for this as a lack of professionals in the field of voice hygiene and physiology, an insufficient number of hours devoted to this type of education, as well as a lack of financial resources. In many cases, singing students see teachers as the 1st source of knowledge concerning voice physiology and hygiene, and doctors are only consulted when voice problems appear. Sielska-Badurek et al. confirms that there is a lack of research on the voice in pop music singing performance. In the group of 45 students analyzed in their study, as many as 20% of respondents started learning with singing nodules [10].

Currently, about 200 cases of occupational diseases are adjudicated annually in Poland, which constitutes 10% of all adjudicated occupational diseases [11], and the incidence of vocal organ disorders resulting from working conditions ranked 3rd in 2017, following pneumoconiosis and parasitic and infectious diseases. According to the literature, occupational diseases of the voice organs are mainly diagnosed in teachers. One of the main conclusions of the "Protect Your Voice" program carried out in the Wielkopolskie voivodeship in 2017 was that all professionally active teachers need training on voice hygiene and emission [12, 13]. This study showed that care should not only be provided to people with voice disorders, but also to those who do not report these problems. A similar conclusion was reached by Ropero Rendón et al., who indicated that learning the correct method of emission allows to repair 'damaged voices' [14].

The aim of this study was to determine the incidence of voice disorders among people working in professional opera theaters with regard to their temperament and personality traits, and the influence of such disorders on the level of stress in this professional group.

MATERIALS AND METHODS

The inclusion criteria for the study included being between 18–67 years old and participation on a voluntary basis. The study involved 225 singers, including 134 women (59.6%) and 91 men (40.4%) from 6, randomly selected opera theaters in Poland: the Grand Theater of the National Opera in Warsaw, the Grand Theater in Poznań, Opera Nova in Bydgoszcz, the

Grand Theater in Łódź, Wrocław Opera, and the Castle Opera in Szczecin. The research instruments were: the Voice Handicap Index (VHI), the Neuroticism Ekstraversion Openness–Five Factor Inventory (NEO-FFI), the Formal Characteristics of Behavior–Temperament Inventory (FCB-TI), and the author's questionnaire.

The VHI is a subjective self-administered questionnaire used to quantify the psychosocial effects of voice disorders. It allows to determine the severity of the voice problem as perceived by the patient. The questionnaire consists of 30 items evenly arranged in 3 domains: functional, emotional, and physical. The functional domain refers to the influence of voice disorders on everyday social and professional activity, the emotional domain concerns voice self-perception, and the physical domain is related to physical aspects of voice disorders. Respondents use a 5-point Likert scale (0 – never, 1 – almost never, 2 – sometimes, 3 – almost always, 4 – always) to rate the frequency with which they experience various negative situations related to their voice impairment. The overall VHI score may range 0–120. Voice disability was classified as mild (0–30), moderate (31–60), and severe (above 61).

The NEO-FFI, developed by Costa and McCrea (1987) and adapted by Zawadzki et al. (1998), is a questionnaire used to diagnose personality traits included in the popular 5-factor model referred to as the Big Five [15]. This instrument consists of 60 self-reporting statements rated on a 5-point scale (1 – I strongly disagree, 2 – I disagree, 3 – I have no opinion, 4 – I agree, and 5 – I strongly agree). These items make up 5 subscales measuring: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness (the Big Five). Based on the results, it is possible to describe the personality and adaptation capability of an individual to a professional environment.

The FCB-TI, developed by Zawadzki and Strelau in 1994 and translated into many languages, is used to assess formal aspects of behavior, comprising energetic and temporal characteristics. The questionnaire consists of 120 yes/no questions, divided into 6 subscales measuring traits such as: briskness, perseverance, sensory sensitivity, emotional reactivity, endurance, and activity. The theoretical basis for developing this research instrument was Strelau's Regulatory Theory of Temperament [16].

The author's questionnaire consists of 25 questions concerning socio-demographic and economic data, as well as working conditions, voice workload, psychosomatic health, chronic diseases, and stressful situations at work.

Statistical analysis was performed using IBM SPSS Statistics (v. 25). The differences in the intensity of personality and temperament traits with regard to the singers' health condition were verified by Student's t-test which is used to compare 2 independent groups. The differences were verified by the cross-tab method using the Pearson χ^2 coefficient. Pairwise correlation using the Pearson correlation coefficient, the Mann-Whitney U test, and the techniques of statistical description using the Shapiro-Wilk test were applied to assess whether

the variable distribution was close to normal. Statistical significance was set at $p \leq 0.05$.

The Project was approved by the Bioethics Committee of the Pomeranian Medical University in Szczecin (KB-0012/02/16).

Most respondents were aged between 48–57 (35.6%) and 38–47 (35.1%) – Figure 1. The number of women in the study ($n = 134$; 59.6%) was higher than that of men ($n = 91$; 40.4%) – Figure 2. The number of years spent working in the industry was between 1–45 (19.43 ± 10.96). Subjects with extensive professional experience were most prevalent – 65.8% of respondents had worked professionally as a singer for over 15 years, 11.6% – 1–5 years, and 3 people worked less than 12 months (Fig. 3). Over half of the respondents reported voice disorders. It was especially important to investigate the working conditions and health behaviors that may have contributed to the development of voice problems. The majority of respondents worked in a noisy environment ($n = 225$; 87.6%). There was a prevalence of voice disorders in this group ($n = 129$; 60.4%) – Table 1. The risk of infection among the singers was very common ($n = 225$; 92.9%). Nearly 97% ($n = 129$) of them had developed voice disorders. Among respondents without voice disorders, the percentage of answers confirming the risk of infection in the workplace was similarly high ($n = 96$; 87.5%) – Table 2. More than half of respondents ($n = 225$; 57%) reported concomitant somatic diseases, including respiratory tract abnormalities (throat or larynx) – 7.1%; voice disorders were confirmed by a specialist (otolaryngologist or phoniatriest) in 38.7% of cases. Over a quarter (25.8%) of the singers had not consulted a doctor, and the symptoms subsided spontaneously. The most common concomitant somatic diseases were allergies (21%), gastro-pharyngeal reflux (14%), and hypertension (15%) – Figure 4. Author of this study analyzed the coexistence of voice disorders and other health problems, as well as psychological factors (personality and temperament). The incidence of chronic sinusitis [$\chi^2(1) = 5.407$; $p < 0.05$] and bronchial asthma [$\chi^2(1) = 4.565$; $p < 0.05$] in singers with voice disorders was statistically significantly higher than in those without (Tab. 3). Almost half of the respondents ($n = 225$; 47.6%) admitted that as well as working in the opera, they also performed other additional work using their voice as an occupational tool, and as many as 77.8% confirmed that whilst being an employee of the opera, they had experienced stressful situations outside of work, such as the loss of a loved one, serious illness, or financial difficulties.

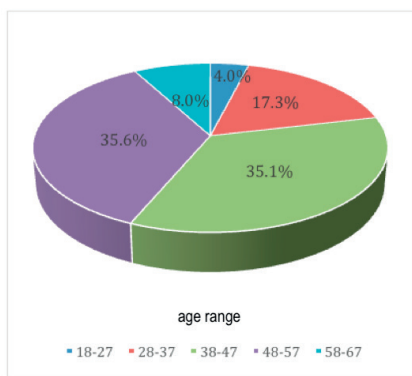


FIGURE 1. The age of the tested opera singers

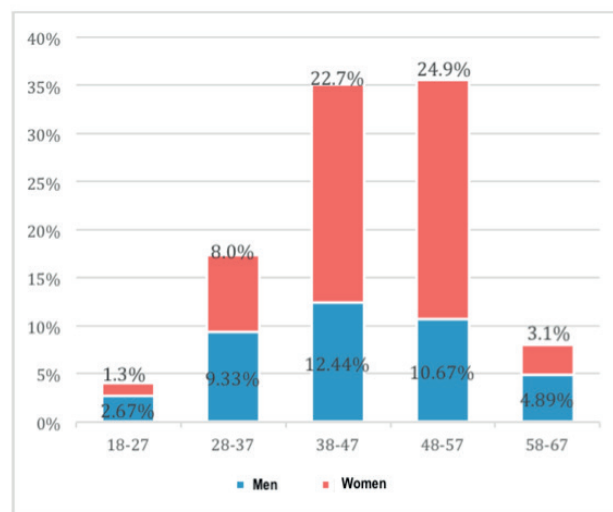


FIGURE 2. The age of the participants with regard to sex

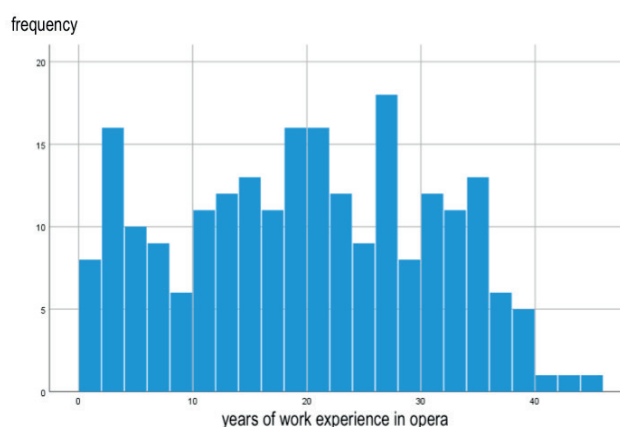


FIGURE 3. Histogram of the opera work experience distribution of the surveyed singers

TABLE 1. Comparison of the incidence of voice disorders in singers with regard to working in noisy environments

Work in noise	Voice disorders				Pearson's χ^2 test		
	yes (n = 129)		no (n = 96)		χ^2	df	p
	n	%	n	%			
Yes (n = 197)	119	60.4	78	39.6	6.110	1	0.023
No (n = 28)	10	35.7	18	64.3			

TABLE 2. Comparison of the incidence of voice disorders in singers with regard to the risk of infection in the workplace

Risk of infection in the workplace	Voice disorders				Pearson's χ^2 test		
	yes (n = 129)		no (n = 96)		χ^2	df	p
	n	%	n	%			
Yes (n = 209)	125	96.9	84	87.5	7.261	1	0.008
No (n = 16)	4	3.1	12	12.5			

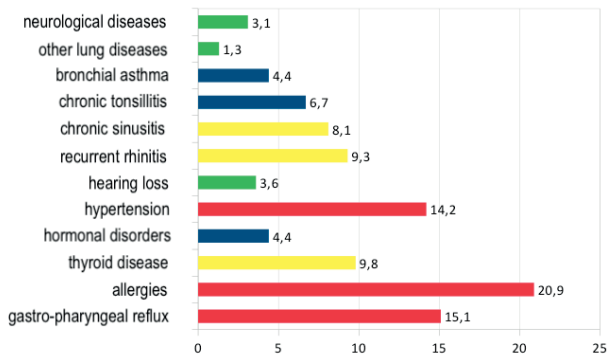


FIGURE 4. The percentage distribution of co-existing somatic diseases in the studied singers

TABLE 3. Comparison of the incidence of voice disorders in singers with regard to co-existing somatic diseases

Somatic diseases	Voice disorders		Pearson's χ^2 test		
	yes (n = 129)	no (n = 96)	χ^2	df	p
Gastro pharyngeal reflux	24	10	2.877	1	0.095
Allergies	31	16	1.806	1	0.190
Thyroid disease	12	10	0.077	1	0.823
Hormonal disorders	5	5	0.230	1	0.747
Hypertension	22	10	1.982	1	0.180
Hearing loss	6	2	1.058	1	0.472
Recurrent rhinitis	15	6	1.881	1	0.246
Chronic sinusitis	15	3	5.407	1	0.024
Chronic tonsillitis	12	3	3.375	1	0.103
Bronchial asthma	9	1	4.565	1	0.047
Other lung diseases	1	2	0.716	1	0.577
Neurological diseases	6	1	2.379	1	0.243

The main variable explaining voice disorders was neuroticism as a determinant of susceptibility to stress. Neuroticism was the least frequent trait in the sample – with a mean score of 20 raw points (5 sten) indicating an average emotional balance in the studied group (Tab. 4). The singers were primarily characterized by high conscientiousness (7 sten) and increased agreeableness (about 7 sten), as well as moderate extraversion and openness to experience (6 sten). The main research hypothesis was that singers with voice disorders were characterized by elevated neuroticism, regarded as the propensity to experience stress (Tab. 5). Neuroticism was the only personality trait in terms of which singers with voice disorders differed from singers without.

In the same way, author of this study compared the intensity of temperamental traits between healthy singers and singers with voice disorders (Tab. 6). The singers differed in terms of 3 out of 5 temperamental traits. Apart from lower endurance

TABLE 4. Basic parameters of the distribution of personality traits in the studied singers

Personality traits	Min.	Max.	Mean	SD	Normality of the distribution
Neuroticism	1	65	19.99	8.56	<0.001
Extraversion	6	44	28.88	6.02	0.090
Openness to experience	10	43	29.34	5.17	0.140
Agreeableness	16	47	30.76	5.66	0.764
Conscientiousness	10	48	33.77	6.29	0.004

TABLE 5. Comparison of the singers' personality traits with regard to voice disorders

Personality traits	Voice disorders				Student's t-test		
	yes (n = 129)		no (n = 96)		t	df	p
	M	SD	M	SD			
Neuroticism	21.23	8.60	18.32	8.28	2.545	223	0.012
Extraversion	28.96	6.15	28.77	5.88	0.234	223	0.815
Openness to experience	29.60	5.16	29.00	5.20	0.855	223	0.393
Agreeableness	30.99	5.57	30.46	5.78	0.689	223	0.491
Conscientiousness	33.74	6.41	33.82	6.17	-0.102	223	0.919

($p < 0.05$), 2 temperamental traits were related to neuroticism and greater susceptibility to stress: emotional reactivity and perseverance. Singers with voice disorders were more emotionally reactive ($p = 0.001$) and perseverative (0.002). Author of this study checked how personality and temperament are related to general health. For each participant, comorbidities were summed up and a pairwise correlation analysis was performed. The study sample included people suffering from up to 6 comorbidities (Tab. 7). As in the case of voice disorders, the only personality trait related to general physical health was neuroticism, however this correlation was weak ($\rho = 0.153$; $p < 0.05$). A similar observation was made in the context of temperamental traits – a higher number of somatic diseases was accompanied by a slightly higher emotional reactivity and perseverance ($p = 0.002$), and by lower endurance ($p = 0.001$) and briskness ($p < 0.03$). All of the above features were significantly associated with neuroticism, wherein personal susceptibility to stress moderately correlated with emotional reactivity ($r = 0.558$; $p < 0.001$), endurance ($r = -0.420$; $p < 0.001$), and perseverance ($r = 0.302$; $p < 0.001$).

The comparison of the VHI results obtained by singers with and without voice disorders demonstrated differences in all 3 VHI domains, with the biggest difference observed in the emotional domain (Tab. 8). The VHI results were also linked to personality traits (Tab. 9). Correlations were observed between the VHI results and neuroticism – all correlations were positive and weak ($p < 0.001$). Moreover, the functional domain negatively and weakly correlated with extraversion,

TABLE 6. Comparison of the singers' temperamental traits with regard to voice disorders

Temperamental traits	Voice disorders				Student's t-test		
	yes (n = 129)		no (n = 96)		t	df	p
	M	SD	M	SD			
Endurance	9.28	4.18	10.62	4.81	-2.222	223	0.027
Activity	8.72	4.38	8.02	4.20	-1.206	223	0.229
Sensory sensitivity	16.31	3.00	16.57	2.75	-0.673	223	0.502
Emotional reactivity	11.04	3.86	8.95	4.72	3.545	223	0.001
Briskness	15.57	3.51	15.53	4.07	0.068	223	0.946
Perseverance	13.67	3.82	11.96	4.08	3.229	223	0.001

TABLE 7. Correlation between personality and temperamental traits and the number of coexisting somatic diseases

Variable	Trait	Pearson's rank correlation	
		rho	p
Personality	neuroticism	0.153	0.022
	extraversion	-0.036	0.588
	openness to experience	0.032	0.636
	agreeableness	-0.049	0.460
	conscientiousness	0.001	0.995
Temperament	endurance	-0.161	0.015
	activity	0.062	0.353
	sensory sensitivity	0.003	0.967
	emotional reactivity	0.220	0.001
	briskness	-0.144	0.030
	perseverance	0.205	0.002

agreeableness, and conscientiousness. Agreeableness correlated with the emotional domain ($\rho = -0.202$; $p = 0.002$) and the physical domain ($\rho = -0.135$; $p = 0.043$). Additionally, author of this study observed that singers with slightly higher conscientiousness showed a statistically insignificant tendency to score lower in the emotional domain ($\rho = -0.125$; $p = 0.061$).

DISCUSSION

Professional singers are regarded as the elite among all professionals using their voice to earn a living. One might expect that the risk of voice disorders in this professional group is particularly high. However, this assumption is not reflected in the available data. According to the literature, diseases of the vocal organs among people whose work requires a great deal of vocal effort mainly affect teachers [17, 18]. As stated by Sinkiewicz et al., approx. 10% of all occupational diseases

TABLE 8. Comparison of the singers' Voice Handicap Index (VHI) results with regard to voice disorders

	Voice disorders				Mann-Whitney U test	
	yes (n = 129)		no (n = 96)		Z	p
	M	SD	M	SD		
Functional VHI	4.66	4.10	3.61	3.66	-2.108	0.035
Emotional VHI	4.56	5.60	1.89	3.28	-4.344	<0.001
Physical VHI	5.52	5.38	3.39	4.31	-3.099	0.002

TABLE 9. Analysis of Spearman's correlation between the VHI results and personality traits

	Correlation coefficient	Neuroticism	Extraversion	Openness to experience	Agreeableness	Conscientiousness
Functional VHI	rho	0.304	-0.193	-0.106	-0.276	-0.170
	p	<0.001	0.004	0.112	<0.001	0.011
Emotional VHI	rho	0.304	-0.108	-0.075	-0.202	-0.125
	p	<0.001	0.105	0.265	0.002	0.061
Physical VHI	rho	0.247	-0.012	0.065	-0.135	-0.013
	p	<0.001	0.862	0.329	0.043	0.843

are diagnosed in teachers, which is about 200 cases annually. No similar data have been found in relation to the singing profession in the available literature. Perhaps this is due to the fact that the number of professional singers in Poland is less than the number of teachers, even if singers as well as actors working with their voices in all types of theaters are summed up together [11].

According to Gębska et al., voice disorders among singers are relatively rare, which is explained by the fact that they know the basics of proper voice emission. Some authors, however, hold a different opinion [18]. They believe that the problem is rather underestimated, and that such a low incidence of voice disorders among singers results from a lack of research on these issues. As such, they indicate the need for a deeper analysis of these issues [1, 19, 20, 21]. As many publications show, the causes of occupational voice disorders are increasingly believed to be of psychosocial origin [22, 23, 24, 25, 26, 27].

In the available national and foreign literature, no data on the incidence of voice disorders among professional singers have been found. In this study, over 57% of respondents reported voice disorders, of whom nearly 63% were women. In author's investigation, neither age nor sex had a statistically significant impact on the development of voice disorders. Based on their study of 292 men and women, Goy et al. made a similar observation about the age of the men they studied [28]. However, in studies by Kim et al. and Garcia Martins et al., which involved women and men working in various professions,

voice disorders were found to be related to the age and sex of respondents over 59 years old [29], and in a group aged from 1 to over 60 years [30]. Other researchers confirm that long-term exposure to noise affects the quality of the respondents' voices, as it forces them to increase their vocal effort. Some authors also emphasize the effect of the influence of noise on human behavior and psyche [31, 32]. In this study, over 88% of singers complained about working in noise, and over 60% of this group were people with voice disorders. This shows that noise was a subjective risk factor for voice disorders. The risk of respiratory tract infection in the workplace was another factor mentioned by the respondents as a significant contributor to the development of voice disorders. As many as 93% of respondents admitted to being at risk of respiratory tract infections, nearly 70% of whom reported voice disorders. Also Ratajczak et al. and Markowska et al. noticed that singers were at increased risk of voice disorders and respiratory tract infections in the workplace, which was irrespective of their sex [26, 33].

In this research, the correlation between voice disorders and sex was not statistically significant, although women reported voice problems much more often. The available literature [18, 34] shows that a higher percentage of voice disorders is observed in women, which is believed to be associated with a lower level of hyaluronic acid in the mucosa of the vocal fold.

With age, the likelihood of developing comorbidities that may contribute to voice disorders increases. The most common chronic diseases the respondents included: reflux disease, hormonal disorders of the thyroid gland, allergies and hypertension. The relationship between comorbidities and voice disorders was investigated in Poland by Markowska et al. [33]. The incidence of diseases, such as allergy, reflux disease, and hypertension in this study was in line with the results reported by Markowska's team. Author of this study noted that the most common diseases were allergy (21%), esophageal-pharyngeal reflux (14%), hypertension (15%), and thyroid disease (10%); 57% of the study sample had voice disorders, and only 40% reported that their voice disorders were diagnosed by a specialist – an ENT specialist or a phoniatriest. This result may seem low considering that professional singers are in a high-risk group for developing voice disorders [1] and suffer from vocal complications more often than people working with their voice in non-performing professions [20, 35, 36]. The reason for this may be the lack of adequate education during vocal studies concerning the anatomy and physiology of the voice, and above all, vocal hygiene, optimization of voice usage, and guidelines for the early detection of voice pathologies [9]. The time between the onset of voice disorders and a visit to a specialist may take 90 days [36] or even 27 months [9]. Singers 1st contact teachers in the case of voice problems (even if they are graduates of music academies). Perhaps that is why singers decide to visit a specialist so late. Sielska-Badurek et al. indicates the need for an interdisciplinary approach to the care of singers by creating a team of specialists. Such a team should include: the singer themselves, the singing teacher, pianist-tutor, phoniatriest, psychologist,

speech therapist, dietitian, trainer of conscious movement and relaxation techniques, as well as doctors of other specialties [10]. Guss et al. included this idea in their notion of the 'laryngology of the performing voice' as a guideline for the appropriate care of this specific professional group [36]. According to the literature data, stress is one of the most serious risk factors for voice disorders [37, 38, 39, 40, 41, 42]. The research of classical singing students conducted by Achey et al. demonstrated that singers who experience high levels of stress may be more prone to voice impairment than those with lower levels. The authors noted that the inability to reduce stress is more burdensome than improper voice hygiene habits, a reduction in the use of the voice and singing, an improper diet, or caffeine consumption [43].

The surveyed singers were also asked to self-evaluate their voice using the VHI. The results confirmed that those with voice disorders significantly differed from healthy individuals in all 3 subscales of voice disability. The biggest difference was observed for the emotional subscale. In the analysis of the correlation between the VHI results and personality traits, the most significant relationships were observed for neuroticism. Thus, it can be concluded that a worse assessment of vocal ability was associated with the personality factor predisposing to stress. Such a correlation has not been found in the available literature.

Psychological predispositions are perceived as risk factors for voice disorders in people using their voice as a tool in their jobs and have been the subject of research in Poland. The main hypothesis in this study was that stress may be a risk factor for voice disorders in professional singers. This hypothesis was verified by means of psychological tests measuring personality and temperamental traits. Neuroticism is linked to the development of voice disorders, such as vocal cord nodules (also called singer's nodules) and functional disorders [17], and is the main variable increasing susceptibility to stress, as has been confirmed by other authors [44, 45, 46]. Comparison of singers with and without voice disorders confirmed the hypothesis that neuroticism is a significant contributor to this health problem. Neuroticism was the only personality trait that differentiated these 2 groups, indicating that it increases susceptibility to stress, and thus may be a risk factor.

An analysis of the temperamental traits of the studied singers with regard to their voice disorders was equally important. The results confirmed the assumption that temperament, like personality, plays a significant role in the susceptibility to stress. Healthy respondents and those with voice disorders differed in terms of 3 temperamental traits: endurance, emotional reactivity, and perseverance. These 3 features are associated with neuroticism and contribute to increased reactivity to stressful stimuli. Higher perseverance and emotional reactivity in people with voice disorders may cause a stronger emotional reaction to events as they occur, as well as thinking back to past situations, especially those arousing negative emotions. When combined with lower resistance to external stimuli, such as time pressure, higher hourly load and working in inconvenient conditions, they may aggravate

subjectively perceived stress. Thus, the surveyed singers who reported voice disorders were not only people who reacted much more strongly to stressful stimuli but were also less resistant to their effects and more likely to remember adverse events. These temperamental traits were significantly associated with neuroticism.

As well as this, comorbidities in people with voice disorders were substantially related to neuroticism and temperamental traits which elevate susceptibility to stress. Higher emotional reactivity and perseveration, as well as lower endurance and briskness, make up the psychological image of singers who, despite a relatively stable mental structure, are predisposed to lower psychophysical resistance to voice diseases, and other somatic disorders [47, 48].

Finally, the participants of the study were asked a direct question about stressful situations in their work. The experience of stressful situations in non-professional life, such as the loss of a loved one, serious illness, or financial problems, were reported by as many as 77.8% of all respondents.

Research on voice disorders among professional singers, and their relationship to personality traits is novel. Taking into account the possible practical aspect, it would be advisable to continue the research with the possibility of extending the methodology and the size of the study sample. It is also worth emphasizing that this research was only based on the subjective opinions of the respondents. Therefore, further research on these issues should involve research methods that would allow for an objective analysis of the assumed hypotheses.

CONCLUSIONS

1. Both during their studies and later in their careers, professional singers battle against numerous external and internal factors that affect the quality of their voice. Therefore, it seems reasonable to create interdisciplinary teams monitoring the process of their education.

2. Neuroticism increased the susceptibility of professional singers to stress, and thus predisposed them to voice disorders, while extraversion, agreeableness, and conscientiousness were positive personality traits that served as protective factors.

3. Special attention should be paid to the working conditions of professional singers. Increased risk of infection and noise in the workplace are significant external factors contributing to voice disorders in professional singers.

4. Higher emotional reactivity and perseverance may predispose to an increased incidence of voice disorders among singers. Hence, the need for a psychologist in an interdisciplinary team dealing with these professionals, both during their education and work.

5. The coexistence of somatic diseases, associated with higher neuroticism, translates into increased susceptibility to stress, and thus, a higher incidence of voice disorders. It is therefore necessary to undertake a phoniatic examination during periodic examinations in the workplace of professional singers.

REFERENCES

- Phyland DJ, Thibeault S, Benninger M, Vallance N, Greenwood KM, Smith JA. Perspectives on the Impact on Vocal Function of Heavy Vocal Load Among Working Professional Music Theater Performers. *J Voice* 2013;27(3):390.e31-9.
- Kepińska-Welbel J. Trema u muzyków. *The International Seminar of Researchers and Lecturers in the Psychology of Music*. Warszawa: Wydawnictwo AMF; 1990. p. 469-74.
- Ratajczak J, Grzywacz K, Wojdas A, Rapiejko P, Jurkiewicz D. Rola czynników psychologicznych w patogenezie zaburzeń głosu spowodowanych guzkami głosowymi. *Otolaryng Pol* 2008;62(6):758-63.
- Husein O, Husein T, Gardner R, Chiang T, Larson DG, Obert K, et al. Formal psychological testing in patients with paradoxical vocal fold dysfunction. *Laryngoscope* 2008;118(4):740-7.
- Roy N, Bless D, Heisey D. Personality and voice disorders: a multitrait-multidimension analysis. *J Voice* 2000;14(4):521-48.
- Zawadzki B, Strelau J, Szczepaniak P, Śliwińska M. Polska adaptacja podręcznika do Inwentarza osobowości NEO-FFI Costy i McRae. Warszawa: PTP; 1998.
- Roy N, McGrory J, Tasko S, Bless DM, Heisey D, Ford CN. Psychological correlates of functional dysphonia: an investigation using Minnesota Multiphasic Personality Inventory. *J Voice* 1997;11(4):443-51.
- McHugh-Munier C, Scherer K, Lehmann W, Scherer U. Coping strategies, personality and voice quality in patients with vocal fold nodules and polyps. *J Voice* 1997;11(4):452-61.
- Latham K, Messing B, Bidlack M, Merritt S, Zhou X, Akst LM. Vocal health education and medical resources for graduate-level vocal performance students. *J Voice* 2017;31(2):251.e1-7.
- Sielska-Badurek E, Kazanecka E, Osuch-Wójcikiewicz E, Domeradzka-Kołodziej A. Rola foniatrii w multidyscyplinarnej opiece nad wokalistami. *Otarynolaryngol* 2012;11(3):87-94.
- Sinkiewicz A, Niebudek-Bogusz E, Szkiełkowska A, Wiskirska-Woźnica B, Śliwińska-Kowalska M. Propozycja optymalizacji systemu profilaktyki i leczenia zawodowych chorób narządu głosu. *Otolaryngol* 2018;17(1):15-9.
- Morawska J, Niebudek-Bogusz E. Risk factors and prevalence of voice disorders in different occupational groups – a review of literature. *Otarynolaryngol* 2017;16(3):94-102.
- Jałowska M, Woškowiak G, Wiskirska-Woźnica B. Ocena wyników programu profilaktycznego "Chroń swój głos" przeprowadzonego przez Wielkopolskie Centrum Medycyny Pracy w Poznaniu. *Med Pr* 2017;68(5):593-603.
- Ropero Rendón MDM, Ermakova T, Freyman ML, Ruschin A, Nawka T, Caffier PP. Efficacy of Phonosurgery, Logopedic Voice Treatment and Vocal Pedagogy in Common Voice Problems of Singers. *Adv Ther* 2018;35(7):1069-86.
- Zawadzki B, Strelau J, Szczepaniak P, Śliwińska M. Inwentarz osobowości NEO-FFI Costy i McRae (adaptacja polska). Warszawa: Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego; 1998.
- Zawadzki B, Strelau J. Formalna Charakterystyka Zachowania – Kwestionariusz Temperamentu (FCZ-KT). Warszawa: Instytut Transportu Samochodowego; 1994.
- Śliwińska-Kowalska M, Fiszer M, Niebudek-Bogusz E, Ziatkowska E, Kotyło P, Domańska M. Ocena skuteczności terapii głosowej w leczeniu zaburzeń głosu u nauczycieli. *Med Pr* 2003;54(4):319-25.
- Gębska M, Wojciechowska A, Żyżniewska-Banaszak E. Zasady i metody rehabilitacji chorych z zawodowymi zaburzeniami głosu. *Ann Acad Med Stetin* 2011;57(2):78-84.
- Williams NR. Occupational groups at risk of voice disorders: a review of the literature. *Occup Med* 2003;53(7):456-60.
- Dsouza JM, Kumaraswamy S. VHI vs. VRQOL in Trained and Untrained Choir Singers. *Language in India* 2015;15(5):140-9.
- Pestana P, Vaz-Freitas S, Manso MC. Prevalence of Voice Disorders in Singers: Systematic Review and Meta Analysis. *J Voice* 2017;31(6):722-7.
- Waszkowska M, Merecz D, Drabek M. Programy prewencji stresu zawodowego – strategie, techniki, ocena skuteczności. Część I. Narodowe i międzynarodowe działania na rzecz przeciwdziałania stresowi w miejscu pracy. *Med Pr* 2009;60(6):523-9.
- Cooper CL, Liukkonen P, Cartwright S. Stress prevention in the workplace. Dublin: European Foundation for Improvement of Living and Working Conditions; 1996.

24. Cielecka A, Sielska-Badurek E, Niemczyk K. Poczucie stresu i niepełnosprawności głosu u pacjentów z dysfonią. *Otolaryngol* 2017;16(1):26-32.
25. Szrajda J, Tudorowska M, Kujawski S, Weber-Rajek M, Sygit-Kowalkowska E, Kobos Z, et al. The big five personality and temperament traits and its correlations with styles of coping with stress in the fire brigade officers. *Journal of Education Culture and Society* 2017;8(2):163-73.
26. Ratajczak J, Rapijko P, Wojdas A, Jurkiewicz D. Wpływ upośledzonej drożności nosa na jakość tworzonego głosu. *Otolaryng Pol* 2009;63(7):58-63.
27. Obrębowski A, Pruszewicz A, Sułkowski W, Wojnowski W, Sinkiewicz A. Propozycje racjonalnego postępowania w orzekaniu o chorobie zawodowej narządu głosu. *Med Pr* 2001;52(1):35-44.
28. Goy H, Fernandes DN, Pichora-Fuller MK, van Lieshout P. Normative voice data for younger and older adults. *J Voice* 2013;27(5):545-55.
29. Kim KH, Kim RB, Hwang DU, Won SJ, Woo SH. Prevalence of and sociodemographic factors related to voice disorders in Korea. *J Voice* 2016;30(2):246.e1-7.
30. Martins RH, do Amaral HA, Tavares EL, Martins MG, Gonçalves TM, Dias NH. Voice disorders: etiology and diagnosis. *J Voice* 2016;30(6):761.e1-9.
31. Pawlas K. Hałas jako czynnik zanieczyszczający środowisko – aspekty medyczne. *Med Środow* 2015;18(4):49-56.
32. Morcinek-Słota A. Stres zawodowy wśród pracowników górnictwa – propozycja badań ankietowych w kopalniach węgla kamiennego. *Systemy Wspomagania w Inżynierii Produkcji* 2017;6(2):205-13.
33. Markowska R, Szkiełkowska A, Ratyńska J. Choroby współistniejące z zaburzeniami głosu u osób zawodowo posługujących się głosem. *Otolaryngol* 2006;5(1):31-5.
34. Śliwińska-Kowalska M, Niebudek-Bogusz E, editors. Rehabilitacja zawodowych zaburzeń głosu. *Poradnik dla nauczycieli*. Łódź: Instytut Medycyny Pracy im. prof. J. Nofera; 2009. <http://www.fuw.edu.pl/~radek/emisjaglosu.pdf> (6.10.2017).
35. Kwok M, Eslick G. The impact of vocal and laryngeal pathologies among professional singers – a meta-analysis. *J Voice* 2019;33(1):58-65.
36. Guss J, Sadoughi B, Benson B, Sulica L. Dysphonia in performers: toward a clinical definition of laryngology of the performing voice. *J Voice* 2014;28(3):349-55.
37. Stothert W. Music performance anxiety in choral singers. *Canadian Music Educator* 2012;54(1):21-3.
38. Kokotsaki D, Davidson J. Investigating musical performance anxiety among music college singing students: a quantitative analysis. *Music Educ Res* 2003;5(1):45-59.
39. Lehrer P, Goldman N, Strommen E. A principal components assessment of performance anxiety among musicians. *Med Problems Performing Artists* 1990;5(1):12-8.
40. Sternbach D. Musicians: a neglected working population in crisis. In: Sauter S, Murphy L, editors. *Organizational risk factors for job stress*. Washington: American Psychological Association; 1995. p. 283-302.
41. Palamar S. Metody przygotowania wokalisty do występu na estradzie. Częstochowa: Wydawnictwo im. Stanisława Podobińskiego Akademii im. Jana Długosza w Częstochowie; 2011. p. 173-7.
42. Kaleńska J. Zjawisko tremy – od badań do praktyki. In: Limont W, Didkowska B, editors. *Edukacja artystyczna a metafora*. Toruń: Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika; 2008. p. 193-201.
43. Achey M, He M, Akst L. Vocal hygiene habits and vocal handicap among conservatory students of classical singing. *J Voice* 2016;30(2):192-7.
44. Sieradzki A, Małyszczak K, Pacan P, Kiejna A. Personality traits in relation to anxiety and depressive symptoms in people who have undergone short-term psychodynamic psychotherapy in daycare conditions. *Post Psychiatr Neurol* 2015;24(3):119-27.
45. Żuchowicz P, Bliźniewska K, Talarowska M, Gałecki P. Zaburzenia osobowości w depresji. *Neuropsychiatr Neuropsychol* 2018;13(1):25-30.
46. Eysenck H, Eysenck S. EPQ-R – Kwestionariusz Osobowości Eysencka EPQ-R. *Podręcznik*. Warszawa: Zespół Pracowni Testów Psychologicznych; 2011.
47. Orlak K, Tylka J. Temporementalny czynnik ryzyka zaburzeń stanu zdrowia pracowników sądownictwa. *Med Pr* 2017;68(3):375-90.
48. Sarzyńska-Mazurek E, Wosik-Kawala D. Postrzeganie pracy przez pracowników wykonujących zawody trudne i niebezpieczne a radzenie sobie przez nich ze stresem. *Ann UMCS Sect J* 2016;29(4):103-14.