João Pedro de Melo Pestana Mouga Malheiro

Fado and its voices:

Contribution to the prevention of occupational voice disorders

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Dissertation presented to *Universidade Fernando Pessoa* as a requirement to obtain the doctoral degree in *Desenvolvimento e Perturbações da Linguagem*, under the supervision of Professor Susana Vaz Freitas and Professor Maria da Conceição Manso.

What is shown here is an obsession that has been dragging from 2015 until yesterday.

José Rodrigues, in *Acerca dos Anjos* (1994)

Abstract

Singing is an activity practiced by many people, both from a professional or recreational standpoint. When a person sings, his/her vocal tract behaves in a way different to speech. Occupational voice disorders in singers are known for their hugely negative impact on their career.

Fado is a Portuguese urban folk song having deep roots in the popular culture. An increased risk of voice disorders among these professionals. Some risk examples are to sing without formal training, to perform frequently with no amplification system, to sing in venues with unsuitable characteristics, etc.

As an expected outcome, this thesis intends to diminish the gap between professional practices and scientific research in this field.

Research on the singing voice was mapped to trace research patterns, to compare the amount of published research and its journals, to analyze trend topics. Descriptive statistics, text mining, and clustering were used. The amount of published papers per annum has been continuously increasing since the first indexed study, in 1949. The major topics highlighted by this study were: voice quality, occupational demands, acoustic analysis, training effects, musical perception and electroglottography.

The prevalence of self-reported dysphonia in singers was calculated through a systematic review and a meta-analysis. Eleven studies met the established criteria and grouped according styles and roles. The overall prevalence of self-reported dysphonia was 46.09% (95%CI: 38.16-54.12) – singing teachers showed the highest prevalence (55.15%), followed by non-classical singers (46.96%), classical singers (40.53%) and

singing students (21.76%). These results suggest that singers are more prone to report dysphonia comparing to the general population.

Fado singers were explored from an epidemiological perspective. First, a population size calculation was done to make this possible. No regulatory institution to handle the professionalization of singers was found in Portugal. A database was created with subjects who met the following criteria: to sing Fado *de Lisboa*; to be alive; to have recorded, at least, one phonogram. Four hundred and eleven were identified, even though the panel of recruited experts believes that there are much more.

A comprehensive self-administered questionnaire was built to find the prevalence and impact of voice disorders in singers, as well as to identify risk or protective factors. It was applied to 111 singers with a convenience and snowball sampling. The overall prevalence of self-reported voice disorders was 39.6%, significantly higher in females. Vocal fold nodules were the most common diagnosis; vocal fatigue and hoarseness were the most common reported symptoms. Nearly half of the singers had to cancel shows due to voice disorders.

Significant risk factors were found through univariate and multivariate logistic regression analysis: nose related disorders, decongestants or antihistamines usage (OR=5.5; 95%CI: 1.6-20.8); oral contraceptive or hormone replacement therapy (OR=4.9; 95%CI: 1.2-20.3); previous smoking habits (OR=4.0; 95%CI: 1.5-10.5); and vocal fatigue after performances (OR=2.9; 95%CI: 1.2-7.1). The use of corticosteroids was found to be near the significance, as a protective factor. To sing Fado was found to increase the risk of developing voice disorders – further research is required to compare this population with other singing styles.

The last study aimed to conduct the cross-cultural adaptation and validation of the instrument “Evaluation of the Ability to Sing Easily” (EASE) into the European Portuguese version “Avaliação da Capacidade para Cantar com Facilidade” (EASE-PT). One hundred and twenty-two Fado and Choir singers were recruited through convenience and snowball sampling to fill the final version of the instrument. High internal consistency was found to prove its reliability (alpha of Cronbach=0.900 and 0.905 for Fado and Choir singers, respectively).

Resumo

Cantar é uma actividade praticada por muitas pessoas, quer seja de um ponto de vista profissional ou recreativo. Quando uma pessoa canta, o seu trato vocal comporta-se de forma diferente da fala. As perturbações vocais no cantor são conhecidas pelo enorme impacto que têm nas suas carreiras.

O Fado é uma música popular urbana Portuguesa com raízes profundas na cultura popular. Foi hipotetizado um risco aumentado para o desenvolvimento de perturbações vocais entre estes profissionais. Podem ser considerados alguns exemplos: cantar sem treino formal, atuar com frequência sem sistemas de amplificação, cantar em locais com características inadequadas, etc.

Como resultado expectável, esta tese pretende diminuir a lacuna entre as práticas profissionais e a investigação científica nesta área.

A investigação em voz cantada foi mapeada para traçar padrões de investigação, para comparar a quantidade de publicações e os seus jornais, para analisar tópicos com maior tendência. Recorreu-se a estatística descritiva, *text mining*, e *clustering*. A quantidade de estudos publicados por ano tem crescido continuamente desde a primeira indexação, em 1949. Os tópicos estudados mais identificados neste estudo foram: qualidade vocal, exigências ocupacionais, análise acústica, efeitos do treino, perceção musical e eletroglotografia.

A prevalência da disfonia auto-relatada foi calculada através de uma revisão sistemática e meta-análise. Onze estudos cumpriram os critérios e foram agrupados de acordo com o estilo do canto e funções profissionais. A prevalência global estimada de disfonia auto-relatada foi de 46,09% (IC95%: 38,16-54,12) – os professores de canto apresentaram a prevalência maior (55,15%), seguidos pelos cantores não-clássicos

(46,96%), pelos cantores clássicos (40,53%), e pelos estudantes de canto (21,76%). Estes resultados sugerem que os cantores estão mais susceptíveis a reportar disfonia, quando comparados com a população geral.

Os cantores de Fado foram estudados de uma perspectiva epidemiológica. Primeiro, foi feito o cálculo do tamanho da população. Não foi encontrada em Portugal qualquer instituição reguladora que gerisse a profissionalização dos cantores. Foi criada uma base de dados com sujeitos que cumprissem os seguintes critérios: cantar Fado de Lisboa; estar vivo; ter, pelo menos, uma gravação. Foram encontrados 411 cantores apesar de o painel de peritos recrutado acreditar que há muitos mais.

De seguida, um questionário compreensivo auto-administrado foi criado para descobrir a prevalência e o impacto das perturbações de voz, assim como identificar os factores de risco ou de proteção. Foi aplicado a 111 cantores com uma técnica de amostragem de conveniência e bola-de-neve. A prevalência global de perturbações vocais auto-relatadas foi 39,6%, significativamente mais alta nas mulheres. Os nódulos vocais foram o diagnóstico mais comum; a fadiga vocal e a rouquidão foram os sintomas mais reportados. Quase metade dos cantores cancelaram espetáculos por causa de perturbações da voz.

Foram encontrados fatores de risco significativos através da análise de regressão logística univariada e mutivariada: perturbações relacionadas com o nariz, uso de descongestionantes ou antihistamínicos (OR=5,5; 95%CI:1,6-20,8); contracetivos orais ou terapia hormonal de substituição (OR=4,9; 95%CI:1,2-20,3); hábitos tabágicos prévios (OR=4,0; 95%CI:1,5-10,5); e fadiga vocal após as atuações (OR=2,9; 95%CI:1,2-7,1). O uso de corticoesteróides esteve perto da significância enquanto factor protetivo. Cantar Fado aumenta o risco de desenvolver perturbações da voz – são necessárias mais publicações para comparar esta população com outros estilos de canto.

No último estudo fez-se a adaptação transcultural e a validação do instrumento “Evaluation of the Ability to Sing Easily” (EASE) para a versão em Português Europeu “Avaliação da Capacidade para Cantar com Facilidade” (EASE-PT). Foram recrutados 122 cantores de Fado e cantores de Coro, através de uma técnica de amostragem de conveniência e bola-de-neve, para preencher a versão final do instrumento. A fiabilidade

do instrumento foi obtida através de uma elevada consistência interna (alfa de Cronbach=0,900 e 0,905 para Fadistas e Coralistas, respectivamente).

Dedication

To my uncle, the one who decisively made academia, science and clinic fascinate me, Professor Fernando Melo Pestana.

To my grandmother who, since ever, supported everything in my personal and professional life, Maria Antónia Pestana.

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Obviously, all this work would not make sense and not be possible without the collaboration and the interest of all singers – I cannot thank them enough. Due to reasons of confidentiality, their names are not listed. A special thanks to the conductor José Manuel Pinheiro, who was of a lot of help in the choir singers' recruitment.

This thesis was written primarily using the open source software and freeware. Thank you so much to all the contributors of LibreOffice©, KH Coder©, Scribus©, Inkscape©, GanttProject©, and Mendeley©.

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List of Abbreviations and Symbols

<	is less than	PhD	Doctor of Philosophy
>	is greater than	Me	median
≤	is less than or equal to	n	number in sample or subsample
≥	is greater than or equal to	OR	odds ratio
=	is equal to	P25	Percentile 25 (or Q1)
±	plus or minus	P75	Percentile 75 (or Q3)
→	from … to	R^2	determination coefficient
≅	is congruent to	r	Pearson's correlation
+	plus	r_s	Spearmans's rho
%	percentage	RR	relative risk
AUC	area under the ROC curve	S.D.	standard deviation
CAC	compact audio cassette (or K7)	S.E.	standard error
CCM	contemporary commercial music	SPA	Sociedade Portuguesa de Autores
CD	compact disk	*t*	t-test value
CI	confidence interval	*T*	Wilcoxon test value
et al.	and others	*U*	Mann-Whitney test value
I^2	degree of heterogeneity	USA	United States of America (or US)
k	Cohen's kappa	WHO	World Health Organization
LP	long play record	VC	Variation coefficient
p	probability	χ^2	Chi square test value

Chapter I – Introduction

Based on a simple search about singing voices on major scientific databases (eg. PubMed, Web of Science), institutional repositories and other types of scientific literature, a conclusion could be drawn – the amount of publications regarding this topic is growing which required a strategy to understand and interpret it from a broader and macroscopic viewpoint. This is the main reason why the first study (Chapter II) emerged, describing the trends that had been studied over the years. An approach based on scientography was followed. This allowed us to assume that there is a conspicuous interest that keeps growing across the years, making the major topic of this thesis pertinent by itself. Also, the occupational demands related to singers and their perceptions were denoted, which reinforces the previous idea.

The first hypothesis of this research was to verify whether traditional and popular music singers were more prone to voice disorders than their peers, who have formal training and follow other career paths. A systematic review and meta-analysis were conducted (Chapter III). This was positively stated, which led us to understand if the same is applied to our population of interest. Scientific research requires some assumptions in order to generalize the results to the population and one of those is to know the size of it, rather than an arbitrary sample size. So, in order to calculate the required sample size to study Fado singers, the size of the population had to be found. *Sociedade Portuguesa de Autores* agreed to collaborate in the task: quantify the Fado singers' population (Chapter IV). In order to conduct the following parts, approval was granted by the Ethical Committee of the Universidade Fernando Pessoa (Appendix IV).

After quantifying the Fado singers' population, the prevalence and impact of voice disorders was then accounted for, as well as the characterization of the professional practice among these singers (Chapter V). Factors that contribute to the increase or decrease of risk of voice disorders were later studied (Chapter VI).

The number of validated instruments in European Portuguese to objectify singing voice is scant. In order to improve the field of voice science in Portugal, it was decided to validate a novel scale that has useful and important distinctive features. The Evaluation of the Ability to Sing Easily (EASE) is originally from Australia and is described by its authors as a concise clinical tool to measure singers' perceptions about the current status of their singing voice. This scale was adapted and validated into European Portuguese (Chapter VII).

The summary of the published papers, presentations and relevant works for the thesis is shown in Table 2.

Further data was collected but not included objectively in any of the papers in order to narrow their scope and, therefore improve their readability. All this data is displayed in the Appendix I, for those readers who want to have a deeper understanding of Fado and its voices.

Moreover, an integrative discussion for the thesis main results is depicted in chapter VIII, followed by a summary of conclusions (Chapter IX).

1.1. Literature review

Here, the theoretical foundations that support the pertinence of the thesis have been presented. From Chapter II to Chapter VII, detailed reviews have been provided relating to each specific topic.

In this thesis some words are systematically used. The word “singer” includes anyone who uses the voice in order to sing. Similarly, the expression “Fado singer” will be used to comprise any subject who sings this music style, whether professionally or not. Voice disorder will be used as synonym of dysphonia – comprises any difficulty in oral communication that prevents natural voice production, including any disorder of pitch, loudness, vocal quality, and resonance (Titze, 2000; Hedge and Pomaville, 2008). Therefore, occupational voice disorder must be understood as any voice disorder that occurred as consequence of the practice of the professional or amateur occupation.

i. Fado and its voice

> “Fado can be broadly defined as an urban folk song in which the singer is usually accompanied by two plucked instruments known as *viola* and *guitarra*, the latter resembling a lute. Its lyrics can take the form of a narrative, description or comment and can develop any topic, from one’s own personal feelings to matters of some social concern or other. (Cook, 2004, p.19)

This music has been imbibed by the population and is transmitted through generations by its interpreters. It has become part of the world’s intangible cultural heritage (UNESCO, 2011). Until the end of the 19th century, the term Fado was not related to music, at least there is no written registry. It was in 1822, that the word was first used for a dance form in colonial Brazil. Over the years, references to this Portuguese Brazilian dance became more frequent in literature. In the beginning of the 19th century, Portuguese urban society was marked by poverty and lawlessness. Popular songs and dances marked a quite bohemian lifestyle. Originally, *Casas de Fado* (a rough translation to ‘Fado Houses’) were eccentric joints, where prostitution thrived. *Fadista*, which nowadays means Fado singer, was originally used to designate the denizens of those ob-

scure establishments. From 1840, this remarkable and popular music spread to other urban centers rather than to Lisbon. Eventually, the Fado arrived in Coimbra city as well, and male students of the local University began to sing and play it, a tradition that continues to this day. Between 1920 and 1930, the practice of this music form became a profession for some, and it was no longer redolent of the underworld. Professor Rui Vieira Nery reported all these findings in his extensive research into Fado history (Nery, 2004).

Fado singers can be regarded as voice professionals with unique characteristics. They are distinguished from their peers of other music styles by their professional demands and routines. A hypothetically increased risk for voice disorders among these professionals was the core of this thesis. Among others, such examples contributing to this are singing without formal training, frequent performances with no amplification system, singing in venues with unsuitable characteristics, an inadequate amount of sleep, an improper interval between last meal and bedtime.

However, despite a large amount of literature stating that the singer is at higher risk of developing a voice disorder, the prevalence of these problems and their influencing factors are indeed scant (Bartlett, 2014). If this holds true for the overall population of singers, it applies even more to our population of interest. The amount of conducted and published research is scant, however, that by no means makes it uninteresting.

Fado is commonly divided into two main substyles: *Fado de Lisboa* and *Fado de Coimbra*. Besides the names' geographical connotations, other differences can also be found. One is the fact that the *Coimbra* substyle is mainly sung by male singers and sometimes performed in an ensemble (Kahle, 2012). Interesting results were found through the analysis of the *Fado de Coimbra* singers (Kahle, 2012). They were closer to classical singing rather than the non-classical or popular styles, given their increased loudness and the vibrato type. Despite the rigorous data collection, the short samples limited the generalization of the results. More lately, in 2014, a larger study was conducted with 384 Fado singers (Mendes et al., 2014). The speaking and singing voice productions of Fado singers were classified by four judges' groups (speech-language pathologists,

singing teachers, Fado singers, general public). All groups were able to distinguish between professional and amateur subjects. Instead of roughness and harshness, there was an agreement regarding the classification of pitch and loudness. The acoustic voice profile of Fado singers has been traced (Mendes et al., 2013; Mendes et al., 2014; Ibrahim et al., 2017a). Their spoken voice is characterized by a low fundamental frequency, maximum phonation time near the physiological threshold, and higher perturbation measures in comparison to non-singers. Their singing voice revealed higher perturbation measures compared to Western Classical and Pop singers, mainly in older amateurs. They also revealed that vibrato is frequent and sometimes exaggerated. However, the opposite was found regarding singer's formant. Some spectral and perturbation measures were also different between amateur and professional singers.

From the auditory-perceptual point of view, the singers' profile have also been described (Ibrahim *et al.*, 2017b). Their voice may be described as having a low pitch, a weak loudness, and a predominant oral and laryngopharyngeal resonance. Their voice quality was mainly described mainly rough, breathy, tense or asthenic. The vibrato is weak or exaggerated. Most singers show a reduced voice projection. Male singers revealed a darker timber, while their female counterparts have a lighter one; both show little brilliance. An emotional expression is noticed and some singers reveal to be out of tune. Some of these characteristics originate from unhealthy lifestyles, lack of training or, as the authors suggest, it is merely a Fado voice characteristic (Kahle, 2012; Mendes *et al.*, 2013). A new scale was recently published – EAVOCZ, which stands for "Singing Voice Appreciation Scale" and is a Portuguese scale aiming to appreciate the adult singing voice from a multi-domain and audio-perceptual standpoint (Ibrahim *et al.*, 2017c; Mendes *et al.*, 2017). It was based on voice samples of 20 Fado singers and the assessments of 40 judges. It is a valid and reliable tool to qualify and quantify singing voices.

ii. Singers as voice professionals and related disorders

Singers are a special population of professional voice users – a slight change in their voice can have a great impact on their performance and their work-related quality of life (Woo, 2015).

Over the last few years, a lot of research has emphasized the use of instrumental analysis, giving a notorious primacy to laryngeal endoscopy, stroboscopy and similar subjective visual measures. A relatively large amount of studies found that from the standpoint of clinical diagnosis, the most prevalent disorders are vocal nodules (Lamarche *et al.*, 2010; Stepp *et al.*, 2011; Klodiana and Agim, 2016; Beaud *et al.*, 2017; Sielska-Badurek *et al.*, 2017). Nonetheless, some singers' subgroups showed distinctive results. In a recent study, opera singers revealed a prevalence of 47% of voice disorders, wand the majority of them developed organic lesions (Klodiana and Agim, 2016). Similarly, 45% of musical theater performers under study showed an organic lesion, mainly due to the great vocal load associated with a combination of singing, acting and physical tasks. Also, supraglottic constriction was frequent, even with an acceptable voice quality (D'haeseleer *et al.*, 2017). Interesting results were found in Carnatic singers; most of them suffer a laryngopharyngeal reflux along with muscle tension dysphonia and chronic laryngitis (Arunachalam *et al.*, 2014). With regard to singing students, a study reports incomplete glottal closure as the most prevalent alteration (Nacci *et al.*, 2017). Also, in this student subpopulation, posterior erythema is quite common (Lundy *et al.*, 1999; Nacci *et al.*, 2017). As shown, most research has been focusing on differentiating subpopulations.

Other widely known ways to collect voice-related information are based on the observation of posture, breathing and palpation; formal auditory perceptual evaluation; patient questionnaires; aerodynamic measures; electroglottography; electromyography (Carding and Miller, 2016).

As stated, some of these measures/outcomes may rely on the patient's self-reports, which is not of less importance than other kinds of diagnosis (Miller and Verdolini,

1995; Tepe *et al.*, 2002; Cammarota *et al.*, 2007; Boominathan *et al.*, 2008; Erickson, 2012; Hapner and Gilman, 2012; Rocha *et al.*, 2012; Sataloff *et al.*, 2012; Watson *et al.*, 2013; Vaiano *et al.*, 2013; Achey *et al.*, 2016). Based on the assumption that the singers sought clinical guidance, both by a medical doctor or any other health professional, it means that they identified some problem or alteration by themselves – otherwise, logically, they would not seek help. Thus, this type of data collection method is significant by itself. Also, it contributes to the adequacy of a patient-focused treatment and increases the patient's adherence to therapy or treatment.

Contemporary Christian singers typically lack professional training and their performances are often conducted in disadvantageous places. Contrary to what was expected, most singers classify their voices as normal, while just 26.1% consider it as not being normal (Neto and Meyer, 2017).

Similarly, among a sample of self-identified healthy professional singers, clinicians found laryngeal abnormalities (Castelblanco *et al.*, 2014). These results lead to the assumption that some abnormalities may have a minimal impact on function and perception and are therefore, unidentified.

Among conservatory students of classical singing, 24% reported prior voice problems (Achey *et al.*, 2016). No significant differences were found between opera, musical theater and contemporary commercial music (other than rock) singers while reporting past voice disorders. Forty four percent of them reported one or more diagnosed voice conditions and 69% experienced some vocal disability. These differences were significantly different from the general population (Phyland et al., 1999).

iii. Risk factors for voice disorders among voice professionals

After searching the major scientific databases, the amount of research that clearly addresses risk factors that contribute to voice disorders among singers was scarce, making the task of designing a questionnaire to apply to our singers harder. To overcome and allow the creation of a proper questionnaire, information about other voice professionals apart from singers was mandatory. The following section contains a review of those risk factors, either using relative risk (RR) or odds ratio (OR) to account for their importance.

In Boston, a large clinical-based population during a broad time period, and the relative risk for each occupational category was calculated (Mori *et al.*, 2017). A significantly high risk was identified in several occupations ranging from arts and entertainment (RR=4.98, 95%CI: 4.18-5.95), law (RR=3.24, 95%CI: 2.48-4.23), education (RR=3.08, 95%CI: 2.70-3.52), and social services (RR=2.07, 95%CI 1.57-2.73). As expected, other occupations had significantly reduced risk: maintenance (RR=0.25, 95%CI: 0.15-0.42), food preparation (RR=0.35, 95%CI 0.26-0.48), and administrative support (RR=0.49, 95%CI: 0.41-0.57).

Teaching is considered to be one of the occupations that is most threatened with vocal problems (Van Houtte *et al.*, 2012). From the author's perception, this is the most studied population in the literature of occupational voice problems.

Based on bivariate and logistic regression analyses, occupational risk factors associated with voice disorders among schoolteachers were identified through telephone interviews (Thibeault *et al.*, 2004). Subpopulations of teachers were found to be at higher risk: teachers of vocal music (OR=2.2, 95%CI: 1.2–4.0), drama (OR=2.1, 95%CI: 0.9–4.8), other performing arts (OR=1.6, 95%CI: 1.0–2.4) and chemistry (OR=2.0, 95%CI: 1.1–3.4). Others were found to be at lower risk: teachers of special education (OR=0.5, 95%CI: 0.3–0.7) and vocational education (OR=0.6, 95%CI: 0.4–0.9). Taking into account the intensity of vocalization, only teachers of chemistry were significantly at risk.

Voice related absenteeism in teachers is usually a major concern. A questionnaire of factors associated to voice disorders and voice-related absenteeism was designed and administered to a large group of teachers (Kooijman *et al.*, 2006). Physical and psycho emotional factors were the most important risk factors while, remarkably, voice load and environment seem to be less important. The same research team (Thomas *et al.*, 2006) compared female student teachers and practicing teachers of primary education early in their career. Some factors were described at a lower extent by the first group as having a negative influence in their voice, such as stress ($p = 0.014$), work pressure ($p = 0.003$), the composition of the class ($p = 0.013$), the number of people they communicate with ($p < 0.001$), and the deterioration of their general physical condition ($p = 0.010$). On the contrary, they reported the following factors more frequently as having a negative influence: environmental irritants ($p < 0.001$), humidity of the classroom ($p = 0.020$). Regarding risk factors, the authors found a significant difference in the pattern of risk factors for student-teachers and teachers, where the first group is more influenced [higher odds ratio (OR) for student-teachers versus teachers] by vocal loading factors and environmental factors, while psycho-emotional factors influences the second group the most (lower OR for student-teachers versus teachers).

In order to identify the risk factors for developing voice pathology in the general population of Polish teachers, primary and secondary school teachers underwent a complete evaluation of the voice and were compared to a control group (Sliwinska-Kowalska *et al.*, 2006). A higher probability to develop incomplete glottal closure (OR 13.2; 95% CI: 1.8–96.8) and hyper functional dysphonia (OR 2.7; 95% CI: 1.14–6.44) was significant in the teacher group. A lifetime of vocal effort, incorrect phonation techniques and psychological predispositions are likely to be the major risk factors for developing occupational voice disorders. Surprisingly, no correlation was found with environmental variables, such as classroom temperature, humidity or airborne dust. The authors claim that self-reported symptoms and the clinical signs of voice disorders are around 2–3 times more frequent in female teachers than in those belonging to other professions.

Schoolteachers in Taiwan were included in a prospective study, based on the assumption that there are a lot of studies comparing the risk factors between different occupations,

but not within the same one (Chen *et al.*, 2010). Through logistic regression, the authors compared two groups: those with and without voice disorders. The authors found an association of voice disorders with medication, as well as with psycho-social factors. However, age, smoking, alcohol, caffeinated drinks or bad habits were not associated. Regarding some of the teaching characteristics, there was no difference between both groups concerning the years in occupation, the grade they taught, or the courses. However, teachers who reported the use of loud voice (OR=4.34; p = 0.009) and the usage of amplification system (OR=4.50; p = 0.018) were associated to the group with voice disorders. Some significant differences were also found in their health conditions such as upper respiratory infection, stress, anxiety, and the amount of diseases. No differences were found regarding nasal allergy, nasal septum deviation, hormonal problems, laryngopharyngeal reflux, and head and neck surgery.

Regarding kindergarten and elementary education teachers, some of the risk factors were also revealed through a multivariate logistic regression analysis (Bermúdez De Alvear *et al.*, 2011). Apart from the fact that women were at a greater risk (OR=3.59; 95%CI: 1.49-8.49), the other factors included the time needed to rest the voice (OR=4.94, 95%CI: 2.88-8.56), inadequate self-perceived general health (OR=0.58; 95%CI: 0.34-0.97), prolonged vocal use (OR=5.62; 95%CI: 2.42-13.04), and students' indiscipline (OR=2.48; 95%CI: 1.14-5.37). Therefore, it can be assumed that these voice disorders have a multifactorial nature.

In order to confirm what is already known and to identify new risk factors regarding this population, researchers associated many of those in the same study, specifically the ones related to the personal life of the teacher and environmental factors (Van Houtte *et al.*, 2012). Among almost one thousand teachers, some factors were not identified as risk factors as it would be normally considered. These included age, allergy, daily fluid intake, gastro-esophageal reflux disorder, grade level taught, years of teaching, number of lecture hours per week, noise from outside the classroom, acoustics in the classroom, and the use of chalk. Contrastingly, quite a few were identified as significant risk factors to this population such as gender (OR=1.95; 95%CI: 1.42-2.66); having family history of voice disorder (OR=2.22; 95%CI: 1.27-3.89); number of pupils per classroom

(OR=2.01; 95%CI: 1.35-2.98); noise from inside the classroom (OR=1.13; 95%CI: 1.05-1.21); temperature changes in the classroom (OR=1.43; 95%CI: 1.07-1.91). Authors found a peculiar result as smoking was shown to be inversely proportional to voice disorders (OR=0.46; 95%CI: 0.30-0.72), and this was justified with the thought that people may have answered regarding only their present smoking status or that they were reluctant to answer properly. They even argued that there is literature which supports the claims that smoking is not always a risk factor (Pekkarinen *et al.*, 1992; Smolander and Huttunen, 2006; Nerrière *et al.*, 2009; Chen *et al.*, 2010).

Aerobics instructors were studied based on a questionnaire intended to indicate the increased risk for developing problems (Long *et al.*, 1998). Some associations to voice disorders such as a sore throat with an illness, specific conditions for voice loss (e.g., weather change), instructor's shouts to cue the class, and vocal symptoms related to giving instructions were found. Surprisingly, other factors such as the instructors' perception of acoustics, class-room size, music volume, microphone usage, substitute for other instructors, and familiarity with vocal hygiene techniques were not found to be associated.

Clergy are also a group of voice professionals known for having higher vocal demands and, therefore, more likely to have a higher risk for voice disorders. Priests and vicars in Slovenia were interviewed by means of a questionnaire (Hočevar-Boltežar, 2009). The major cause for the high prevalence of voice disorders was respiratory tract infections. Regarding risk factors, some were identified. They included frequent throat clearing ($p < 0.001$), vocal load during spare time ($p = 0.002$), voice disorders during training ($p = 0.039$) and not receiving proper instructions about vocal techniques ($p = 0.017$). There was no association to age nor the time they taught per week.

An occupation also recognized as having a higher risk for voice disorders is telemarketing. This population was identified to be twice as likely to report vocal attrition symptoms [described as the wear of the vocal apparatus and reduction of the associated skills due to chronic or acute abuse (Sapir *et al.*, 1992)] regarding their matched controls ($p < 0.001$) (Jones *et al.*, 2002). Some strong risks were found. These included smoking ($p =$

0.02); use of drying medications ($p < 0.001$); nasal disorders ($p = 0.04$), frequent colds ($p < 0001$); a dry mouth ($p < 0.001$) and a sedentary lifestyle ($p < 0.001$). Women were also at higher risk of having vocal attrition ($p < 0.001$). The same authors alert to the modifiable status of these factors, which shall be the main focus of the prevention approach.

iv. Self-perception of voice disorders

The following section is intended to support the part of this thesis that relied on self-perception rather than other measurements. Perception is, by definition, subjective, although it does not mean it cannot be quantified. Despite considering that some medical inaccuracy is fairly attributed to the patient's illness perception, the clinician should understand that the major role is played by the patient regarding behavioral changes and consequent outcomes (Benyamini, 2011). The understanding of these concepts and knowledge from the field of health psychology (such as theories of illness perception) can be regarded as being of major importance to the voice disorders' study and development. A great advantage is its stability over time across different periods, and somehow conferring reliability (Moss-Morris *et al.*, 2002).

The willingness to comply with some kind of treatment, or instead its refusal, highly depends on the one's general view of life and health, prior to the medical information (Vos and de Haes, 2007; Benyamini, 2011). Thus, self-perception of an illness is associated to the compliance with health care (Wichowski and Kubsch, 1997), which means that if one does not identify the issue as a problem (such as voice disorders), no clinical guidance will be sought and any type of treatment is less likely to be adhered.

Vocal self-perception was early described as "the physical and psychological experience of one's own voice", functioning as "a monitor of the physical aspects of vocal production, and reflects an individual's vocal self-identification" (Haskell, 1987, p. 172). The same author, John A. Haskell, proposed a model that is represented in Table 1. Here, the author suggests two different levels to operationalize vocal self-perception. Level I regards the self-monitoring of sensory feedback in voice production, whereas Level II features the vocal self-perception taking into account the vocal set comprised by the acoustic and the physiological patterns. A vocal set may be seen as a usual pattern of vocal communication, whether in speech or one's singing voice.

What is important to be retained from this model is that people may develop different vocal sets, depending on the situations they are exposed to. This model is particularly

interesting since it allows us to understand that an inappropriate vocal set must be identified, and hence be conscientious, so that the subject is able to explore its characteristics and its meaning.

Thus, while working with voice patients it is important to consider what is the actual experience by the speaker and not only the observations by the clinician.

Table 1 – Organization of vocal self-perception

Level I: Sensory monitoring			
Auditory feedback	_____		Self-hearing of: pitch, loudness, quality, and duration
Tactile-proprioceptive feedback	_____		Sensations associated with voice production: touch, pressure, movement, and position
Level II: Vocal self-identification			
Acoustic pattern Physiological pattern	├	Vocal set =	Learned behavior determined by: Vocal modeling Cultural factors Self-concept Attitude towards own voice

(adapted from John A. Haskell, 1987)

Some researches prove that the clinician's perception of voice alterations correspond to what is perceived by the subject (Phyland *et al*., 1999; Ugulino *et al*., 2012; Aquino and Teles, 2013). Several instruments have been developed to collect data regarding the voice, based on the information given by the person, varying from quality of life parameters to voice-related symptoms.

In Portugal, the amount of scales and similar instruments that were validated are yet scant, when compared to other countries. However, advances were already made. Voice Handicap Index (VHI) (Jacobson *et al.*, 1997) and Singing Voice Handicap Index (SVHI) (Rosen and Murry, 2000; Cohen *et al.*, 2007) are perhaps the most-used ad-

vancements worldwide used and were validated into the European Portuguese language (Guimarães and Abberton, 2004; Verdonck-De Leeuw *et al.*, 2008; Nawka *et al.*, 2009; Capucho, 2018). There are already some versions of SVHI that are not yet adapted to the European Portuguese language: Modern Singing Handicap Index (MSHI) (Fussi and Fuschini, 2008); Classical Singing Handicap Index (CSHI) (Fussi and Fuschini, 2008), and Singing Voice Handicap-10 (SVHI-10) (Cohen *et al.*, 2009).

1.2. Motivations

This work was primarily driven by an indivisible mix of motivation, obsession and passion. It was based on the will to contribute, in a long-term perspective, for the longevity and protection of the main instrument of Fado singers: their voice. Most of this thesis was written while listening to them.

During my first steps as a Fado singer, I dealt with some difficulties that had a negative impact over my performances, from a vocal standpoint. Naturally, some disadvantages that contributed to it had been identified or hypothesized, somehow. After that, I could understand that I was not alone in this regard and, like me, subtle changes in one's routine would interfere with their vocal efficiency. The knowledge I had acquired as a speech-language pathologist interested in, helped me overcoming such troubles.

Also, both as a clinician and researcher, I noticed an enormous disparity between the clinical practices with regard to professional voices in our country and others. Also, a gap was noticed between clinical research and practice in this field. If this holds true outside our country, it will have a greater impact in ours.

Aspiring to accomplish the main goal of any researcher, which is to share and contribute with results to the scientific community, a PhD by publication was adopted, rather than a PhD by monograph. More than a mere compilation of scientific papers, each one was shaped by the results of its predecessors. Hence, the logic process of the thesis is explained below.

1.3. Research goals

The expected outcomes were to diminish the gap between the clinical practices and scientific research on occupational voice disorders in singers; to contribute to a broader scientific, academic and clinical knowledge of not only the fragilities but also the potential of the voice of Fado singers.

The aim of this doctoral thesis was to investigate Fado singers from an epidemiological point of view. Adopting a funnel approach, the relevance of the studied topic was proven, the population was calculated, increasingly tapering to the study of prevalence, risks and symptoms related to Fado singing.

Chapter II – The aims of the first study were to trace the evolution of singing research as well as to examine and interpret the published studies from a macroscopic view.

Chapter III – The aim of this study was to find and compare the prevalence of self-reported voice disorders in singers found in other studies.

Chapter IV – The aim of this study was to determine and characterize the population of *Fado de Lisboa* singers.

Chapter V – The aims of these studies were to estimate the prevalence of self-reported voice disorders in singers, as well as to describe its impact on the singers' career.

Chapter VI – The aim of this study was to identify risk and protective factors which have led to the increase of self-reported voice disorders.

Chapter VII – The aim of this study was to conduct the cross-cultural of EASE-PT as well as to validate it to European Portuguese.

In Table 2, a summary of every scientific and/or academic activity is presented.

Table 2 – Summary of the activities related to the thesis

Chapter II	**Trends in Singing Voice Research: an innovative approach**
Publications	Pestana, PM, Vaz-Freitas, S and Manso, MC (in press). "Trends in Singing Voice Research: An Innovative Approach." *Journal of Voice*. Doi: https://doi.org/10.1016/j.jvoice.2017.12.003.
	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2017). "Singing voice therapy: First step to clinical entrepreneurship in Portugal." In *7a Conferência Ibérica de Empreendedorismo: Atas da conferência*, edited by MC Negas, C Rodrigues, J Ribeiro, O Castilho, O Rua, A Oliveira, and B Pereira. Esposende: Empreend. ISBN: 978-989-97513-6-1
Presentations	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2018). "Trends in Singing Voice Research: An Innovative Approach." In *47th Annual Symposium: Care of the Professional Voice*. Philadelphia: The Voice Foundation. (Poster)
	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2017). "Singing voice therapy: First step to clinical entrepreneurship in Portugal." In *7a Conferência Ibérica de Empreendedorismo: Empreender para o Sucesso*. Ofir, Portugal: Empreend. (Oral Communication)
Chapter III	**Prevalence of Voice Disorders in Singers: Systematic Review and Meta-Analysis**
Publications	Pestana, P. M., Vaz-Freitas, S., and Manso, M. C. (2017). "Prevalence of voice disorders in singers: systematic review and meta-analysis." *Journal of Voice*, 31(6), 722-727. doi:10.1016/j.jvoice.2017.02.010.
Presentations	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2016). "Prevalence of voice disorders in singers: systematic review and meta-analysis." In *CoMeT 2016.* Milan: Collegium Medicorum Theatri. (Oral Communication)
	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2016). "Self Perceived Voice Disorders in Singers: Systematic Review and Meta-Analysis." In *28th Congress of the UEP and 22nd Congress of the SOMEF.* Bilbao: Union of The European Phoniatricians and Sociedad Médica Española de Foniatría. (Oral Communication)
	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2016). "Prevalência de Perturbações Vocais em Cantores: Revisão Sistemática." In *Dias da Investigação 2016*. Oporto: Universidade Fernando Pessoa. (Oral Communication)
Chapter IV	**How many Fado singers exist in Portugal? Population size calculation**
Publications	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2017). "How Many Fado Singers Exist in Portugal? Regulation through Cultural Entrepreneurship." In *7a Conferência Ibérica de Empreendedorismo: Atas da conferência*, edited by MC Negas, C Rodrigues, J Ribeiro, O Castilho, O Rua, A Oliveira, and B Pereira. Esposende: Empreend. ISBN: 978-989-97513-6-1
Presentations	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2017). "Determinação do tamanho da população dos cantores de Fado". In *Dias da Investigação 2017*. Oporto: Universidade Fernando Pessoa. (Oral Communication)
	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2017). "How many Fado singers exist in Portugal? Regulation through cultural entrepreneurship". In *7a Conferência Ibérica de Empreendedorismo: Empreender para o Sucesso*. Esposende: Empreend. (Oral Communication)

Chapter V	**Prevalence, characterization and impact of voice disorders in Fado singers**
Publications	Pestana, P. M., Vaz-Freitas, S., and Manso, M. C. (in press). Prevalence, Characterization, and Impact of Voice Disorders in Fado Singers. Journal of Voice. *Journal of Voice*. doi:10.1016/j.jvoice.2018.10.015.
Presentations	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2017). "Prevalence of voice disorders in Portuguese Fado singers: Preliminary results." In *11° Corso internazionale di foniatria e logopedia*. Ravenna: La Voce Artistica 2017. (Oral Communication)
Chapter VI	**Risk factors for voice disorders among Fado singers**
Publications	Under review
Presentations	Ready for submission
Chapter VII	**Evaluation of the Ability to Sing Easily: Adaptation and validation to the European Portuguese language**
Publications	Under review
Presentations	Pestana, P. M., Vaz-Freitas, S. and Manso, M. C. (2018). "Evaluation of the Ability to Sing Easily (EASE): Instrument validation process to the European Portuguese language." In *International Voice Symposium – Care of the Professional Voice*. Salzburg: International Voice Center Austria. (Poster)
	Other relevant publications
Book chapter	Vaz-Freitas, S., Alegria, R., Pestana, P. M. (in press). Saúde Vocal e Prevenção de Alterações da Voz em Professores de Desporto em Natação. In Brasil, C., Catrib, A. and Caldas, J. (Eds.), *Tendências e Tecnologias na Promoção da Saúde nos Espaços Educacionais*. Fortaleza: UNIFOR
Paper	Vaz-Freitas, S., Pestana, P. M., Almeida, V. and Ferreira, A. (2018). Acoustic analysis of voice signal: Comparison of four applications software. *Biomedical Signal Processing and Control*, *40*, 318-323. Vaz-Freitas, S., Pestana, P. M., Almeida, V., and Ferreira, A. (2015). Integrating voice evaluation: correlation between acoustic and audio-perceptual measures. *Journal of Voice*, 29(3), 390-e1.
	Other relevant presentations
Presentations	Pestana, P. M. (2017). "Alterações da Voz em Profissionais da Voz: Classificações e Epidemiologia". In *V Jornadas dos Meios Complementares de Diagnóstico e Terapêutica em ORL*. Oporto: Centro Hospitalar do Porto, Hospital Geral de Santo António.
	Pestana, P. M. (2017). "Alterações da Voz nos Cantores de Fado". In *PubhD #6*. Oporto: PubhD
	Pestana, P. M. (2016). "Perturbações Vocais em Cantores de Fado: Prevalência e Factores de Risco". In *I Encontro de Metodologias de Investigação: Da teoria à prática*. Oporto: Universidade Fernando Pessoa
	Vaz-Freitas, S., Rego, A., Carvalho, I. and Pestana, P. M. (2017). Patient-Reported Outcome Measures (PROM) in Pediatric Dysphonia: pVHI and pVR-QOL. In *Pan-European Voice Conference 12*. Ghent: PEVOC
	Vaz-Freitas, S., Teixeira, A. F., Pestana, P. (2017). Self-perception of quality of life after total laryngectomy. In *Pan-European Voice Conference 12*. Ghent: PEVOC

	Vaz-Freitas, S., Santos, M., Cardoso, E., Carvalho, I., Pestana, P. 2017. Unilateral vocal fold paralysis in elderly patients: efficacy of Speech Therapy. In *Pan-European Voice Conference 12*. Ghent: PEVOC
	Vaz-Freitas, S. and Pestana, P. (2016). Pediatric dysphonia sample: aerodynamic and audio perceptual analysis. In *28th Congress of the UEP and 22nd Congress of the SOMEF*. Bilbao: Union of The European Phoniatricians and Sociedad Médica Española de Foniatría
	Pestana, P. and Vaz-Freitas, S. (2015). Aerodynamic measures: accuracy in childhood dysphonia. In *11th Pan-European Voice Conference*. Firenze: PEVOC
Posters	Pestana, P. and Vaz-Freitas, S. (2015). Length and Frequency of Speech Therapy on Childhood Dysphonia. In *11th Pan-European Voice Conference*. Firenze: PEVOC
	Vaz-Freitas, S. and Pestana, P. (2015). pVHI: Suitability in a European Portuguese Cluster. In *11th Pan-European Voice Conference*. Firenze: PEVOC
	Vaz-Freitas, S., Ferreira, S., Pestana, P. and Carvalho, I. (2015). PVR-QOL: Outcomes of the Pre Test Application in a European Portuguese Sample. In *11th Pan-European Voice Conference*. Firenze: PEVOC
	Vaz-Freitas, S., Cardoso, E., and Pestana, P. (2015). Vocal Fold Paralysis – Speech Therapy Effectiveness Using Audioperceptual Assessment. In *11th Pan-European Voice Conference*. Firenze: PEVOC
	Relevant attended courses during the PhD
	Introduction to Meta-analysis with Stata. Lecturer: Professor Aurélio Tobias (Spanish Scientific Research Council). Oporto: ISPUP. 8 hours (27/9/17)
	Network Meta-Analysis with Stata. Lecturer: Professor Aurélio Tobias (Spanish Scientific Research Council). Oporto: ISPUP. 12 hours (28/9/2017-29/9/17)
	Development of questionnaires and scales: Factorial, exploratory and confirmatory analysis. Lecturers: Carla Lopes, Milton Severo. Oporto: ISPUP. 28 hours (25/52017-9/6/2017).

Chapter II – Trends in Singing Voice Research: an innovative approach

2.1. Abstract

Objectives: The objectives of this study were to trace and describe research patterns in singing voice, to compare the amount of published research over time, to identify journals that published most papers on "singing voice," and to establish the most frequent research topics.

Materials and Methods: The study uses qualitative and quantitative approaches through descriptive statistics, text mining, and clustering. The authors conducted a search to identify scientific papers. The titles and abstracts were analyzed regarding word frequency and relations between them, through hierarchical cluster analysis and co-occurrence networks. The frequency of journals was calculated, as well as the amount of papers across time.

Results: Since 1949, 754 papers were published and an increase was noticed. Even though 162 journals were identified by the authors, the *Journal of Voice* holds the majority of papers, in every analyzed period. An evolution of studied topics is described. Up to 2010, the main theme was professional singers, especially classical and opera interpreters. Since then, voice quality and the effects of training gathered more attention.

Conclusions: The growing interest in singing has been conspicuous since the first indexed paper. However, it has been slightly slowing down. Until 2010, great importance was given to the voice quality of singers and their occupational demands. Acoustic analysis was widely used to study the effects of training. Since 2010, the concern with functionality is increasing, rather than the organic voice structures. Musical perception studies have been a trend, as well as the use of electroglottography.

2.2. Introduction

Voice research and focal themes of interest have evolved across times. The demands of professional voice use currently play an important role in clinical research – and singing is no exception (Sataloff, 2006a, 2006b; Riley and Carroll, 2016; Rubin, 2016). Professional voice users comprise people who depend on their voice at, at a high level of proficiency demands (eg, lawyers, telemarketers, actors, singers). Singers are considered elite vocal performers among all professional voice users (Koufman and Isaacson, 1991). Compared to speech, such activity requires more endurance, flexibility and vocal tract control (Phyland, 2014). There is a lot of hidden information in scientific literature that cannot be studied from a simple statistical point of view. Data mining tries to discover and interpret such information. Specifically, text mining, as an interdisciplinary approach, analyzes data in natural language text through the use of algorithms (Choudhary *et al.*, 2009; Han *et al.*, 2011; Clark, 2013; Nie and Sun, 2017). Clustering is a process to group words from a dataset into clusters, according to their frequency and proximity (Viswanth *et al.*, 2009). It finds and establishes natural groups of data elements (Wong *et al.*, 2009). The combination of text mining and bibliometric techniques allows the identification of unseen patterns in research fields. Bibliometrics and scientometrics are relatively unexplored from both qualitative and quantitative perspectives (Nie and Sun, 2017). A bibliometric approach to research allows the quantification of studies of literature related to singing voice, promoting knowledge advancement in the field related to social and to policy questions (Ding *et al.*, 2001). Some limitations are known – this kind of analyses does not represent the quality of the included studies – rather, it is merely a quantity indicator. Also, this method does not allow to measure the impact of each topic or single paper (eg, number of citations) (Belter, 2015). Thus, this study sheds new light on the identification of major academic branches and research trends in singing voice. The study presented here is one of the first investigations using this technique.

This paper primarily aims to trace the history of research in singing voice. It sets out to compare the amount of published research over decades and, yearly, in the last decade.

Journals are identified that published the most papers on the topic of “singing voice”. Also, most recurrent research subtopics were established.

2.3. Methods

The study uses qualitative and quantitative approaches through descriptive statistics, text mining and clustering.

i. Source selection and search strategy

PubMed was used to conduct the search using the expression *(singing[mh] OR singer[tiab] OR singers[tiab]) AND (voice[mh] OR voice[tiab]) NOT (neoplasms[mh] OR laryngectom*[tiab])*. PubMed is a widely used free scientific search engine that provides the access to references of scientific papers. In order to narrow the search, authors included some Medical Subject Headings – MeSH terms or [mh] - and limited the search to title and abstract - [tiab]. Filters to article types (clinical trial, review) and species (humans) were activated. Publication date filters were activated as needed.

ii. Information extraction

Results from PubMed were exported in two different ways. First, a CSV file was exported with information on indexation data. LibreOffice© 5.2.3.3 was used to import and transform text into columns. Only columns with title, journal, year of publication and first author remained. Secondly, two TXT files were generated with titles and abstracts— each one for one time period (1949-2010 and 2011-2016), hereafter referred as 1st and 2nd time periods, respectively.

iii. Treatment of data

Graphics of published research distribution were generated by the previous software. Frequency tables of published research about singing voice and journals were generated by IBM® SPSS© Statistics V23.

Authors used text a mining approach to identify and compare main topics between two-time intervals (from 1949 up to the end of 2010; from the beginning of 2011 up to the end of 2016). KH Coder © version 3 was used to conduct semantic measures. Based on the previously described search query, information regarding titles and abstracts was retrieved from PubMed as a text file. Standard stop words provided by software were used, along with some selected by authors to exclude usefulness of such information used by PubMed indexation:

> index, author, %, jjvoice, doi, /, publish, rights, reserve, copyright, electronic, address, significant, difference, datum, j.jvoice, information, methods, method, conclusion, conclusions, introduction, objectives, f.

Hierarchical cluster analysis was conducted for the same periods. Such method allows finding and analyzing combinations of words with similar appearance grouped into patterns with a dendogram as a final result (Higuchi, 2016). For this, the Ward method and Jaccard distance were used. Such an approach creates word groups that point to major themes. Both methods transform the data into a visual representation while considering the nature of words (Ding *et al.*, 2001).

Co-occurrence networks of words were generated for both periods. This method presents closely associated words connected with lines (Higuchi, 2016). The analysis was based on sentences and the filter edge was set up to 30 words. Only nouns and adjectives were analyzed. This allowed the detection of high frequency words occurring together and the identification of communities. Graphs were created – using a color coding – to represent parts of the network that are more closely associated with each other. (Higuchi, 2016). Node sizes were set up to mirror word frequency, and edge thickness to the strength relation between words.

2.4. Results

i. Amount of published research

The first study retrieved by the query was published in 1949. Since then, 754 research studies have been published. An analysis of publishing distribution over decades is presented in Table 3. Figure 1 represents the amount of research published per year in the last decade, representing 45.32% of the total amount since the beginning.

Table 3 – Distribution of published research about singing voice over decades

Years	Number of papers
2011-present	225
2001-2010	259
1991-2000	116
1981-1990	60
1971-1980	28
1961-1970	27
1949-1960	39
Total	***754***

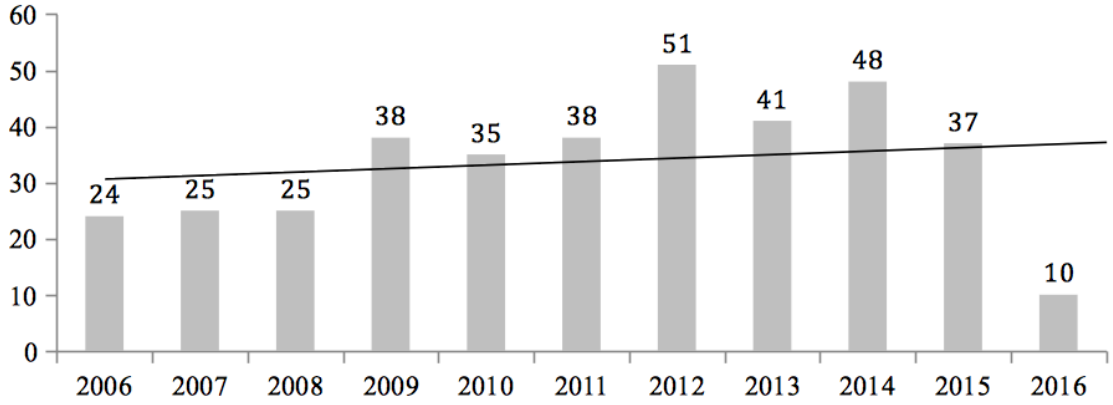

Figure 1 – Distribution of published research on singing over the last decade with linear forecast trend line. Number of publications per publication year.

ii. Journals that published most papers

Since 1949, 162 journals published studies on singing. Research of the last decade (2006–2016) was published in 82 different journals. A ranking of journals was created, taking into account the number of published papers on singing. In both periods, the Journal of Voice published the largest number of studies, as seen in Tables 4 and 5.

Table 4 –Top 10 Journals on singing research (from 1949 to the end of 2005)

Journal	Frequency	%
1. Journal of Voice	108	28.3
2. Folia Phoniatrica (Basel)	30	7.9
3. Revue De Laryngologie-Otologie-Rhinologie	22	5.8
4. The Journal of the Acoustical Society of America	17	4.5
5. Folia Phoniatrica Et Logopaedica	16	4.2
6. Vestnik Otorinolaringologii	16	4.2
7. Logopedics, Phoniatrics, Vocology	15	3.9
8. Journal of Speech and Hearing Research	8	2.1
9. The Laryngoscope	7	1.8
10. HNO	6	1.6

Table 5 –Top 10 Journals on singing research (from the beginning of 2006 to 2016)

Journal	Frequency	%
1. Journal of Voice	152	40.9
2. Logopedics, Phoniatrics, Vocology	37	9.9
3. The Journal of the Acoustical Society of America	32	8.6
4. Folia Phoniatrica Et Logopaedica	13	3.5
5. PLoS One	9	2.4
6. Revue De Laryngologie-Otologie-Rhinologie	7	1.9
7. HNO	6	1.6
8. Jornal Da Sociedade Brasileira de Fonoaudiologia	5	1.3
9. Vestnik Otorinolaringologii	5	1.3
10. Annals of the New York Academy of Sciences	4	1.1

iii. Most frequently researched topics

In Figure 2, both periods show six clusters that correspond to the same number of cuts in the tree, at about level 1.1 (observed value). The bars on the left side of the colored dendrogram shown in Figure 2 indicate the term frequency of each word. The dendogram generated for the first time period (Figure 2A) revealed six different groups.

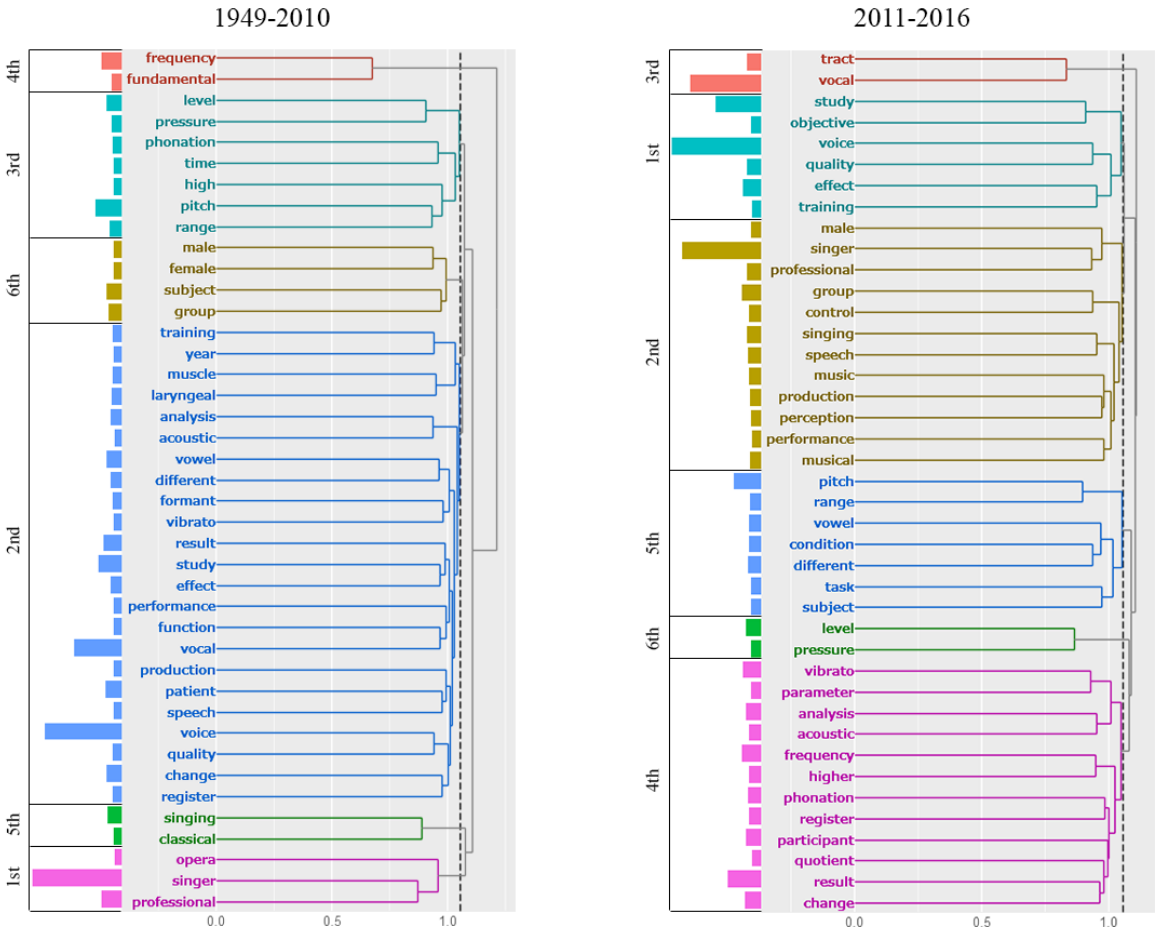

Figure 2 – Hierarchical cluster analysis for titles and abstracts (a – 1949 to 2010; b – 2011 to 2016).

The first group shows that “singer” was frequently near “professional.” Thus, professional singer is considered the first main theme. “Opera” was the word most related to professional singer.

In the second group, “voice” was the most frequently used word appearing mainly related to “quality,” so this is the second main theme. In turn, voice quality was related to “change” and “register.” The expression “vocal function” was related to “performance.” Other words from this cluster suggest the analysis of acoustic parameters related to singing (“acoustic analysis,” “vibrato,” and “formant”) and training influence on laryngeal muscles (“training,” “year,” “laryngeal,” and “muscles”). The third cluster shows the highly frequent word “pitch” related to “range,” thus considered as the third main theme. The fourth cluster is composed by fundamental frequency, on its own. The fifth cluster is about classical singing, mirroring the importance given by scientific community to that genre of singers.

For the second time period, the dendogram (Figure 2B) also revealed six different groups. The first cluster also relates the high-frequency word “voice” to “quality,” considered as the first main theme. However, in this period, an emphasis was given to training effect. The second cluster’s most common word was “singer,” also related to “professional”—thus, the second main theme. The presence of the “control group” expression suggests that there were more studies with clinical relevance and evidence. Musical perception is also a trend in the second cluster. The third cluster contains only “vocal tract,” and the fourth cluster is composed of acoustic and electroglottographic analysis.

Co-occurrence networks (Figures 3 and 4) reveal 41 most frequent words for each time period. Between 1949 and 2010, different communities were identified.

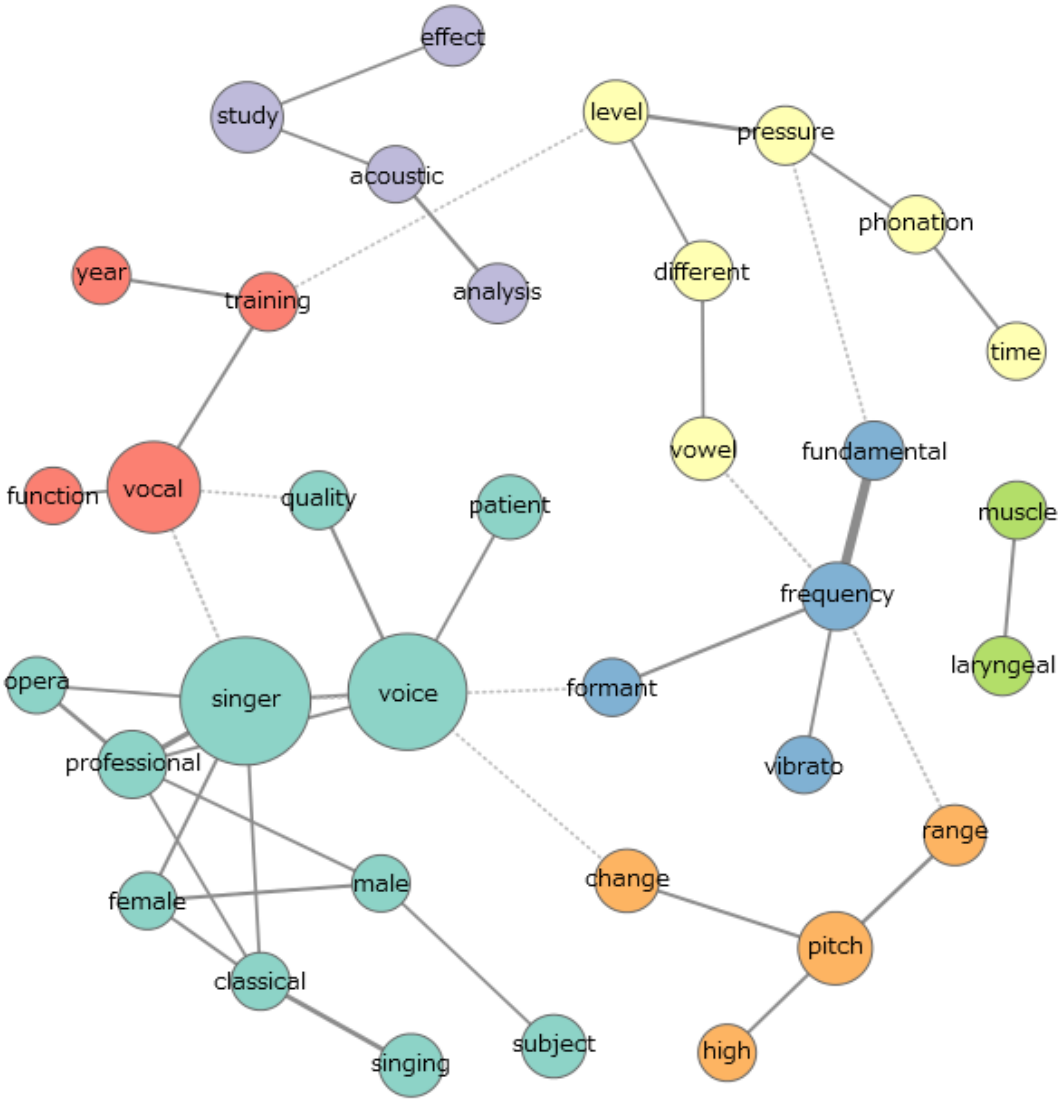

Figure 3 – Co-occurrence network from titles and abstracts (1949-2010).

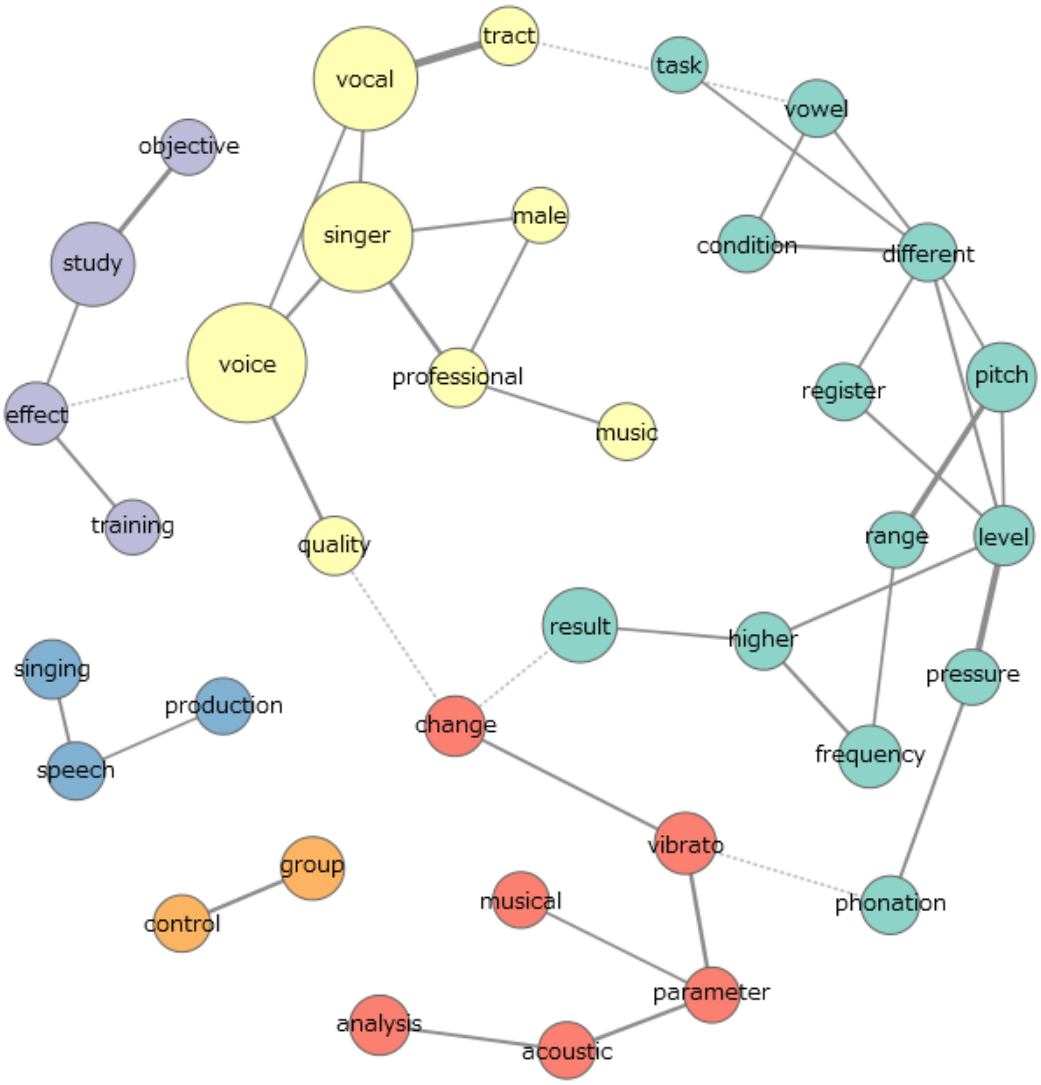

Figure 4 – Co-occurrence network from titles and abstracts (2011-2016).

The first community (light green) is identified by biggest nodes, representing highest frequency words “singer” and “voice.” Professional is close to the first, with a thicker edge revealing a strong connection between them. Terms “female” and “male” are present, although just the first is connected to “classical” and “singing.” “Voice” is related to “patient” and “quality,” which reveals high interest in the clinical standpoint. The red community can be pointed out as the second one, because of its dual connection to the first. “Vocal” and “function” are very close to each other. “Year” and “training” are also in that community. The blue community is the third, as it has four edges to three different communities: including “fundamental frequency”, “vibrato,” and “formant.” The yellow community is the fourth as it has three edges to two different communities and includes words related to glottal competence. The fifth community is the orange one, including “pitch”, “range,” and “change”; the “high” word is also connected to pitch. The sixth community is the purple one, not directly related to any other community, but intercepted by one edge. This includes the words “study”, “effect,” and “acoustic analysis,” revealing that most studies used such assessment method and analyzed effects. The most unrelated community was the green one, as the seventh, mirroring some isolated importance given to laryngeal musculature.

Between 2011 and 2016, six communities were identified. The first one (yellow) includes the most frequent words, also connecting “singer” to “voice” and “vocal.” The second community has scattered words, although “pitch range” and “pressure level” are central words and are close to each one. The red community is the third because it connects to two communities. Purple is the fourth, denoting the study of “training effects.” The remaining communities’ order is not clear. One relates “speech production” to “singing,” whereas the other has “control” and “group” suggesting a higher usage of such clinical research methodology.

2.5. Discussion

The interest in singing has been conspicuously growing since the first indexed paper in PubMed was published in 1949. However, since the apogee in 2012, it has been slightly slowing down. An abrupt decrease was noticed in 2016, even though the search was conducted during the last days of that year — maybe due to the not yet completed indexation of PubMed. The linear forecast trend line indicates a slight positive tendency of such growth, except the last 2 years.

In the journal ranking, the *Journal of Voice* was the most prolific for both time periods.

It is interesting to note that *Jornal da Sociedade Brasileira de Fonoaudiologia* came into the list in the last decade, as it is published in Portuguese. Another two non-English written journals were found in both lists — *Vestnik Otorinolaringologii*, Russia, and *HNO*, Germany.

Until 2010, the dominating topic was the professional singer, mainly opera singers. Great importance was given to the voice quality of singers and to their occupational demands. During this period, “pitch range” received great attention, as well as “acoustic analysis.” Classical singing was frequently under study. Fundamental frequency, vibrato, and formants were the most studied characteristics.

From 2010 up to 2016, the research focus underwent slight changes. Voice quality related to training effect received more attention, suggesting that concern with functionality is increasing, against organic structure in the first period. Also, researchers are looking more into the function rather than the subject. In the last decade, it was possible to notice that male singers were studied more. In this epoch, studies seem to be more clinical. Musical perception and electroglottography emerged as trend topics in this period.

2.6. Conclusion

This is a brief paper that summarizes almost all the research that has been conducted over time. Although it is a relatively new topic in scientific research, the field of singing voice has evolved rapidly. The number of papers published annually has increased steadily, as well has the clinical relevance of singing. The present study presents an innovative approach for the study of this field, with both bibliometric and scientometric approaches. Also, it provides an overview and a comparison of research trends. The topics studied in this field have changed across time.

The authors limited their search to PubMed because of time restrictions. This approach can add a certain bias, because it indexes publications from life sciences and biomedical fields; therefore, some scientific papers can be missing. A selection bias can also be considered when these research approaches are used. Some of the reported topics can appear out of its original context, which induces interpretation errors. Even though publication count is one of the most used indicators, it can be criticized because it reveals the quantity and not the quality of the publications. In the future, it is recommended to include more search engines to cover other fields. The number of analyzed words was limited on purpose, so the interpretation could be done — future researchers can use other selection methods. Another type of methodological approach could be adopted, so the validity and precision can be achieved. It would be relevant to reproduce this research in every decade, so that history and trends could be easily traced.

Chapter III – Prevalence of Voice Disorders in Singers: Systematic Review and Meta-Analysis

3.1. Abstract

Objective: review the prevalence of self-reported voice disorders in singers.

Methods: a systematic review of five major scientific databases was conducted. An extensive search strategy was used considering the rules of each database. Original articles were included only if they had data related to self-perception of dysphonia in the past. Furthermore, heterogeneity and its relative significance were assessed. *Study design:* systematic review; and meta-analysis.

Results: 2371 articles were identified; duplicates were deleted; screenings were conducted; and inclusion and exclusion criteria were applied. The final analysis was conducted on 11 studies. The most implemented instruments for the study were customized questionnaires. The findings about singing styles, voice use, and age were found to be different among subjects. The overall prevalence of self-reported dysphonia in singers was 46.09% (95%CI: 38.16-54.12). The heterogeneity was considerable among the studied samples (I^2=90.59%). Four groups were then established – students, teachers, classical, and non-classical – and compared regarding overall prevalence (21.76% in students and significantly higher and non-different in the other 3 groups, 55.15%, 40.53%, 46.96% respectively) and heterogeneity (low only for the students' studies).

Conclusion: although with low homogeneity, singers present a high prevalence of self-perceived dysphonia over their careers. Singing students were a group with a lower prevalence. On the other hand, traditional and popular music singers, as well as singing teachers, revealed significantly higher prevalence of self-perceived dysphonia. Overall, singers are likely to report voice disorders, no matter their singing style or skills. This highlights the need of a preventive approach to address voice disorders in traditional and untrained singers.

3.2. Introduction

"Singer" is a term that, in a broad sense, can include anyone: a young singing student; an untrained popular or traditional singer; or a famous classical singer. Among them, the demands, the training and the effects of their voice use will vary. Singers are considered elite vocal performers among all the professional voice users (Koufman and Isaacson, 1991). As suggested by Phyland, "singers could be considered vocal athletes in the sense that they have to carry out complex phonatory maneuvers, and require endurance, flexibility and vocal tract control that exceed the needs of the speaking voice" (Phyland, 2014, p. 20). The same author assumes that they will rely on a quality voice for longer periods of time and under less than ideal conditions for vocal health. The age of the performers as well as the training they went through, will influence their ability and use of voice (Mozzanica *et al.*, 2016).

A disruption in voice quality brings a negative impact on performers' careers as well as on business' profits (Titze *et al.*, 1997). For some voice professionals, even a slight voice disorder represents a significant, functional and occupational impairment, and affects their quality of life related to work (Woo, 2015). Naturally, to seek help or treatment, the voice user must recognize the voice problem. Compared with the other laryngological assessment procedures, "perceptual measurement has become the accepted 'gold standard' for voice assessment" (Webb et al., 2007, p. 765). The perception of voice plays an important role in a singer's life, as they are more likely to notice subtle changes in their voice (Phyland, 2014).

If the perceptual assessment of voice is conducted by someone other than the self, its impact on the quality of life will be not reflected (Steen *et al.*, 2008). The importance assigned to self-perception of voice disorders has increased and, in the last few years, some important research tools have emerged based on it (Jacobson *et al.*, 1997; Hogikyan and Sethuraman, 1999; Ma and Yiu, 2001; Steen *et al.*, 2008). Most of them have been translated and adapted to other languages or specific clinical populations. On singing voice, an original instrument (EASE) was created (Phyland, Pallant, *et al.*,

2013) and some adaptations of others (e.g. VHI) were already conducted (Cohen *et al.*, 2007, 2009; Murry *et al.*, 2009; de Ávila *et al.*, 2010; Moreti *et al.*, 2011; Paoliello *et al.*, 2013).

Among professional voice users, singers have been pointed out as the most demanding vocal group (Petty, 2011). Even though they are recognized as being more susceptible to voice disorders, studies corroborating such prevalence are scarce (Verdolini and Ramig, 2001; Williams, 2003; Phyland, 2014). The great variability among the existing ones is mainly related to inconsistent definitions of what a voice disorder is (Roy *et al.*, 2005). Previous authors relied on self-perception and considered a voice disorder to be "any time the voice does not work, perform, or sound as it normally should, so that it interferes with communication". The sample in that epidemiological study was general population (Roy *et al.*, 2005).

Some studies (Titze *et al.*, 1997; Martins *et al.*, 2015) report epidemiological data about voice disorders in singers. Among them, Titze *et al.* found that 11.5% of the clinical voice population was composed of singers, and there was a high representation of non-classical singers. The size of that study allowed them to conclude that singers represent 0.22% of USA workforce (Titze *et al.*, 1997).

These results contrast with others that found 2.43% of singers among voice patients (Martins *et al.*, 2015). Among the working treatment-seeking population, there is an estimation of 71.9% of professional voice users (Mozzanica *et al.*, 2016), while among general population, 8.8% report past vocal problems and 6.2% refer to voice problems at that moment (Verdolini and Ramig, 2001).

Until now, the authors did not find any study comparing data about prevalence of voice problems in singers. Besides, this systematic review allows an understanding of the importance of voice disorders associated with different singing styles. This study aims to find out the prevalence of self-reported voice disorders among singers using a meta-analysis.

3.3. Materials and Methods

i. Search Strategy

Studies included in this research were selected through a systematic search of literature in the PubMed, Web of Science, Academic Search Complete, CINHAL and Medline databases. Grey literature was not included. An extensive search strategy was adopted (detailed and presented in section 3.7). Searches were restricted to original papers written in English, Portuguese or Spanish, and published in peer-reviewed journals.

A senior librarian was asked about the queries/search strategy to be used.

ii. Study Selection

Study design – the following study types were included: retrospective and prospective cohort, cross sectional, case control and cross-sectional. The excluded studies were on intervention, reviews, case reports or editorials.

Participants – studies about animals were excluded. It was a must for the participants in the selected studies to be singers of any style. There was no age limit; for instance, there are young boys and girls performing as well as choirs with elderly artistes/singers. Those studies in which the subjects were healthy were not included.

Timing – no minimum time limit was applied. Studies published up to January 15th, 2016 were included.

Disorder – all the studies reporting data of self-reported voice disorders in the past were included.

Other disorders – cases with voice problems not associated with occupational use were excluded from the study.

iii. Data extraction

There was a screening of the results based on 4 different phases. In phase one, duplicates were detected (42) and removed using Mendeley Desktop (R). In the second phase, irrelevant papers were excluded based on titles (1329). The third phase aimed to exclude irrelevant studies based on abstract (729). The previously presented criteria were reapplied in the last phase. Study selection is detailed in the Figure 5.

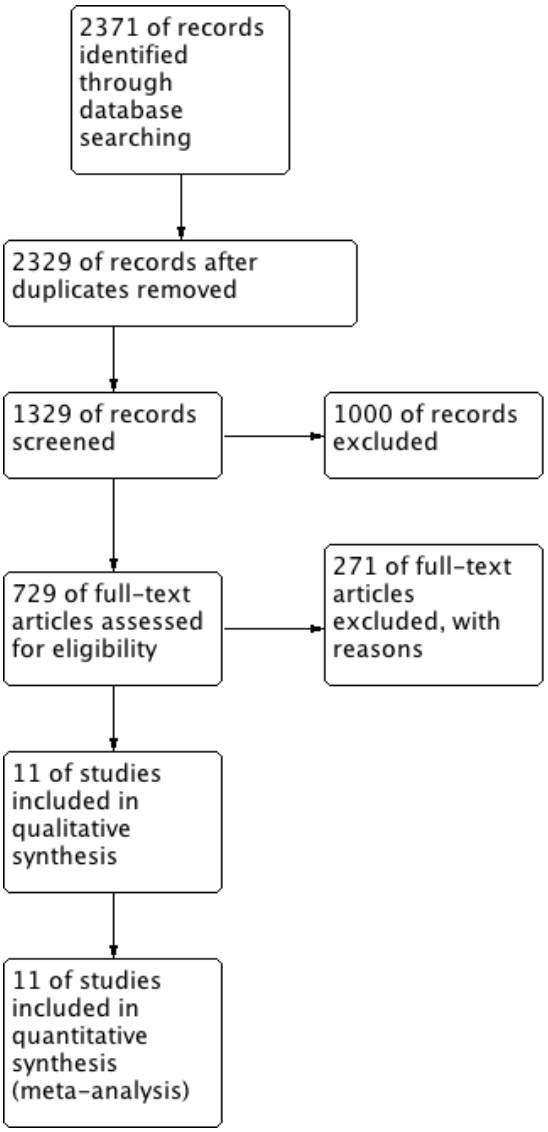

Figure 5 – Study flow diagram.

iv. Statistical analysis

All calculations and graphs were made using the software MedCalc ® 14.8.1.0 (Ostend, Belgium). The statistical heterogeneity among studies was assessed using the inconsistency index, I^2 measure. The analysis was conducted with a random-effects model, and the standardized mean difference with 95% confidence intervals (95%CI).

The authors were as detailed as possible in order to make this research reproducible in future. This systematic review and meta-analysis did not intend to compare interventions. This is the reason why common protocols (e.g. PRISMA) were not formally used.

3.4. Results

Our search strategy identified 2371 articles among the aforementioned five databases. After conducting the screening in four phases, 11 studies were identified (Miller and Verdolini, 1995; Tepe *et al.*, 2002; Cammarota *et al.*, 2007; Boominathan *et al.*, 2008; Erickson, 2012; Hapner and Gilman, 2012; Rocha *et al.*, 2012; Sataloff *et al.*, 2012; Watson *et al.*, 2013; Vaiano *et al.*, 2013; Achey *et al.*, 2016) and, therefore, included. In Table 6, authors summarize the characteristics of the studies.

Table 6 – Characteristics of related studies included in the meta-analysis

Reference	Country	Study type	Study Population	Sample	Assessment	Reported Prevalence
Achey *et al*., 2016	USA	Cross-sectional, survey-based study	Students of classical singing	n=104, 22yo (17-63), F=66%, M=34%	Vocal hygiene and voice handicap survey	24% (n=25)
Vaiano *et al*., 2013	Brazil	Descriptive transversal study	Classical choral singers	N=50, 18-57yo, F=58%, M=42%	Self-explanatory questionnaire	38% (n=19)
Watson *et al*., 2013	England	Cross-sectional study	Musical theatre students	n=49, 20yo (18-23), M=57.1%, F=42.9%	VHI-10	16.3% (n=8)
Erickson, 2012	USA	Descriptive cross-sectional study	Artists performing at local venues	n=270, mode = 25-29yo, M=67.05%, F=32.20%	53-item questionnaire	56% (n=150)
Hapner and Gilman, 2012	USA	Prospective observational design	Reform Jewish cantors	n=75, M=34%, F=66%, median age 40-59yo (20-79)	35-item multiple-choice survey	65% (n=49)
Rocha *et al*., 2012	Brazil	Retrospective cohort	Popular singers	n=100, M=50%, F=50%, age mode=21-40yo	Self-explanatory questionnaire	61% (n=61)
Sataloff *et al*., 2012	USA	Prospective evaluation	Singing teachers	n=72, M=16.7%, F=83,3%, 48.7yo±12.0 (27-82)	Strobovideolaryngoscopy, questionnaire, voice/speech recording	47% (n=34)
Boominathan *et al*., 2008	India	(not clear)	Professional stage singers and students	n=100, M=54%, F=46%	Questionnaire about vocal hygiene	37% (n=148)
Cammarota *et al*., 2007	Italy	Case-control	Professional opera choristers	n=351, M=44.73%, F=55.27% (40.8yo±10.3)	GERS Screening self-administered questionnaire	43.59% (n=153)
Tepe *et al*., 2002	USA	Retrospective cohort	Young choir singers	n=129, M=26.36%, F=72.87%, Unspecified genre=1.29%, 15yo±4.4 (3-25)	Vocal habits and hygiene questionnaire	55.8% (n=72)
Miller and Verdolini, 1995	USA	Case-control	Teachers of singing	n=129, M=39.53%, F=34.88%, 50yo (30-82)	Questionnaire	64% (n=80)

A twenty-year interval was obtained, with studies from 1995 up to 2015. Most of them were from USA (n=6), followed by Brazil (n=2). England, Italy and India got one study each. It was not possible to find out the mean age because of the lack of methodological consistency – some used age as an integer, while others referred to ranks. However, young adults comprised most of the samples.

In this meta-analysis, the pooled prevalence of self-reported dysphonia among singers (with 95% CI) is 46.09% (95%CI: 38.16-54.12) for the random effects model (Figure 6). A considerable heterogeneity was obtained for the different studies included in the meta-analysis (I^2=90.59%).

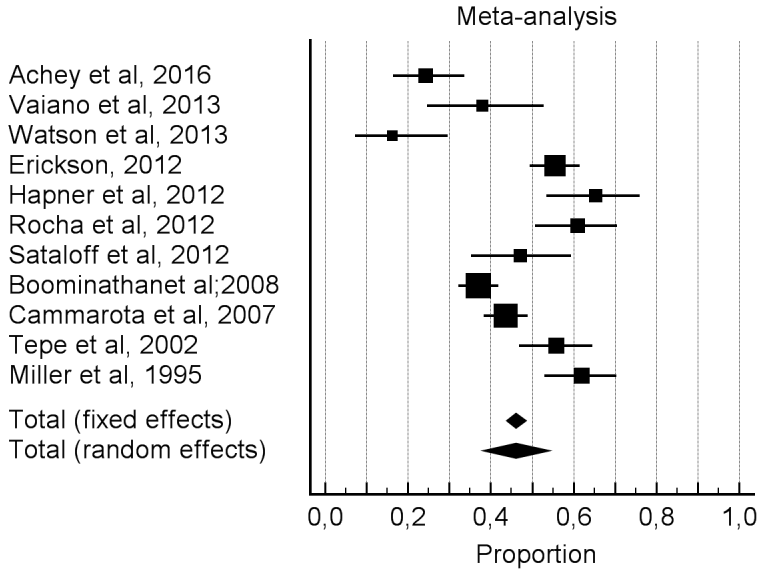

Figure 6 – Forest plot of self-reported prevalence of voice disorders in singers.

Studies with students (Watson *et al.*, 2013; Achey *et al.*, 2016) show an overall prevalence of voice disorders of 21.76% (15.04%-29.35%) and a non-significant heterogeneity (I^2=14.72%). Studies about non-classical styles, like traditional and popular music singers (Boominathan *et al.*, 2008; Erickson, 2012; Hapner and Gilman, 2012; Rocha *et al.*, 2012; Watson *et al.*, 2013) present a higher overall prevalence of voice disorders of 46.96% (32.98%-61.19%) and a considerable heterogeneity (I^2=93.77%). Singing teachers (Miller and Verdolini, 1995; Sataloff *et al.*, 2012) is another group with high overall prevalence of voice disorders of 55.15% (40.76%-69.11%) and a substantial to considerable heterogeneity (I^2=75.52%). Regarding classical singers (Tepe *et al.*, 2002; Cammarota *et al.*, 2007; Vaiano *et al.*, 2013; Achey *et al.*, 2016), authors found an overall prevalence of 40.53% (28.65%-53.00%) and a considerable heterogeneity (I^2=88.06%).

3.5. Discussion

With this study, the authors aimed to collect studies revealing data about prevalence of self-reported dysphonia in singers. The findings suggested that a great number of singers had a history of voice problems during their careers. The mean prevalence of self-reported dysphonia obtained in the meta-analysis was higher in singers (46.01%) when compared against the 18.8% in general population (Roy *et al.*, 2005). If we assume that singers have an increased awareness and concern about their voices, it can be considered a bias – it could mean that either the general population underestimates or the singers overestimate voice issues. However, more studies are needed to prove this statement, as within the general population also there are groups with high concern about their voices (e.g., professors, politicians, etc.).

A substantial heterogeneity was attained, which may not be methodological heterogeneity since the studied variable was always the same. To the authors, the major justification is because of differences among samples, in quantity and quality. However, it only represents and reflects the variability of the term “singer”.

Inspecting the forest plot and the meta-analysis data, some considerations can be made. Studies with students have significantly lower prevalence of voice disorders, compared

with other groups. A possible justification is their yet short career (Phyland, 2014), combined with their increased knowledge and awareness of vocal health and technique. Studies with traditional and popular music singers present a higher prevalence, though not significantly different from the classical and the singing teachers. The probable lack of formal training and singing technique can contribute to this (Hapner and Gilman, 2012; Phyland, 2014); however, more studies are needed to prove this assumption. Another group with high prevalence is the one of the singing teachers. The increased voice load seems to be one of the major reasons (Carroll *et al.*, 2006; Solomon, 2008; Hapner and Gilman, 2012; Phyland, Thibeault, *et al.*, 2013). All these assumptions represent future research challenges to the authors, as they are not yet proven.

3.6. Conclusion

This paper shares epidemiological data regarding self-reported disorders in singers. From the clinical standpoint, this study is important to obtain information regarding the needs of treatment of voice disorders in singers.

The variability of methodologies adopted to calculate prevalence across studies makes it difficult to establish comparisons. For instance, some authors assess the presence of laryngeal abnormalities at some point, whereas others consider the self-report of dysphonia in the past. In the second group, the prevalence is more likely to be higher, since a greater time-period was considered. Also, to seek professional opinions, singers must recognize a problem. These were the reasons why authors of the present study opted to rely on self-reported voice disorders.

The term singer is unspecific as it can apply to an imitation singer, up to a classical singing teacher, and a broad spectrum of singers in-between. With this variability comes a different vocal, training and performance demands.

Variables such as singing style, vocal education, and occupational demands seem to contribute, both positively and negatively, to increasing the prevalence of voice disorders. Singing students were the only group with significantly lower prevalence. On the

other hand, traditional and popular music singers, as well as singing teachers, revealed significantly higher prevalence of self-reported voice disorders. The authors suggest increasing the number of searched databases in future.

These results should be used to stimulate prevention programs targeting this specific population at high risk. Furthermore, this indicates an urgency to prevent dysphonia among each sub-population observed in this study.

Before making any decision, a clinician relies on clinical history reported by the patient – some complaints are impossible to prove *in loco* although they are not less important. This highlights the need of including self-reporting in clinical reasoning and decision making.

With this paper, authors hope that the clinical community will be more aware about the high prevalence of past voice alterations. Furthermore, it aims to contribute to Evidence Based Practice.

The overall conclusion is that singers are likely to report voice disorders, no matter their singing style or ability. This highlights the need of a preventive approach to address voice disorders in traditional and untrained singers.

3.7. Search strategies

Pubmed – ((((dysphonia[mh] OR phonation[mh] OR aphonia[mh] OR hoarseness[mh] OR (dysphon*[tiab] OR phonation disorders[tiab] OR phonation disorder[tiab] OR voice disorder[tiab] OR voice disorders[tiab] OR hoarse*[tiab] OR voice problem[tiab] OR voice problems[tiab] OR voice loss[tiab])) AND (vendor[mh] OR school teacher[mh] OR singing[mh] OR clergy[mh] OR Military Personnel[mh] OR counseling[mh] OR social workers[mh] OR lawyers[mh] OR health professional[mh] OR (perfom*[tiab] OR performer[tiab] OR performers[tiab] OR vocal performer[tiab]OR vocal performers[tiab] OR professional[tiab] OR professionals[tiab] OR practioner[tiab] OR practioners[tiab] OR priest[tiab] OR priests[tiab] OR clerical[tiab] OR pastor[tiab] OR pastors[tiab] OR preacher[tiab] OR preachers[tiab] OR teacher[tiab] OR teachers[tiab] OR instructor[tiab] OR instructors[tiab] OR actor[tiab] OR actors[tiab] OR singer[tiab] OR singers[tiab] OR cantor[tiab] OR cantors[tiab] OR choral[tiab] OR choir[tiab] OR choirs[tiab] OR cheerleader[tiab] OR cheerleaders[tiab] OR soldier[tiab] OR soldiers[tiab] OR army[tiab] OR counselors[tiab] OR counselor[tiab] OR worker[tiab] OR workers[tiab] OR work*[tiab] OR attourney[tiab] OR attourneys[tiab] OR telemarketer[tiab] OR telemarketers[tiab] OR telemarket*[tiab] OR sales*[tiab] OR ticket sales[tiab] OR health care[tiab] OR telesales[tiab] OR telesale*[tiab])) NOT cancer[ti])))

Web of Science – TI=(dysphon* OR phonat* OR aphoni* OR hoarse OR hoarse* OR phonation disorder$ OR voice disorder$ OR voice problem$ OR voice loss) AND TI=(vendor$ OR sing* OR clergy OR military OR counsel* OR lawyer$ OR health professional$ OR perfom* OR professional$ OR practioner$ OR priest$ OR clerical OR pastor$ OR preacher$ OR teacher$ OR instructor$ OR actor$ OR cantor$ OR choral OR choir$ OR cheerleader$ OR soldier$ OR army OR counselor OR work* OR attourney$ OR telemarketer$ OR telemarket* OR sales* OR ticket sale$ OR health care OR telesale$ OR telesale*) NOT TI=cancer

EBSCO (ASC, CINHAL, MEDLINE) – TI (dysphon* OR phonat* OR aphoni* OR hoarse OR hoarse* OR phonation disorder OR voice disorder# OR voice problem# OR voice loss) AND TI (vendor# OR sing* OR clergy OR military OR counsel* OR lawyer OR health professional OR perfom* OR professional OR practioner OR priest OR clerical OR pastor OR preacher OR teacher OR instructor OR actor OR cantor OR choral OR choir OR cheerleader OR soldier OR army OR counselor OR work* OR attourney OR telemarketer OR telemarket* OR sales* OR ticket sale OR health care OR telesale OR telesale*) NOT TI cancer

Chapter IV – How many Fado singers exist in Portugal? Population size calculation

4.1. Abstract

Fado is an urban folk song from Portugal performed by a singer typically to the accompaniment of Portuguese and classical guitars. There is no regulatory institution to handle or to monitor the professionalization of Fado singers nor other singers. The lack of requirements to perform professionally makes the competition bigger and not so fair. The aims of this study were: to determine the population of alive Fado singers who recorded at least one phonogram; to compare subpopulations. A demographic approach was adopted. A database was built based on records of *Sociedade Portuguesa de Autores*. The author and two experts characterized all entries based on the role, gender and life status of the subjects. Authors found 411 subjects. Female performers were significantly more than male ones. Instrument players represent 4.05%. The achieved results intend to serve clinical research purposes.

4.2. Introduction

Fado is as "an urban folk song in which the singer is usually accompanied by two plucked instruments known as *viola* and *guitarra* (…). Its lyrics can take the form of a narrative, description or comment and can develop any topic, from one's own personal feelings to matters of some social concern or other" (Cook, 2004, p. 19). This music has been imbibed by the population and is transmitted through generations by its interpreters. It has become part of the world's intangible cultural heritage (UNESCO, 2011). Until the end of the 19th century, the term Fado was not related to music, at least there is no written registry. It was in 1822, that the word was first used for a dance form in colonial Brazil. Over the years, references to this Portuguese Brazilian dance became more frequent in literature. In the beginning of the 19th century, Portuguese urban society was marked by poverty and lawlessness. Popular songs and dances marked a quite bohemian lifestyle. Originally, *Casas de Fado* (a rough translation of 'Fado Houses') were eccen-

tric joints, where prostitution thrived. *Fadista*, which nowadays means Fado singer, was originally used to designate the denizens of those obscure establishments. From 1840, this remarkable and popular music spread to other urban centers rather than to Lisbon. Eventually, the Fado arrived in Coimbra city as well, and male students of the local University began to sing and play it, a tradition that continues to this day.

Between 1920 and 1930, the practice of this music form became a profession for some, and it was no longer redolent of the underworld. Professor Rui Vieira Nery reported all these findings in his extensive research into Fado history (Nery, 2004).

Fado de Lisboa and *Fado de Coimbra* are the two main Fado substyles. Besides the names' geographical connotations, other differences also can be found. One, as earlier stated, is the fact that the *Coimbra* substyle is only sung by male singers and usually performed in ensemble (Kahle, 2012).

Mendes *et al.* made an acoustic and phonatory characterization of 15 Fado singers (Mendes *et al.*, 2013). The authors did not state what Fado substyle the subjects belonged to; however, since the studied cohort has female subjects, it can be assumed to be the Lisbon substyle. Compared to non-singers, their spoken fundamental frequency was higher, but not so high as found in Western Classical singers. Regarding singing voice, acoustic perturbation-related measures (jitter, shimmer and HNR) were different from other singing substyles and, occasionally, similar to Western Classical or Pop. Yet they found that, although vibrato was used while singing, singer's formant was scant. Some of these characteristics come from uncommon lifestyles, lack of singing training, or, as the authors suggest, it is merely a Fado voice characteristic.

In 2012, Kahle found interesting results from the analysis of 7 *Fado de Coimbra* singers (Kahle, 2012). In addition to providing a thorough description of acoustic data like Mendes *et al.* did, Kahle found that these singers do not aim at great vocal preparation. It is also possible to conclude that this substyle is closer to classical singing rather than non-classical or popular, given the greater loudness and the vibrato type. Singer's for-

mant was found. Like Mendes *et al.*, Kahle also suggested the existence of unique characteristics.

Considering the taxonomy of singers proposed by Bunch and Chapman, Fado can be regarded as folk and world music (Bunch and Chapman, 2000). Therefore, a Fado singer can reach the following performance achievements: international, national, regional or touring, local community (semi-professional) and amateur.

Based on previous authors' classification, these singers will hardly reach superstar-level performance achievement. Child singers are not common, either.

For Pinto de Carvalho, the voice to sing Fado is an unclassifiable one, *sui generis*, with modulations and inflections (Pinto de Carvalho, 1903). Yet he defends it, saying it should not be the subject of repressive teaching methods. Although we consider this stand rather exaggerated, there are contemporaneous truths in this claim. As a traditional folk form, Fado is almost inconceivable of being taught or learned, so that singing teachers or voice students are unlikely to be found.

Since 1927, legal impositions have mutated this particular music style across its multiple domains (Pellerin, 2015). For instance, performers became professionals. They were even forced to acquire an individual license (Museu do Fado, no date; Pinto de Carvalho, 1903; Inspecção Geral dos Teatros, 1927; Nery, 2004). Although censorship doesn’t exist anymore and only a license is required, it is mandatory to pay fees and report each show.

According to PORDATA, in 2015, 10401100 people were living in Portugal (PORDATA, 2015). Of these, 6759544 (65.3%) constituted the active population (between 15 and 64 years old). The elderly population (more than 65 years old) accounted for 2122996 individuals (20.5%).

The main goal of this research is to determine the population of living Fado singers, who have recorded at least one phonogram. In addition, it is intended to compare sub populations.

4.3. Methods

This paper is part of a broader research, and to proceed further it will be mandatory to calculate sample sizes. Therefore, the population size has to be determined. The absence of a settled platform for collecting all data on Fado singers was discovered after an exhaustive search among governmental institutions that manage the performing arts. To account for every active Fado singer would be an intensive and impracticable task for the authors of the present research. Criteria had to be defined in order to create more common characteristics beyond being Fado singers. Throughout this paper, the authors refer to phonogram as a sound register for material support (e.g. CD, LP, K7).

i. Data collection

Sociedade Portuguesa de Autores (SPA) is a national organization founded in 1925. Its main task is to manage authors' rights. It also approves the use of the represented authors' works (national, international, their successors or transferee). Moreover, SPA represents Portuguese authors of every literary and artistic genre (SPA, 2010).

Regarding our specific population, SPA collaborators were kindly available to collect every name related to this music style – irrespective of their role (e.g. singer, lyricist, instrumentalist). After 7 months of work (in 2016), the database was filled but not useful yet. Duplicates were removed and, subsequently, inclusion and exclusion criteria were applied.

ii. Subject selection

Before starting to apply selection criteria to the database, duplicates were excluded (Phase I). The author applied criteria based on his knowledge (Phase II). Gender was also characterized according to being male, female or ensemble (for entries of group performers).

Two experts were conveniently selected (given their closeness to the author) in order to apply criteria to the remaining subjects (Phase III). Each expert lives and work in the major locations of interest to Fado – Oporto and Lisbon, the cities where, traditionally, there is a greater concentration of these performances. This was useful since each expert knows different colleagues and they might provide useful information.

Expert 1 is male and 53 years old, living and performing mainly in Oporto. His career as a singer began 29 years ago. He was the winner of some noteworthy regional and national contests and has recorded 3 phonograms. Expert 2 is female and 73 years old, living and performing mainly in Lisbon. She began singing as a child. During her career, she has recorded 6 phonograms and performed at different important national venues. They were invited to cooperate and characterize the remaining subjects. They went through a spreadsheet including subjects who were not yet classified. Experts categorized those subjects according to singer of *Fado de Lisboa* (“yes” or “no”) and whether still alive (“yes” or “no”).

iii. Inclusion and exclusion criteria

A classification was established to characterize the role of every database entry. Subjects should be singers of *Fado de Lisboa* and be alive. Subjects who sing *Fado de Lisboa* and also play an instrument will be included, as well. As exclusion criteria, authors rejected subjects who: are or were only instrument players; are or were lyricist; perform or performed as an ensemble; sing or sang *Fado de Coimbra* substyle (due to the great differences comparing to the *Fado de Lisboa* interpreters); do not or did not represent *Fado de Lisboa* substyle. Unknown entries are those whom no one could trace.

iv. Statistical analysis

To determine descriptive and inferential statistics, the authors conducted data analysis using IBM® SPSS Statistics (V23; SPSS Inc, Chicago, IL).

4.4. Results

At Phase I, after removing duplicates, the database had 839 subjects (Table 7). Of these, 58.88% were either just *Fado de Lisboa* singers or both singers and players.

Table 7 – Data on entire database entries' roles and gender

	Frequency	**%**
Role		
Fado de Lisboa singer	486	57.93%
Fado de Lisboa singer and player	8	0.95%
Fado de Coimbra singer	46	5.48%
Instrument player	34	4.05%
Ensemble	5	0.60%
Not representative	21	2.50%
Author	7	0.83%
No information	232	27.65%
Gender		
Male	444	52.92%
Female	390	46.48%
Ensemble	5	0.60%
Total	***839***	***100.00%***

From Phase II, 373 subjects remained although 295 were not yet classified. At Phase III, the 1st expert could characterize 22 subjects and the 2nd expert was able to classify another 17 subjects. None could characterize 232 subjects (Table 8).

Of the 494 *Fado de Lisboa* singers or singer-players accounted for during the period from 14th September to 4th November 2016, 411 (83.2%) were alive (Table 8). And within those, there were 56.40% females, which does account for a significant difference in gender distribution (Binomial test, p=0.010).

Table 8 – Data of subgroups "Fado de Lisboa singers" and "Fado de Lisboa singer-players" on their gender and life status (for the period between 14th September and 4th November 2016)

	Frequency	**%**
Life status		
Yes	411	83.20%
No	75	15.18%
Unknown	8	1.62%
Gender (alive)		
Male	227	45.95%
Female	267	54.05%
Total	***494***	***100.00%***

4.5. Discussion

Fado de Lisboa singers were the most representative (58.8%), while *Fado de Coimbra* singers were much less (5.5%). Even though these phonograms need instrument players, in this database they just represent 4%. They are clearly underrepresented, maybe because this database contemplates only those who conducted solo recordings. Despite some singers performing together in the same show they do not do it as a rule, so it shall not be considered as performing in an ensemble. Traditionally this is not common, as proven by this data (0.6%; Table 8). Non-representative entries (2.55%) comprise those who represent another music style, even though they recorded at least one non-significant isolated music track related to Fado. Authors are clearly underrepresented as well (0.8%), since every phonogram is likely to have different authors for lyrics.

According to official reports, Portugal's area is 92225.6 km^2 (DGT, 2016). Considering the active population plus elderly ones, there are 8.882.540 individuals in Portugal. Though the population density of Portugal is 96 inhabitants per km^2, Fado singers' population density is 0.004 subjects per km^2. It can be stated that there is 1 *Fado de Lisboa* singer per 21612 inhabitants. Considering the second main substyle, there is 1 *Fado de Coimbra* singer per 11 *Fado de Lisboa* singers.

i. Bias

Although *SPA* (the organization that provided data) represents many similar international companies, it just provided names registered with them. This could create a bias, since there might be Fado singers registered only with similar international companies, and therefore not found in this one.

Furthermore, some subject names are common and, perhaps, ambiguous since it is not clear who they are (e.g. SPA began working at the beginning of the last century, which means neither authors nor experts can say if some subjects are deceased or contemporaneous).

A difficulty emerged while researching. Even after two highly regarded experts screened the database, 27.07% of all subjects were not classified and, therefore, had to be excluded.

From a rough analysis, the authors and experts can say that there are many more active Fado singers performing. However, some are not registered with the SPA since they have never recorded phonograms. This was a known constraint, at the outset. The authors needed to apply limits to get a more accurate population and, therefore, a replicable research for the future. Otherwise, in the same database, amateur and professional singers would be mixed and that might also be considered a potential bias.

4.6. Conclusion

Difficulties found by the authors in arriving at Fado singers' population size reflect the popular, and sometimes not so professional, origin of this peculiar music style. From SPA registries, 411 living Fado singers who had recorded at least one phonogram were identified. The low representation of instrumentalists and lyricists leads to the conclusion that subjects are included in the database according to their principal role. Secondary participants or roles on phonogram recordings are not likely to be registered.

Further steps include the study of occupational voice usage using a representative sample.

Comparison with other music styles can also be done following a similar methodology. Also, this same work can be expanded by including other subjects than those under SPA scope. The population of singers who did not record could be also a point of interest for making comparisons between them and professional ones.

Chapter V – Prevalence, characterization and impact of voice disorders in Fado singers

5.1. Abstract

Introduction: Fado is a genre of urban folk music from Portugal characterized by some peculiarities. Some indications point this population of singers to be at higher risk of developing voice disorders.

Aim: To provide estimates of the prevalence of voice disorders in Fado singers; to characterize the professional practice and the impact of voice disorders on their careers

Methods: Cross sectional study; self-administered questionnaire split into six parts and 55 questions

Results: A gender-balanced sample of 111 singers, most of whom did records, was achieved. Winter and spring were found to be the most difficult seasons to sing in. The overall prevalence of self-reported voice disorders was 39.6%, significantly higher in females. Almost all sought clinical guidance. Vocal fold nodules, functional dysphonia, and vocal fold polyp were the most common diagnoses. Vocal fatigue and hoarseness were the main symptoms reported. Nearly half of the singers had to cancel shows due to voice disorders.

Conclusion: Fado singers reveal both a relative high prevalence of voice disorders and related concerns, even though some discrepancies were found regarding other apparently similar singer populations. These results lead and support the need for further investigation regarding the risk or protective factors influencing them.

5.2. Introduction

i. Fado and its voice

Fado is a Portuguese urban folk song with a lyrical expression. It has become a part of the world's intangible cultural heritage (UNESCO, 2011). In the 20th century, the practice of this musical form became a profession for some and was no longer redolent of the underworld. Nowadays, the emergence of new Fado singers accompanies the continuous growth of tourism in the country. In the Fado community, it is accepted that the voice to sing Fado is an unclassifiable one, *sui generis*, with modulations and inflections (Pinto de Carvalho, 1903). Therefore, it should not be the subject of repressive teaching methods. As a traditional folk form, it is almost inconceivable of Fado being taught or learned, and therefore singing teachers or voice students are unlikely to be found. Besides, the information in historical literature about Fado and its voice was found to be scant. *Fado de Lisboa* and *Fado de Coimbra* are the two main *Fado* substyles. Considering the taxonomy of singers (Bunch and Chapman, 2000), *Fado* can be regarded as folk and world music. A few studies have directly addressed the voice of *Fado* (Kahle, 2012; Mendes et al., 2013; Mendes et al., 2014; Ibrahim et al., 2017a, 2017b), where some vocal health thresholds were hinted. In 2017, a study was conducted in order to determine the population of living *Fado* singers who recorded at least one phonogram and to compare subpopulations (Pestana *et al.*, 2017a). The authors found 411 living singers of *Fado de Lisboa* substyle.

ii. Voice problems among singers

A professional voice user is one who relies on his vocal apparatus to perform his job (Koufman and Isaacson, 1991; Vilkman, 2000, 2004; Verdolini *et al.*, 2013; Sataloff, 2014; Przysiezny and Przysiezny, 2015). Voice disorders in singers can be regarded as occupational disorders since they have a negative functional impact on the career, culture, and profit of self and associated businesses (Sataloff, 2014). Professional voice use can be classified by relying on different parameters. Some authors propose different

classifications (Koufman and Isaacson, 1991; Vilkman, 2000; Shewell, 2013; Sataloff, 2014). Traditional classifications of overall impairments do not mirror the real impact of voice problems in the person (Sataloff, 2014). Classifications such as the *International Classification of Impairments, Disabilities and Handicaps* (World Health Organization, 1980), *Guides to the Evaluation of Permanent Impairment* (American Medical Association, 1990), and *International Classification of Functioning, Disability and Health* (World Health Organization, 2001) are some examples. Mandatory changes have already been recommended and a new classification has been proposed (Sataloff, 2014), taking into account specific parameters such as audibility, intelligibility and functional efficiency, with a final conversion of the voice alteration to a percentage.

Regarding the general population, a recent large study found that 1.2% to 1.7% of US citizens present dysphonia (Benninger *et al.*, 2017). Other authors (Roy *et al.*, 2005) found that 29.9% of the general population developed some kind of a voice disorder during their lifetime and 6.6% report a current voice disorder. Two percent to 7.2% of the subjects had to miss work one to four days due to voice disorders. Similarly, in the general population, 2.1% subjects were found to have short-term disability related to dysphonia with a mean absence from work of 39.2 days (Cohen *et al.*, 2012). Other large studies state the great frequency and impact of these kind of disorders on the general population (Sułkowski and Kowalska, 2005). A slight increase in the prevalence of voice disorders in the general population has been noticed. Acute laryngitis is the most common diagnosis in younger subjects, while malignant disorders are the most common among older ones. Compared to the general population, service industry workers are more likely to develop benign neoplasms while manufacturing industry workers are more likely to develop malignancies. This high prevalence is associated with growing costs in the healthcare industry (Benninger *et al.*, 2017).

It is claimed and assumed, among the scientific and clinical community, that professional voice users, especially singers, tend to report more voice disorders than the general population (Klodiana and Agim, 2016). A systematic review and meta-analysis was recently conducted, aiming to establish the prevalence of self-reported voice disorders in singers (Pestana *et al.*, 2017b). Even though a great heterogeneity was found among

the included studies, a pooled prevalence of 46.09% self-reported voice disorders was found. It was found that singers are likely to report voice disorders, commonly associated with organic or functional alterations of the larynx, irrespective of singing style or skills (Beaud *et al.*, 2017; Nacci *et al.*, 2017; Pestana *et al.*, 2017b). It is estimated that singers represent 11.5% of the clinical load (Titze *et al.*, 1997), and the most of patients (64%) are non-professional or semi-professional (Beaud *et al.*, 2017). Phonotraumatic lesions are more prevalent in performers while neurologic disorders, neoplasms, and presbyphonia are more prevalent in non-performers (Guss *et al.*, 2014).

Data suggests that women are more likely to develop voice disorders than men, even among singers. Singers population is no exception (De Bodt *et al.*, 2015; Beaud *et al.*, 2017; Remacle *et al.*, 2017). However, there may be some exceptions – such as the results of some functional disorders in opera singers (Klodiana and Agim, 2016).

It is not uncommon to find structural or functional alterations over time despite the allegedly normal voice quality (Lundy *et al.*, 1999). This is the reason why it is important to gather results from more than one assessment tool. Besides the clinical evaluation with instruments that allow the visualization of the larynx, a lot of researchers rely on self-reported data from the subjects (such as questionnaires and scales). Also, the measure of the impact of the disorder on the professional life has been frequently assessed and recommended (Jacobson *et al.*, 1997; Hogikyan and Sethuraman, 1999).

iii. Identification of voice disorders

Identification of voice disorders may rely on different aspects. From self-report to laryngostroboscopy, there is a substantial spectrum of clinical tools available for clinicians to conduct a proper assessment. Moreover, from a broad standpoint, reports about the prevalence of structural and functional alterations, clinically diagnosed voice disorders and self-reported ones and current and past voice disorders are commonly found in scientific literature. Therefore, it is both difficult and unfair to directly compare all of these measures. This is partly the reason for narrowing the present research down to self-report. The author also advocate that a voice disorder has to be previously recognized by

the singer as a problem, otherwise the subject will probably be satisfied without professional help.

iv. Aim of the study

As previously stated, an increasing interest in the singing voice and singers has been noticed in the scientific and clinical community (Pestana *et al.*, 2018). This study arises from the need to assess the burden of voice disorders in a specific population. It primarily aims to provide estimates of the prevalence of voice disorders in Fado singers. It also aims at making a comprehensive characterization of their professional practice and the professional impact of these voice disorders.

To the best of our knowledge, there is no scientific study conducted on Fado singers from a clinical standpoint.

5.3. Methods

i. Sample

Eligible singers were recruited using convenience/snowball sampling techniques. Primary inclusion criteria for these participants were: singer of the *Fado de Lisboa* substyle; older than 18 years old; an active singer. One hundred sixty-one subjects were recruited to participate in this study. The questionnaire was completed by 111 (68.9%). Fifteen individuals (9.3%) were excluded from the study because they did not complete the entire questionnaire. The remaining 21.7% subjects did not answer, were unavailable or unwilling to participate.

ii. Questionnaire development

Singers were asked to fill a questionnaire built on purpose to fit the research questions of a more comprehensive study conducted by the authors. It was built using the following strategy.

1st Phase: The survey was developed after identifying studies with similar goals regarding voice disorders (Miller and Verdolini, 1995; Timmermans *et al.*, 2002; Cammarota *et al.*, 2007; Gilman *et al.*, 2009; Awan and Ensslen, 2010; Rocha *et al.*, 2012; Cohen *et al.*, 2012; Erickson, 2012; Hapner and Gilman, 2012; Kirsh *et al.*, 2013; Phyland, Thibeault, *et al.*, 2013; Vaiano *et al.*, 2013; Bhattacharyya, 2014; Donahue *et al.*, 2014; Gehling *et al.*, 2014; Achey *et al.*, 2016; Pinheiro *et al.*, 2017). The findings were based on the search strategy of the authors' previous research (Pestana *et al.*, 2017b). The most pertinent topics of each survey were collected. The number and type of questions were scattered, so they were shaped to organize them according to constructs under investigation. The very first version was composed of 114 questions.

2nd Phase: The previous version was still heterogeneous and too long. The questions were selected to reduce its length and remove those that assessed the same constructs. This phase was conducted by the first author, a Speech Language Pathologist specializing in voice disorders (2nd author) and a specialized statistician (3rd author). The number of questions was reduced to 92.

3rd Phase: The goal of this phase was to select only the questions that assessed the constructs under study in this research. The selected questions were syntactically improved to be more understandable for the subjects. The way some of the questions were measured was also changed. They were organized according to six different parts: personal and demographic data, musical experience and knowledge, performance demands and habits, personal and social habits, vocal health and wellbeing, and strategies adopted to overcome voice problems, and a reduction to 55 questions was achieved.

4th Phase: A pilot test was conducted with two singers to identify some potential flaws. Two questions were reformulated to ensure the comprehension of the remaining participants.

For this study, a cross-sectional design was adopted, based on the self-completion questionnaire method.

iii. Questionnaire fulfillment

An online version of the questionnaire was built in LimeSurvey version 2.63.1+170305 hosted in a private domain. The overall administration began on 21st February 2017 and it lasted up to 2nd March 2018. At the end of the questionnaire, leaflets with scientifically based information on vocal hygiene for singers were sent to the subjects (Appendix II). Confidentiality was ensured along with the impossibility to respond more than once through the creation of individual tokens.

iv. Data analysis

The data analysis and graph generation were conducted in IBM© SPSS® Statistics vs. 25 (IBM© Corporation, Chicago, USA).

Quantitative variables were described as average and respective standard deviation if they showed normal distribution and as median and respective interquartile range (P25–P75) if they had non-normal distribution as well as the minimum and maximum observed values, while categorical variables were described as counts and percentages (n, %). Regarding vocal problems (yes/no groups), the comparison of normally distributed quantitative variables was assessed using the t-student test, while the non-normal distributed quantitative variables were compared using the Mann-Whitney test.

Confidence limits for prevalence of vocal problems were calculated using the adjusted Wald method, considering 95% confidence level.

5.4. Results

i. Sample characterization

An overview of the sample is shown in Table 9 that displays the summary statistics that characterize this sample. A gender-balanced sample of the interviewed singers was obtained; 59 were female (53.2%) and 52 were male (46.8%). The mean age of the participants was 42.2 years (±16.5), ranging from 18 to 74 years. Over half of the subjects (64.9%) reported that they perform more frequently in the north of Portugal. A minority (6.3%) performs mostly in the Portuguese islands. It is to be noted that one singer can perform frequently in more than one region. Most subjects have Fado as their main musical style (96.4%), and the others sing Fado, although their primary style is popular music and musical theater (3.6%). Most subjects (52.3%) perform more often at *Casas de Fado* (Fado houses), which are places dedicated to Fado performances, followed by a group who perform more often in restaurants and similar locations (39.6%). Phonogram is understood as the recording of any form of audio [such as compact disk (CD), compact audio cassette (CAC), vinyl, or digital streaming]. Among this sample, 38 singers (34.2%) did not record any. The mean of recordings was 4 and the maximum was 100 phonograms for one subject. Most singers revealed that they did not know their type of voice (53.2%). Those who knew their singing voice type were fairly distributed, though the bass was only described by one subject.

In this dichotomic question, most singers (88.3%) reported satisfaction with their self-perceived voice quality.

When asked if there were periods in the year when it was hard to sing, a great majority answered yes (72.1%) and among the multiple-choice answers regarding the seasons, winter was the most reported season (48 singers), followed by spring (26 singers).

Table 9 – Sample characterization

Variable	Characteristic	Statistic
Gender (n)	Male	52 (46.8%)
	Female	59 (53.2%)
Age (years)	min-max	18-74
	average (S.D.)	42.2 (16.5)
Most frequent geographic areas	North	72 (64.9%)
	Center	48 (43.2%)
	South	27 (24.3%)
	Portuguese Islands	7 (6.3%)
	Foreign	26 (23.4%)
Most frequent style	Fado	107 (96.4%)
	Popular	3 (2.7%)
	Musical theatre	1 (0.9%)
Venue where the subject sing more often	Fado venues	58 (52.3%)
	Restaurants and similar	44 (39.6%)
	Stages	1 (0.9%)
	Others	8 (7.2%)
Number of recorded phonograms	min-max	0-100
	average (S.D.)	4 (12.3)
Singing voice type	Don’t know	59 (53.2%)
	Soprano	17 (15.3%)
	Contralto	17 (15.3%)
	Tenor	10 (9%)
	Baritone	10 (9%)
	Bass	1 (0,9%)
Singers satisfied with their voice quality		98 (88.3%)
Singers who feel there are seasons more difficult to sing	Yes	80 (72.1%)
	Spring	26 (23.4%)
	Sumer	5 (4.5%)
	Autumn	15 (13.5%)
	Winter	48 (43.2%)

ii. Self-reported voice problems

Even though most singers, 60.4% (95%CL: 51.1%-69.0%), did not report any past vocal problems, 39.6% (95%CL: 31.0%-48.9%) identified having had a voice problem in the past. Almost all the 44 singers that reported voice problems in the past sought clinical guidance (n=40, 90.9% of 44; 36% out of the 111; 95%CL: 27.7%-45.3%).

The group provided, in an open question, the diagnosis of the voice problem, which was posteriorly categorized. These results were quite heterogeneous, as shown in Table 10. The most common problems were vocal fold nodules, functional dysphonia, and vocal fold polyp. Inflammations of the respiratory tract were also commonly reported. Six subjects were not able to give a proper description or any description at all. Three subjects reported more than one descriptor that contributed to their voice problem.

Table 10 – Diagnosis of past voice problems

Diagnosis (n=44)	**n (%)**
Single	
Vocal fold nodules	7 (15.9%)
Functional dysphonia	6 (13.6%)
Laryngitis	6 (13.6%)
Undefined or poorly defined	6 (13.6%)
Vocal fold polyp	5 (11.4%)
Tonsillitis	4 (9.1%)
Gastroaesophageal reflux disease (GERD)	3 (6.8%)
Reinke's edema	1 (2.3%)
Sinusitis and/or rhinitis	1 (2.3%)
Pulmonary disease	1 (2.3%)
Intubation related	1 (2.3%)
Combined	
GERD; Sinusitis and/or rhinitis	1 (2.3%)
GERD; Vocal fold nodules	1 (2.3%)
Functional dysphonia; Sinusitis and/or rhinitis	1 (2.3%)

This subgroup also described the treatment to overcome their problem (Table 11). There were 44 singers (39.6%) who sought professional guidance regarding voice problems. Based on a multiple answer question, singers reported medicines as the most common approach (68.2%), followed by voice therapy (29.5%), and surgery (15.9%). Nothing was done to improve the vocal problem by three singers.

Table 11 – Approach to improve past voice problems (n=44)

Approaches	**n (%)**
Medicines	30 (68.2%)
Voice therapy	13 (29.5%)
Surgery	7 (15.9%)
Other	4 (9.1%)
Nothing	3 (6.8%)

The same group of Fado singers described their past voice problems (multiple answers allowed) given in the categories presented in Table 12. “Tired voice” and “Hoarse voice” were clearly the most described, followed by “Loss of high notes”, “Loss of ability to speak or sing loudly”, and “Effortful voice”.

Table 12 – Voice symptoms of past voice disorders

Symptoms	**n**	**Percentage**	**Cases percentage**
Tired voice	28	23.9%	63.6%
Hoarse voice	27	23.1%	61.4%
Effortful voice	15	12.8%	34.1%
Loss of ability to speak or sing loudly	14	12.0%	31.8%
Loss of high notes	13	11.1%	29.5%
Loss of ability to speak or sing quietly	8	6.8%	18.2%
Breathy voice	8	6,8%	18.2%
Loss of low notes	4	3.4%	9.1%
Total	***117***	***100.0%***	***265.9%***

The number of canceled shows due to voice disorders during their career was used to assess the professional impact of voice disorders. For this group, the median number was 0 (0–2) shows, that is, half the professionals canceled no show, and the 25% that canceled more, canceled 2 to 10 shows. Most said that no show had to be canceled (54.1%), while others had to cancel one to five times. However, three subjects reported ten canceled shows. At the time of the survey, just four individuals reported having vocal problems (3.6%; 95%CL: 1.1%-9.2%) and three of them still did not seek medical help. The other was diagnosed with glottal incomplete closure and receiving voice therapy at the time of the study.

A significantly higher number of female singers (65.91%) reported more past voice problems than males (34.09%) (χ^2=4.763; p=0.029). The mean age was not significantly different for those who suffered past vocal problems in the past, nor was the median number of recorded phonograms (vocal problems: 42.7 ±17.0 years old vs. no vocal problems: 41.9 ±16.3 years old, t(109)=-2.919; p=0.781; vocal problems problems [median (1st quartile-3rd quartile)]: 1 (0-3) vs. no vocal problems: 1 (0-3), Mann-Whitney test, p=0.693, respectively). The venues where the singers usually perform did not show any association with past vocal problems (χ^2=1.160; p=0.763). Satisfaction with self-perceived vocal quality at the time of the administration did not reveal a significant association with vocal problems outcome (χ^2=0.009; p=0.926). However, the median number of canceled shows were significantly higher when vocal problems were reported (vocal problems: 1 (0–3) vs. no vocal problems: 0 (0–2), Mann-Whitney test, p=0.027).

5.5. Discussion

Taking into account the previous work (Pestana *et al.*, 2017a) that aimed to calculate the population of Fado singers, 199 singers should have been included in the expected sample, considering a 95% confidence interval and an anticipated frequency of 46.09% (achieved in the Chapter III). During the data collection time this sample size was not achieved, even though this remains a goal for future researches. Throughout the results, a predominance of northern singers was noticed which is justified due to the place of residence and work of the 1st author along with the used convenience sampling method.

Even though all subjects sing Fado, this may not be their main musical style. This was the reason why some subjects answered styles other than Fado. The most frequent venues of performance were *Casas de Fado*, restaurants and similar locations, perhaps because this question did not allow multiple answers. If so, the other venues (such as stages) were expected to be higher. The fact that the subjects perform most frequently or on a daily basis at these venues does not necessarily mean that they perform any less frequently at others.

Most singers recorded at least one phonogram. Surprisingly, some reported a huge number of recordings (maximum = 100). These numbers should be interpreted considering that the question does not discriminate among the types of recording and that the singers may have confused or mixed individual songs with entire albums.

One interesting finding is that an extensive number of singers do not know what their voice type is, and that mirrors a lack of formal training, as well as a lack of self-knowledge about singing. This is not unexpected due to the cultural roots of Fado, as mentioned in the literature review (Pinto de Carvalho, 1903).

Winter and Spring were the seasons singers reported experiencing greater difficulty in singing, most likely due to the increase in allergies and viruses during this period (Millqvist *et al.*, 2008; Ohlsson *et al.*, 2016). Summer was also reported by some, which can

be justified by a hypothetical work overload due to the increase in tourism during the period.

The first question in this study sought to determine the prevalence of voice problems in the past.

The results indicate that the prevalence is considerably higher in singers than in the general population (Roy *et al.*, 2005; Sułkowski and Kowalska, 2005; Cohen *et al.*, 2012; Benninger *et al.*, 2017). This is not unpredicted since several studies have shown that singers are more likely to report or notice voice changes. It is also known that some singers are more likely to experience or notice subtle voice changes and suffer a disability as a result of it (Klodiana and Agim, 2016). Also, the significant relationship between gender and past vocal problems is consistent with other researches (Miller and Verdolini, 1995; Erickson, 2012).

With respect to the other singing populations, Fado singers report lesser voice disorders than the majority of singers (Pestana *et al.*, 2017b). These results match those observed in classical choral singers (Vaiano *et al.*, 2013). Classical singing students report less voice disorders (Achey *et al.*, 2016). Some singer subpopulations (such as classical and non-classical singers and singing teachers) report more voice disorders than the Fado ones of this study (Miller and Verdolini, 1995; Tepe *et al.*, 2002; Cammarota *et al.*, 2007; Erickson, 2012; Hapner and Gilman, 2012; Rocha *et al.*, 2012; Sataloff *et al.*, 2012). Such comparison allows us to infer possible protective factors that this population may develop or about their lower concern about vocal health or vocal demands. An odd number of career prevalence of self-reported voice problems was found among the singer subpopulation of Yakshagana artists in India, which was 91.2% (Devadas *et al.*, 2017).

It was possible to state that the Fado population is very careful with their voice since almost all subjects sought professional guidance towards their voice problems. The present results were similar to those found in a sample of female student teachers and practicing teachers (Thomas *et al.*, 2006). However, this outcome is contrary to that of

contemporary commercial music (CCM) singers, Indian classical singers and Western singers, where the hesitation of singers towards seeking vocal health care is highly noticeable (Phyland et al., 1999; Petty, 2012; Gunjawate et al., 2016; Neto and Meyer, 2017).

Regarding past diagnoses, the most frequent, whether isolated or in comorbidity with others, are clearly associated with a high vocal load or a vocal hyper functional pattern. These relationships may partly be explained by the conditions of performances and their venues, as well as their vocal demands (such as duration of performances or lack of amplification system), which will require more investigation. Phonotraumatic lesions are commonly correlated to performers, and our findings are in keeping with previous studies (Lamarche *et al.*, 2010; Stepp *et al.*, 2011; Guss *et al.*, 2014; Klodiana and Agim, 2016; Beaud *et al.*, 2017; Nacci *et al.*, 2017; Sielska-Badurek *et al.*, 2017). This value could change if all singers were formally assessed by a professional team – it is known that some mass lesions may be asymptomatic and hence, underdiagnosed (Lundy *et al.*, 1999).

The already mentioned concern about voice was also mirrored by the only three subjects who didn't do anything to overcome voice problems. Medicines were the most common approach to overcome voice problems. The question was not sensitive enough to be able to understand whether they were prescribed or not.

The voice symptoms presented in the results derive from a previous study with singing teachers (Miller and Verdolini, 1995). Compared with that population, Fado singers revealed similar results: their voice was described more frequently as tired, hoarse, and losing high notes. Regarding vocal symptoms reported by traditional/acoustic local musicians, 41% said that they already experienced vocal fatigue, 30% experienced loss of the top range of the voice or a total loss of voice (Erickson, 2012).

Regarding the number of canceled shows, it was clearly associated with the subjects who reported voice problems in the past, suggesting a negative impact on their career. In an Indian artists' population (Devadas *et al.*, 2017), 48% of the singers reported they

had missed performances due to voice problems in the previous year. Regarding absence from work, 80% missed work up to one week. These variables were considered to be of interest to future studies in assessing the financial burden of voice disorders in Fado singers.

The number of singers that reported any kind of voice disorder in the present was anecdotal. This discrepancy could be attributed to a lack of negative self-perception or not wanting to be associated with a voice problem, fearing some kind of labor disadvantage.

The chosen method for collecting data may have biased the results, since the older singers may not have access to or the ease of working with digital platforms. A predominantly young population was reached rather than an older population which could've been expected to provide a larger sample size.

5.6. Conclusion

Contrary to what the authors expected, the prevalence of self-perceived voice disorders was neither as high as nor matched other hypothetical similar traditional and folk singing styles.

Some future investigation was already advanced during the discussion, but one priority is to increase the sample size and to study each result in depth. Even though this sample could be larger to be more representative of the population, the amount is already considerable (27% of the estimated population), especially since it is a group of artists and we are dealing with the fragilities of their primary work tool – the voice. It is essential to explore what is promoting or protecting voice disorders in the Fado community, since this is an understudied population, and at the same time, performing and developing their careers differently from their fellow singers of other styles. Hereupon, further work is required to assess the underlying risk of this practice.

Chapter VI – Risk factors for self-reported voice disorders among Fado singers

6.1. Abstract

Introduction: Fado is a Portuguese urban folk song with deep roots in popular culture. Previous data found on the prevalence of self-reported voice disorders, types of laryngeal alterations, voice parameters near the pathological threshold, among other hazard factors, make believe that Fado singers may have an increased risk of developing voice disorders.

Aim: To determine the risk factors for the development of self-reported voice disorders among Fado singers.

Methods: A cross-sectional study was conducted through the administration of a questionnaire containing questions related to voice disorders in singers. The relation of personal and social data, musical background, performance demands and habits, vocal health and well-being, and the strategies to overcome voice problems are reported here. Beyond a comprehensive characterization, odds ratios (OR) and their 95% confidence intervals (CI) for the association with voice disorders were calculated through univariate and multivariate logistic regression analysis.

Results: Significant risk factors for voice disorders were found: nose related disorders, decongestants or antihistamines (OR=5.5; 95%CI: 1.6-20.8); oral contraceptive or hormone replacement therapy (OR=4.9; 95%CI: 1.2-20.3); previous smoking habits (OR=4.0; 95%CI: 1.5-10.5); and vocal fatigue after performances (OR=2.9; 95%CI: 1.2-7.1).

Conclusion: This activity significantly increased the risk of developing voice disorders. Some predictable factors – mentioned later – commonly associated with folk music and active untrained singers were not identified here. The evidence from this study and the relative low prevalence of self-reported voice disorders suggest that these singers may develop a kind of protective combination of factors beyond the scope of this research.

6.2. Introduction

i. Singing and risk of voice disorders

Singing is known to be a professional occupation that increases the risk of voice disorders, however the scientific evidence on this is sometimes conflicting. Indeed, a positive relationship between singing and laryngeal pathologies was found (Mori *et al.*, 2017; Kwok and Eslick, 2018) and an association with vocal misuse and overuse is clear – however it is not yet clear its relationship with the music style. Earlier, in 1996, occupational disorders related to voice were considered underdeveloped and poorly studied compared to other fields. This was a major impediment to professionals in need of clinical guidance. Vocal load, background noise, room acoustics, and relative humidity in the air were assigned and hence studied as possible risk factors (Vilkman, 1996). Even nowadays, as perceived during the research, the amount of literature that clearly addresses risk factors for voice disorders in singers is still limited. It was expected to be higher since this occupation is more commonly associated with voice disorders than a lot of other activities, as claimed in the professional and the academic community. The research on this subject is, indeed, scant (Garzón García *et al.*, 2017), which makes it difficult to compare results. Based on a meta-analysis approach, the risk of laryngeal pathologies and associated symptoms among professional singers was calculated (Kwok and Eslick, 2018). Professional singers are more likely to reveal hoarseness (OR=2.00; 95%CI:1.61–2.49), gastroesophageal reflux disease (OR=1.45; 95%CI: 1.19– 1.77), Reinke's edema (OR=2.15; 95%CI: 1.08–4.30), and vocal fold polyps (OR=2.10; 95%CI: 1.06–4.14). The risk factors in developing voice disorders were quite similar when comparing singing teachers with a control group (Miller and Verdolini, 1995). However, the first group was much more likely to report past or present voice disorders (OR=3.67; 95%CI: 1.82-7.38). A current voice problem was three times more likely to be reported if the subjects were taking medications that contribute to dehydration (OR=3.30; 95%CI: 1.50-7.24). The subjects who had reported past voice problems were five times more likely to refer a present voice problem (OR=4.73; 95%CI: 1.86-12.01). Also, in this study, female subjects were two times more likely to report past voice

problems than males (males OR=0.49; 95%CI: 0.26-0.93). Younger subjects showed a slightly lower probability of reporting than older ones (OR=0.97; 95%CI: 0.94-0.99).

ii. Fado and its voices

Fado is as "an urban folk song in which the singer is usually accompanied by two plucked instruments known as *viola* and *guitarra* (…). Its lyrics can take the form of a narrative, description or comment and can develop any topic, from one's own personal feelings to matters of some social concern or other" (Cook, 2004, p. 19). Sociohistorical literature about this singing style is abundant. However, anecdotal information about voice of Fado anyhow was found. Culturally, formal training or singing lessons are not expected (Pinto de Carvalho, 1903). There were already some characteristics that could be considered hints for an increased risk for voice disorders such as vocal health thresholds near pathological levels combined with unhealthy lifestyles and performing under poor acoustic conditions (Kahle, 2012; Mendes et al., 2013; Mendes et al., 2014; A. Mendes et al., 2014; Ibrahim et al., 2017a, 2017b). In a previous study, a prevalence of 39.6% of self-reported voice disorders was found among Fado singers (Chapter V). The kind of reported laryngeal alterations are compatible with the consequence of a hyper functional pattern of voice production as well as a hypothetical vocal overload. The combination of all these aspects translate into an apparently unruly setting that may constitute a hazard to the voice of singers.

Hence, the purpose of this paper is to determine the risk and protective factors of voice disorders associated with self-reported voice disorders in Fado singers.

6.3. Methods

The adopted methodology regarding data collection and questionnaire administration for this study was the same as the one that was previously described in the chapter V. The referred questionnaire had 55 questions divided into six different sections: personal and demographic data, musical experience and knowledge, performance demands and habits, personal and social habits, vocal health and well-being, and strategies adopted to

overcome voice problems. A cross-sectional design was adopted, and convenience/ snowball sampling was used. Primary inclusion criteria for these participants were: singers of *Fado de Lisboa* substyle; older than 18 years old; an active singer. One hundred sixty-one subjects were recruited to participate in this study. The questionnaire was completed by 111 (68.9%). Fifteen individuals (9.3%) were excluded from the study because they did not complete the entire questionnaire. The remaining 21.7% subjects either did not answer or were unavailable or unwilling to participate.

i. Data analysis

Statistical analysis was performed using the IBM© SPSS® Statistics V25 (IBM© Corporation, Chicago, USA). The level of significance was set to 0.05 for all inference situations. Categorical dichotomic variables were described using counts and percentages (n, %) and the ordinal ones using the median and corresponding interquartile range, while the quantitative ones were described using the average and standard deviation (av (st.dev.)) and the range (minimum-maximum) (Tables 13 and 14). The prevalence of having had a voice disorder and being satisfied with their voice quality were calculated together with confidence interval using the adjusted Wald method. Bivariate analyses of associations with voice problems outcome were evaluated for statistical significance using the univariate logistic regression, which allowed the estimation of odds ratios (OR) and the corresponding confidence intervals (CI) (Table 3). Multivariable binary logistic regression models (Wald backward stepwise method, p=0.05 for covariate inclusion and p=0.10 for exclusion) were used to predict association (as risk or protective factors) between covariables identified in previous binary logistic regression analysis (Table 3) and having “Voice Problems”, which were adjusted for age and gender (Table 4). The quality of the logistic regressions was assessed using as measures the percentage of correctly predicted, the -2 Log Likelihood and Cox & Snell and Nagelkerke determination coefficients and the area under the ROC curve (AUC) that indicates the adjustment of the model for prediction of voice problems.

6.4. Results

An overview of the sample is shown in Table 13 that displays the summary statistics for sample characterization. The authors attempted to have a balanced sample regarding gender, and 59 of the interviewed singers (53.2%) were female. The mean age of the participants was 42.2 years old (±16.5), ranging from 18 to 74 years.

Singers were asked whether they had or have voice problems. Based on this Based on this self-reported measure, 40.5% (95%CI: 31.9%-49.9%) stated so. Regarding self-perceived voice quality, a great majority of singers (88.3%; 95%CI: 80.9%-93.6%) affirmed they were satisfied with their own.

Table 13 – Sample characterization

Variable	**Categories**	**Statistics**	
Gender	Male	52 (46.8%)	
	Female	59 (53.2%)	
Age (years)	min-max	18-74	
	av (st.dev)	42.2 (16.5)	
			95%CI
Voice Problems (past/present)	yes	45 (40.5%)	31.9%-49.9%
Satisfaction with voice quality	yes	98 (88.3%)	80.9%-93.6%

Even though every variable of the previously described questionnaire was analyzed, the authors opted only to show the ones that were posteriorly identified in univariate and multivariate logistic regression analysis, in order to improve the readability of the paper. Therefore, Table 14 displays the descriptive statistics for those variables. The descriptive statistics of all variables included in the questionnaire are shown in the Appendix I.

Vocal fatigue at the end of the performances was revealed to be occasionally associated with at least half of the singers. Very few subjects refer to frequently feeling vocally tired. Infrequent use of amplification systems is shown by most of the subjects, since they only use it occasionally or sometimes. The great majority stated that they had never smoked. The majority did not report the following: nose related disorders and the use of decongestants or antihistamines (78.4%); the use of corticosteroids (84.7%); hormone

replacement therapy or the use of oral contraception (88.3%). More than half usually increase the intake of water at the time of the shows. A lot of singers say that they have at least one disease of any order or take medicines. Specifically, asthma and the use of related medicines were reported by nine singers. Only less than half of the subjects have access to information that helps them to maintain vocal health.

Singers were qualitatively asked about the strategies that they usually adopt to overcome voice problems (Table 14). Only those strategies that are related to vocal behavior (such as vocal exercises or avoiding bad vocal habits) were associated to voice disorders.

Table 14 – Descriptive characterization of the influencing factors on voice disorders

Variable	Categories	n (%)	Me (P25-P75)
Vocal fatigue after performances	Never	21 (18.9%)	Occasionally (Occasionally-Sometimes)
	Occasionally	49 (44.1%)	
	Sometimes	36 (32.4%)	
	Often	4 (3.6%)	
	Always	1 (0.9%)	
Use of voice amplification system	Never	12 (10.8%)	Occasionally (Occasionally-Sometimes)
	Occasionally	44 (39.6%)	
	Sometimes	42 (37.8%)	
	Often	12 (10.8%)	
	Always	1 (0.9%)	
Previous smoking habits	No	82 (73.9%)	
	Yes	29 (26.1%)	
Nose related disorders, Decongestants or Antihistamines	No	87 (78.4%)	
	Yes	24 (21.6%)	
Corticosteroids	No	94 (84.7%)	
	Yes	17 (15.3%)	
Oral contraceptive or hormone replacement therapy	No	98 (88.3%)	
	Yes	13 (11.7%)	
Water intake during performances	Stop	5 (4.5%)	Increases (Maintains-Increases)
	Decreases	9 (8.1%)	
	Maintains	23 (20.7%)	
	Increases	49 (44.1%)	
	Increases a lot	25 (22.5%)	
Has any disease and/or takes medicines	No	42 (37.8%)	
	Yes	69 (62.2%)	
Having asthma or taking medications to	No	102 (91.9%)	
	Yes	9 (8.1%)	
Vocal behavior strategies to overcome voice problems	No	73 (65.8%)	
	Yes	38 (34.2%)	

Using univariate logistic regression, it was possible to identify several variables independently associated with the outcome "self-reported voice problem" (Table 15). Covariables vocal fatigue after performances (OR≅2.4, p=0.033), oral contraception or hormone replacement therapy (OR≅3.9, p=0.033), nose related disorders and medications (OR≅2.5, p=0.049) were found to be risk factors independently associated with self-reported voice problems, while having access to information that helps maintain vocal health (OR=0.4, p=0.024) was identified as a protective factor (decreasing the probability of having self-reported voice problems by 60%). Moreover, gender (female OR≅2.2) and previous smoking habits (OR≅2.2), although not significantly associated with voice problems, are very significant as risk factors.

Table 15 – Univariate logistic regression analysis of risk factors independently associated with self-reported voice problems (n=111 for most variables).

		Voice Problems			
Covariate	**Category**	**no**	**yes**	**p**	**OR (95%CI OR)**
Gender	Male	36 (54.5)	16 (35.6)		1
	Female	30 (45.5)	29 (64.4)	0.051	2.175 (0.998-4.741)
Age	<40 years	37 (56.1)	23 (51.1)		1
	≥40 years	29 (43.9)	22 (48.9)	0.608	1.22 (0.571-2.610)
Vocal fatigue after performances	Never/Occasionally	47 (71.2)	23 (51.1)		1
	at least Sometimes	19 (28.8)	22 (48.9)	**0.033**	2.366 (1.073-5.218)
Use of voice amplification system	Never/Occasionally	37 (56.1)	19 (42.2)		1
	at least Sometimes	29 (43.9)	26 (57.8)	0.154	1.746 (0.812-3.754)
Previous smoking habits	No	53 (80.3)	29 (64.4)		1
	Yes	13 (19.7)	16 (35.6)	**0.065**	2.249 (0.951-5.318)
Water intake during performances	Maintains – Increases a lot	55 (83.3)	42 (93.3)		1
	Stop –Decreases	11 (16.7)	3 (6.7)	0.132	0.357 (0.094-1.362)
Has any disease and/or takes medicines	No	25 (37.9)	17 (37.8)		1
	Yes	41 (62.1)	28 (62.2)	0.991	1.004 (0.460-2.194)
Nose related disorders, use of decongestants or antihistamines	No	56 (84.8)	31 (68.9)		1
	Yes	10 (15.2)	14 (31.1)	**0.049**	2.529 (1.005-6.362)
Having asthma or taking medications to	No	63 (95.5)	39 (86.7)		1
	Yes	3 (4.5)	6 (13.3)	0.111	3.231 (0.764-13.667)
Corticosteroids	No	29 (43.9)	28 (62.2)		1
	Yes	37 (56.1)	17 (37.8)	0.102	0.523 (0.242-1.128)
Oral contraceptive or hormone replacement therapy	No	62 (93.9)	36 (80)		1
	Yes	4 (6.1)	9 (20)	**0.033**	3.875 (1.113-13.489)
Vocal behavior strategies to overcome voice problems	No	47 (71.2)	26 (57.8)		1
	Yes	19 (28.8)	19 (42.2)	0.145	1.808 (0.815-4.008)

Multivariate logistic regression (adjusting the results per age and gender) helped to identify vocal fatigue after performances (OR≅2.9, p=0.023), previous smoking habits (OR≅4, p=0.006), nose related disorders and medications (OR≅5.6, p=0.011) and Oral contraceptive or hormone replacement therapy (OR≅5, p=0.026) as significative independently associated risk factors of having "voice problems" (Table 16). Taking corticosteroids (OR≅0.22) was retained by the model as a protective factor of having "voice problems", although not a significant one (p=0.057).

Table 16 – Multivariate logistic regression analysis of risk factors independently associated with self-reported voice problems (n=111).

Covariable	**p**	**OR (95%CI OR)**
Vocal fatigue after performances (YES)	**0.023**	2.868 (1.157-7.109)
Previous smoking habits (no missing) (YES)	**0.006**	3.955 (1.488-10.515)
Nose related disorders, Decongestants or Antihistamines (YES)	**0.011**	5.552 (1.481-20.817)
Corticosteroids (YES)	0.057	0.219 (0.046-1.048)
Oral contraception or hormone replacement therapy (YES)	**0.026**	4.955 (1.210-20.293)
Constant	<0.001	0.216

Variables entering the first step of the analyses: Vocal fatigue after performances, Use of voice amplification system, Previous smoking habits (no missing), Water intake during performances, Has any disease and/or takes medicines, Nose related disorders and medications, Having asthma or taking medications to, Vocal behavior, Allergies or taking corticosteroids, Oral contraception or hormone replacement therapy.

This model predicts 70.0% results correctly. Model quality: -2 Log Likelihood=127.2; Cox & Snell R^2=0.185; Nagelkerke R^2=0.249; AUC=0.735 (95%CI: 0.638–0.831).

6.5. Discussion

Fado singing is commonly and popularly associated with some possible unhealthy habits. Such examples could be singing with no formal training, performing frequently with no amplification system, singing in venues with unfavorable characteristics, going to bed late, and so on. This would lead us to the hypothesis that singing Fado is a highly demanding task for the vocal tract, associated with a probable vocal overload and consequently a likely increase in the risk of developing voice disorders.

The lack of access to information that helps maintain vocal health was revealed to be a protective factor in the univariate analysis. This apparently odd result can be explained

by the assumption that the singers who seek clinical guidance are likely to be those who already have voice disorders. Those who do not have any voice problems are less likely to seek for clinical guidance as a voluntary or preventive initiative. Therefore, this variable was not included in the multivariable model.

Nose related disorders, such as rhinitis and sinusitis, as well as related medications (decongestants or antihistamines) were found to be the most impactful factor for voice disorders in Fado singers, increasing the risk by more than five times. This can be interpreted in two different ways: the cause may arise from the disorder or from the medication intake. This is not surprising since allergic rhinitis is commonly associated with voice changes (Millqvist *et al.*, 2008; Turley *et al.*, 2011; Verguts *et al.*, 2011; Hah *et al.*, 2015; Ohlsson *et al.*, 2016). Singers tend to be in environments, such as stages, that are more prone to air, dust, or pollutants which trigger these kinds of disorders (Herman Jr and Rossol, 2006; Sataloff, 2006; Geneid et al., 2009).

Oral contraceptives and/or hormone replacement therapy increase the risk of developing voice disorders by five times. This primarily applies to female singers. Even though some men may undergo hormone replacement therapy, it did not happen in our sample and therefore it has not been considered. The impact of hormonal fluctuations on voice has already been studied for some time (Amir and Biron-Shental, 2004). Traditionally, oral contraceptives are considered a risk factor for voice quality. However, some contradictions were found in literature that defends the innocuous effect or even the improvement in voice parameters or resonance caused by oral contraceptives, whether it is in professional voice users or not (Amir and Kishon-Rabin, 2004; Gorham-Rowan *et al.*, 2004; Van Lierde *et al.*, 2006; Lã *et al.*, 2007, 2009; Morris *et al.*, 2011; Amir *et al.*, 2016; Pavela Banai, 2017). An interesting and recent revisitation to the available literature on the topic was conducted, which, specifically addressing singers, states that oral birth pills improve vocal stability (Rodney and Sataloff, 2016). Hormonal replacement therapy is usually taken by postmenopausal women to regulate hormone levels. Though consequent changes in voice are not unexpected, there is a significant decrease in the fundamental frequency and sound pressure level of postmenopausal women with no hormonal replacement therapy. Hormonal therapy, on the other hand, counteracts the

vocal changes related to menopause (Lindholm *et al.*, 1997; D'haeseleer *et al.*, 2012). Indirect effects of replacement therapy could also contribute to positive changes, such as restored libido and well-being and improved mood (Davison and Davis, 2003; Papalia and Davis, 2003; Amir and Biron-Shental, 2004). The adverse effects of this therapy on voice seems to be under-explored. A recent study found a significant increase in the jitter value, a measure that reflects the short-term frequency instability associated with the irregularity of the thyroarytenoid muscle contraction (Hamdan *et al.*, 2017).

Smoking is perhaps the most straightforward risk factor among all voice users. It increases the risk of voice disorders among Fado singers by four times. Numerous studies state the highly destructive and adverse effects of smoking cigarettes on vocal folds (Gonzalez and Carpi, 2004; Jetté *et al.*, 2016; Liu *et al.*, 2016; Babalık *et al.*, 2017; Inan *et al.*, 2018).

Another significant factor was vocal fatigue, which increases the risk of voice disorders by three times. This may represent both the lack of vocal endurance and the high vocal load that these singers are prone to. Vocal fatigue is seen as a complex clinical phenomenon associated with a perceived effort and discomfort while producing voice which changes according the usage load, i.e., – increases with use and decreases with rest (Solomon, 2008; D'Haeseleer *et al.*, 2017). Commonly, some factors such as increased viscosity of the vocal folds, reduced blood circulation, and increased tissue strain (other than muscle) are associated (Titze, 1984, 1994). Even though more objective studies are needed, vocal fatigue is accepted as a vocal sign that leads subjects to clinical guidance to prevent a possible broad clinical event (D'Haeseleer *et al.*, 2017). The study of the bioenergy of the intrinsic laryngeal skeletal muscle is pointed as a topic in contemporary trend to justify vocal fatigue (Sandage and Smith, 2017). A recent study points that the traditional vocal warm-up when compared to a physiological approach may trigger fatigue earlier (Portillo *et al.*, 2018). Some subpopulations of singers were found to be more prone to fatigue than others (Yiu and Chan, 2003; Phyland, Thibeault, *et al.*, 2013; Yiu *et al.*, 2013; Arunachalam *et al.*, 2014; Garzón García *et al.*, 2017).

Taking corticosteroid was found to be a protective factor for the sample, although without significance (p=0.057) for the population. This requires a cautious interpretation. This result may be explained by the fact that the singers that take these medications already have problems and, thereafter, feel their reduction. Another possible explanation for this is that most singers take this medication for other reasons other than voice disorders. Thus, a secondary effect over the vocal apparatus may exist, particularly on the respiratory tract and resonance.

Indeed, more risk factors were identified than protective ones, which suggests that singing significantly increases the risk of voice disorders. However, further variables should be considered, such as the lack of professional regulation, the lack of protective laws regarding this occupation, and the lack of preventive programs. Multiple regression analysis revealed a hazardous combination of risk factors. The univariate analysis suggests that the access to vocal health information is effective enough to prevent voice disorders. During the data collection, leaflets with scientific information about vocal hygiene for singers were individually sent. These results may be interpreted in combination with the low prevalence of self-reported voice disorders compared with similar singing styles (Pestana *et al.*, 2017b). Thus, some kind of a protective combination of factors may be hypothesized which, evidently, requires cautious further study.

6.6. Conclusions

The purpose of the current study was to determine risk factors contributing to the development of voice disorders in Fado singers. Surprisingly, taking into account the whole applied questionnaire, some predictable variables were not identified as either risk or protective factors among Fado singers, such as the use of amplification systems, voice warm-up, voice usage in other occupations other than singing, and strategies adopted to overcome voice problems. Thus, these results contribute to demystifying some preconceptions associated with singing folk and popular music. However, the achieved results are based on self-reported data, and they must be interpreted as such. Future investigations shall include other data collecting methods beyond this, such as the so-called instrumental voice analysis. Furthermore, an assessment of objective vocal load and the adequacy of the repertoire regarding the voice range and register is required.

As a pioneer study, the authors recommend further investigation of the individual risk factors. These results are important for the prevention of voice disorders among this population. Therefore, an awareness program is recommended, highlighting these risk factors and stating measures for avoiding them.

Chapter VII – Evaluation of the Ability to Sing Easily: Adaptation and validation to the European Portuguese language

7.1. Abstract

Introduction: This paper addresses the adaptation and validation of the Evaluation of the Ability to Sing Easily (EASE) to the European Portuguese language. It is a tool intended to measure the singing voice function based on self-report which reflects how at ease singers' voices are perceived at the time of the administration.

Aim: To adapt the tool to the European Portuguese language (EASE-PT); to compare scores according to singing style, voice use and demography variables; to conduct psychometric tests.

Methods: A five step approach was adopted to ensure a rigorous cross-cultural adaptation of the instrument including forward translation, backward translation, committee opinions, and pilot testing. Fado and Choir singers were recruited through a convenience sampling procedure.

Results: The pilot test was conducted with ten singers, which determined the reformulation of seven items allowing the creation of the EASE-PT final form. Evident internal consistency was found for the scale and its sub scales.

Conclusion: EASE-PT may be considered a reliable tool to apply in the case of Portuguese singers.

7.2. Introduction

Evaluation of the Ability to Sing Easily (EASE) was first developed in Australia with a large sample of musical theater singers (Phyland *et al.*, 2013). It is a vocal function self-report instrument intended to be sensitive enough to quantify subtle nuances of a singer's voice. This scale aims to reflect how singers' voice is felt and sound at the time of the administration measuring their perceptions of their vocal status. It is composed of twenty-two items with good psychometric properties, including descriptors of vocal fatigue and impairment previously described in the literature for professional voice users.

EASE can be considered an innovative instrument due to various reasons. It is quick to administer and user-friendly. A singer is asked to answer according to the current status, hence eliminating the recall bias which is more reliable for symptom evaluation than retrospection (Schmier and Halpern, 2004; Lee *et al.*, 2005). Perhaps the most notable distinction is that it does not assume that there is an already established alteration in a singer's voice, nor is it a disease-specific instrument which allows it to capture even slight differences in the singer's vocal health. Also, at the end, it is expected to screen for singers that are at risk for developing voice disorders.

According to the original authors (Phyland *et al.*, 2013), this scale intends to be useful to: determine load thresholds and vocal doses, determine recovery times to assist performance scheduling and quotas, predict voice problems evolution, monitor therapeutic outcomes, and determine performance fitness.

The ability of EASE to predict findings regarding instrumental evaluation is still unknown and requires further study. Some advances have been already achieved regarding EASE's usability from the clinical standpoint (Phyland *et al.*, 2014; Schloneger, 2014; Randolph *et al.*, 2015; Marchand *et al.*, 2017; Pacheco and Behlau, 2018).

Lately, the construct validity of the scale and respective sub-scales (VF = Vocal Fatigue, PRI = Pathologic Risk Indicators) were evaluated (Phyland *et al.*, 2014). Vocal concern (VC) items were also collected. Highly statistically significant differences were found

according to whether singers perceived themselves having a voice problem. EASE was also able to discriminate active and nonactive singers; in active cohort, it was able to discriminate gender, role, and the perceived voice problem. Higher scores in the VF sub-scale were associated to those with high vocal load. So far, these results validate EASE as a useful tool for measuring singers' perceptions of vocal function. Also, it supports the ability of the sub-scales to be scored separately.

The cross-cultural adaptation to Brazilian Portuguese was done (Rocha *et al.*, 2014). The validity, reliability, and sensitivity measures have also been calculated for this language along with the cut-off values for individuals at a risk for developing voice disorders (Rocha *et al.*, 2016).

The propose of this study is to allow the use of EASE in a country and for a language other than the original also taking the cultural variability into consideration. Thus, the aim of this study is to conduct a cross-cultural adaptation of the original EASE into the EASE-PT.

7.3. Methods

The permission from the original author is shown in the Appendix V. The certificates of the recruited translators are in the Appendix VI.

i. Cross-cultural adaptation

During the construct validity, the original authors compared scores across age, gender, current employment status, role, the perceived vocal load over the past 24 hours and self-reported voice problems (Phyland *et al.*, 2014). Along with the scale administration, the data for these parameters were also collected by us, trying to achieve results as similar as possible.

The cross-cultural adaptation followed the guidelines from Sousa and Rojjanasrirat and was organized into the following phases (Sousa and Rojjanasrirat, 2011):

1st phase – one-way translation: The forward translation (FT) from the source language (SL) – English – to the target language (TL) – Portuguese – was done by two independent, and certified translators native to the TL (FT 1 and FT 2): one is from the specific field under study and skilled about health care terminology; the other is only familiar with medical terminology and is not aware of the construct of the instrument.

2nd phase – comparison of the two translated versions: The comparison was conducted through a committee approach, composed of a third independent reviewer (CR) so that ambiguities and discrepancies could be identified. A consensus was achieved among the previous translators and the authors of this paper. This process generated the preliminary initial (PI) translated version of the EASE-PT.

3rd phase – blind backward translation: The PI was translated back into the source language by two independent translators (BT 1 and BT 2) who match the characteristics of the translators of the 1st phase, but with the European Portuguese language as their native language.

4th phase – comparison of the two back-translated versions: The comparison of the two back-translations and of both the forward translations with the original version was done. A consensus was achieved in the same way as the 2nd phase. The similarities and discrepancies were discussed.

5th phase – pilot testing of the pre-final version: The pilot test was done through a pre-final version of the scale. According to the mentioned recommendations, ten subjects with different backgrounds were recruited. Participants were asked to rate the items of the scale, deciding whether each one was clear or unclear. They were asked to provide a suggestion if the item was rated as unclear. The item was reformulated assuming a minimum inter-rater agreement of 80%.

ii. Data collection

The pilot test was sent to the subjects through email in a spreadsheet or filled by hand. The final version of the instrument was administered through LimeSurvey version 2.63.1+170305 hosted in a private domain. It began on 25st April 2018 and it lasted till 10th June 2018. At the end of the administration, leaflets with scientifically based information on vocal hygiene for singers were sent to the subjects. Confidentiality was ensured along with the impossibility to respond more than once through the creation of individual tokens.

Singers were recruited using convenience/snowball sampling techniques. Primary inclusion criteria for these participants were: singer of Fado or choir singer; older than 18 years old; an active singer. Other characterization questions were also added in an attempt to meet the results of the original version.

iii. Data analysis

Statistical analysis was performed using the IBM© SPSS® Statistics V25 (IBM© Corporation, Chicago, USA).

The descriptive statistics of the scales were also calculated. The negatively scored items were identified and interpreted accordingly. Differences in the median value of the scale and subscales or of the items according to several independent variables (group, gender, voice use in the previous day) were identified by means of the Mann-Whitney test. Relation between these scales and age or work load in the previous week was assessed using the Spearman correlation coefficient.

To calculate the scaling properties and construct validity, the following properties were evaluated: (a) item-internal consistency; (b) equality of item-scale correlations within a scale; (c) approximate equality of item means and standard deviations.

Also, the internal consistency reliability of the scale and each sub-scale's score was estimated through Cronbach's alpha coefficient.

7.4. Results

i. Cross-cultural adaptation for the European Portuguese language

The results of the adaptation of the instrument are detailed in the Table 17. In the 5th phase, ten singers were recruited: two Fado singers and eight choir singers. Seven items were classified as unclear by at least 20% of the subjects. Therefore, seven items (2, 4, 5, 6, 7, 11, 20) needed further revision. The final form of such items was achieved by combining the singers' recommendations and the committee's opinions. Also, the author of the original scale was contacted throughout the process when needed to ensure that items retain their original intent. The final and full version of the scale is presented in Appendix III.

ii. Descriptive Statistics for the Sample

Overall, 122 respondents started answering but only 120 singers completed the EASE (all items). Out of these, 70 (58.3%) were female whose age range varied between 17–72 years with a mean of 36.2 (±12.8) years. Of the respondents, 42 (35%) were Fado singers (48 (61.5%) were female, and ages ranged from 18–69 years with a mean of 38.8 (±13.0) years) and 78 (65%) were choir singers (22 (52.4%) were female and ages ranged from 17–72 years with a mean of 34.8 (±12.6) years). Specifically, 8% were aged between 16–24 years, 38% 25– 44 years, 32% 45–64 years, and 22% were 65 years or older.

Different results (Table 18) were obtained for Fado and Choir singers for several items (items 4, 12, 13, 14, 17, and 18) with a median result significantly higher for Choir singers ($p < 0.05$) except for item 4 where median result was significantly higher for Fado singers. Hence, data analysis regarding the validation of the scale was conducted separately for both groups.

Table 17 – Summary of cross-cultural adaptation of EASE-PT.

Scale	Original items	1st and 2nd phase	3rd and 4th phase
Title	Evaluation of the Ability to Sing Easily	FT 1 – Avaliação da Capacidade para Cantar com Facilidade FT 2 – Avaliação da Capacidade para Cantar com Facilidade CR – (no change)	BT 1 – Evaluation of Ability to Sing with Ease BT 2 – Assessing the Ability to Sing with Ease CR – Avaliação da Capacidade para Cantar com Facilidade
VF	1. My voice is husky	FT 1 – A minha voz está rouca FT 2 – A minha voz está rouca CR – (no change)	BT 1 – My voice is hoarse BT 2 – My voice is hoarse CR – A minha voz está rouca
VF	2. My voice is dry/scratchy	FT 1 – A minha voz está seca/arranhada FT 2 – A minha voz está seca/arranhada CR – (no change)	BT 1 – My voice is dry/scratchy BT 2 – My voice is dry/scratchy (raspy) CR – A minha voz está seca/arranhada
PRI	3. My voice cracks and breaks	FT 1 – A minha voz muda e tem falhas FT 2 – A minha voz muda e tem falhas CR – A minha voz quebra e falha	BT 1 – My voice changes and makes mistakes BT 2 – My voice changes and falters CR – A minha voz quebra e falha
VF	4. My throat muscles are feeling overworked	FT 1 – Os músculos da minha garganta estão sobrecarregados FT 2 – Os músculos da minha garganta estão exaustos CR – Os músculos da minha garganta estão sobrecarregados	BT 1 – My throat muscles are strained BT 2 – My throat muscles are overworked CR – Os músculos da minha garganta estão sobrecarregados
PRI	5. My voice is breathy	FT 1 – A minha voz está soprada (ar na voz) FT 2 – A minha voz está aspirada CR – A minha voz está soprada	BT 1 – My voice is wheezy (air in the voice) BT 2 – My voice is airy (air in the voice) CR – A minha voz está soprada
VF	6. My singing voice feels good*	FT 1 – A minha voz a cantar é agradável FT 2 – A minha voz a cantar proporciona uma sensação agradável CR - A minha voz a cantar é boa	BT 1 – My singing voice is pleasant BT 2 – My singing voice is pleasant CR – A minha voz a cantar é boa
VF	7. The onsets of my notes are delayed or breathy	FT 1 – Os inícios das minhas notas são atrasados ou soprados FT 2 – Os inícios das minhas notas são atrasados ou aspirados CR – Os inícios das minhas notas são atrasados ou soprados	BT 1 – The beginnings of my notes are delayed or wheezy BT 2 – My beginnings of notes are delayed or airy CR – Os inícios das minha notas são atrasados ou soprados
VF	8. My voice feels strained	FT 1 – A minha voz está tensa FT 2 – A minha voz está tensa CR – (no change)	BT 1 – My voice feels tight BT 2 – My voice is tense CR – A minha voz está tensa
VC	9. I am worried about my voice	FT 1 – Estou preocupado com a minha voz FT 2 – Estou angustiado(a) com a minha voz CR – Estou preocupado(a) com a minha voz	BT 1 – I am worried about my voice BT 2 – I am worried about my voice CR – Estou preocupado(a) com a minha voz
PRI	10. I am having difficulty with my breath for long phrases	FT 1 – Estou a ter dificuldades com a minha respiração em frases longas FT 2 – Estou a ter dificuldades com a minha respiração em frases longas CR – (no change)	BT 1 – I am having difficulty with my breathing with long phrases BT 2 – I am having trouble breathing in long sentences CR – Estou a ter dificuldades com a minha respiração em frases longas
VF	11. My top notes are breathy	FT 1 – As minhas notas mais altas são sopradas FT 2 – As minhas notas altas são aspiradas CR – As minhas notas mais agudas são sopradas	BT 1 – My higher notes are wheezy BT 2 – My highest notes are airy CR – As minhas notas mais agudas são sopradas

Scale	Original items	1st and 2nd phase	3rd and 4th phase
VF	12. My voice sounds rich and resonant*	FT 1 – A minha voz soa de forma rica e sonante FT 2 – A minha voz soa de forma profunda e ressonante CR – A minha voz soa de forma rica e sonante	BT 1 – My voice sounds rich and vibrant BT 2 – My voice sounds rich and full CR – A minha voz soa de forma rica e sonante
PRI	13. My voice is cutting out on some notes	FT 1 – A minha voz falha em algumas notas FT 2 – A minha voz falha em algumas notas CR – (no change)	BT 1 – My voice misses some notes BT 2 – My voice falters on a few notes CR – A minha voz falha em alguns notas
PRI	14. I am having difficulty singing softly	FT 1 – Estou a ter dificuldades em cantar de forma suave FT 2 – Estou a ter dificuldades em cantar de forma suave CR – Estou a ter dificuldades em cantar suavemente	BT 1 – I am experiencing difficulty singing gently BT 2 – I am having trouble singing softly CR – Estou a ter dificuldades em cantar suavemente
VF	15. My voice is tired	FT 1 – A minha voz está cansada FT 2 – A minha voz está cansada CR – (no change)	BT 1 – My voice is tired BT 2 – My voice is tired CR – A minha voz está cansada
PRI	16. I am having difficulty changing registers	FT 1 – Estou a ter dificuldades em mudar de registos FT 2 – Estou a ter dificuldades em mudar de registos CR – Estou a ter dificuldades a passar de registo	BT 1 – I am having difficulty switching registers BT 2 – I am having trouble switching scales CR – Estou a ter dificuldades a passar de registo
PRI	17. I am having difficulty with my high notes	FT 1 – Estou a ter dificuldades com as minhas notas agudas FT 2 – Estou a ter dificuldades com as minhas notas agudas CR – Estou a ter dificuldades com as notas mais agudas	BT 1 – I am having difficulty with sharp notes BT 2 – I am having trouble with my sharp notes CR – Estou a ter dificuldades com as notas mais agudas
PRI	18. Singing feels like hard work	FT 1 – Cantar é uma tarefa difícil FT 2 – Cantar é uma tarefa difícil CR – Sinto que cantar é uma tarefa difícil	BT 1 – Singing is a difficult task BT 2 – Singing is a difficult task / Singing is difficult CR – Sinto que cantar é uma tarefa difícil
PRI	19. I am having difficulty projecting my voice	FT 1 – Estou a ter dificuldades em projetar a minha voz FT 2 – Estou a ter dificuldades em projetar a minha voz CR – (no change)	BT 1 – I am having difficulty projecting my voice BT 2 – I am having trouble projecting my voice CR – Estou a ter dificuldades em projetar a minha voz
VC	20. I am concerned about my voice	FT 1 – Estou preocupado(a) com a minha voz FT 2 – Estou preocupado(a) com a minha voz CR – (no change)	BT 1 – I am worried about my voice BT 2 – I am worried about my voice CR – Estou preocupado(a) com a minha voz
VF	21. My voice feels ready for performance if required*	FT 1 – A minha voz está preparada para atuar, se necessário FT 2 – A minha voz está preparada para atuar se necessário CR – (no change)	BT 1 – My voice is ready to perform, if necessary BT 2 – My voice is ready to perform, if necessary CR – A minha voz está preparada para atuar, se for necessário
PRI	22. I am having difficulty sustaining long notes	FT 1 – Estou a ter dificuldades em manter as notas longas FT 2 – Estou a ter dificuldades em manter as notas longas CR – (no change)	BT 1 – I am having difficulty holding long notes BT 2 – I am having trouble holding long notes CR – Estou a ter dificuldades em manter as notas longas

* Reverse scored items

Table 18 – Descriptive analysis of the 22 items of EASE-PT, and comparison by singer group.

Scale	Item		All		Fado	Choir	Fado	Choir	p
			n (%)	Me (Q1-Q3)	n (%)	n (%)	Me (Q1-Q3)	Me (Q1-Q3)	
VF	1- A minha voz está rouca.	Not at all (1)	78 (65)	1 (1-2)	23 (54.8)	55 (70.5)	1 (1-2)	1 (1-2)	0.139
		Mildly (2)	32 (26.7)		16 (38.1)	16 (20.5)			
		Moderately (3)	10 (8.3)		3 (7.1)	7 (9)			
VF	2- A minha voz esta seca/áspera.	Not at all (1)	65 (54.2)	1 (1-2)	18 (42.9)	47 (60.3)	2 (1-2)	1 (1-2)	0.082
		Mildly (2)	43 (35.8)		19 (45.2)	24 (30.8)			
		Moderately (3)	11 (9.2)		4 (9.5)	7 (9)			
		Extremely (4)	1 (0.8)		1 (2.4)				
PRI	3- A minha voz quebra e falha.	Not at all (1)	84 (70)	1 (1-2)	28 (66.7)	56 (71.8)	1 (1-2)	1 (1-2)	0.541
		Mildly (2)	29 (24.2)		11 (26.2)	18 (23.1)			
		Moderately (3)	7 (5.8)		3 (7.1)	4 (5.1)			
VF	4- Os músculos da minha garganta estão hiper contraídos.	Not at all (1)	87 (72.5)	1 (1-2)	26 (61.9)	61 (78.2)	1[a] (1-2)	1[b] (1-1)	**0.046**
		Mildly (2)	25 (20.8)		11 (26.2)	14 (17.9)			
		Moderately (3)	7 (5.8)		5 (11.9)	2 (2.6)			
		Extremely (4)	1 (0.8)			1 (1.3)			
PRI	5- A minha voz esta com ar/soprada.	Not at all (1)	79 (65.8)	1 (1-2)	24 (57.1)	55 (70.5)	1 (1-2)	1 (1-2)	0.118
		Mildly (2)	36 (30)		15 (35.7)	21 (26.9)			
		Moderately (3)	5 (4.2)		3 (7.1)	2 (2.6)			
VF	6- Ao cantar sinto que a minha voz esta bem. ‡	Extremely (1)	31 (25.8)	2 (1-2)	11 (26.2)	20 (25.6)	2 (1-2)	2 (1-2)	0.943
		Moderately (2)	69 (57.5)		24 (57.1)	45 (57.7)			
		Mildly (3)	16 (13.3)		6 (14.3)	10 (12.8)			
		Not at all (4)	4 (3.3)		1 (2.4)	3 (3.8)			
VF	7- Os ataques das minhas notas não são colocados ou têm ar/soprados.	Not at all (1)	60 (50)	1.5 (1-2)	24 (57.1)	36 (46.2)	1 (1-2)	2 (1-2)	0.206
		Mildly (2)	40 (33.3)		13 (31)	27 (34.6)			
		Moderately (3)	20 (16.7)		5 (11.9)	15 (19.2)			
VF	8- A minha voz esta tensa.	Not at all (1)	62 (51.7)	1 (1-2)	23 (54.8)	39 (50)	1 (1-2)	1.5 (1-2)	0.290
		Mildly (2)	39 (32.5)		16 (38.1)	23 (29.5)			
		Moderately (3)	17 (14.2)		3 (7.1)	14 (17.9)			
		Extremely (4)	2 (1.7)			2 (2.6)			
VC	9- Estou preocupado(a) com a minha voz.	Not at all (1)	68 (56.7)	1 (1-2)	19 (45.2)	49 (62.8)	2 (1-2)	1 (1-2)	0.173
		Mildly (2)	30 (25)		16 (38.1)	14 (17.9)			

Scale	Item		All		Fado	Choir	Fado	Choir	p
			n (%)	Me (Q1-Q3)	n (%)	n (%)	Me (Q1-Q3)	Me (Q1-Q3)	
		Moderately (3)	17 (14.2)		5 (11.9)	12 (15.4)			
		Extremely (4)	5 (4.2)		2 (4.8)	3 (3.8)			
PRI	10- Estou a ter dificuldades com a minha respiração em frases longas.	Not at all (1)	46 (38.3)	2 (1-2)	16 (38.1)	30 (38.5)	2 (1-2)	2 (1-2)	0.772
		Mildly (2)	50 (41.7)		19 (45.2)	31 (39.7)			
		Moderately (3)	20 (16.7)		6 (14.3)	14 (17.9)			
		Extremely (4)	4 (3.3)		1 (2.4)	3 (3.8)			
VF	11- As minhas notas mais agudas têm ar/são sopradas.	Not at all (1)	63 (52.5)	1 (1-2)	22 (52.4)	41 (52.6)	1 (1-2)	1 (1-2)	0.479
		Mildly (2)	36 (30)		17 (40.5)	19 (24.4)			
		Moderately (3)	17 (14.2)		2 (4.8)	15 (19.2)			
		Extremely (4)	4 (3.3)		1 (2.4)	3 (3.8)			
VF	12- A minha voz soa de forma rica e sonante. ‡	Extremely (1)	17 (14.2)	2 (2-3)	11 (26.2)	6 (7.7)	2[b] (1-2)	2[a] (2-3)	**0.039**
		Moderately (2)	70 (58.3)		22 (52.4)	48 (61.5)			
		Mildly (3)	26 (21.7)		6 (14.3)	20 (25.6)			
		Not at all (4)	7 (5.8)		3 (7.1)	4 (5.1)			
PRI	13- A minha voz falha em alguns notas.	Not at all (1)	42 (35)	2 (1-2)	20 (47.6)	22 (28.2)	2[b] (1-2)	2[a] (1-3)	**0.039**
		Mildly (2)	53 (44.2)		21 (50)	32 (41)			
		Moderately (3)	22 (18.3)		1 (2.4)	21 (26.9)			
		Extremely (4)	3 (2.5)			3 (3.8)			
PRI	14- Estou a ter dificuldades em cantar suavemente.	Not at all (1)	76 (63.3)	1 (1-2)	28 (66.7)	48 (61.5)	1[b] (1-2)	1[a] (1-2)	**0.001**
		Mildly (2)	35 (29.2)		13 (31)	22 (28.2)			
		Moderately (3)	9 (7.5)		1 (2.4)	8 (10.3)			
VF	15- A minha voz esta cansada.	Not at all (1)	57 (47.5)	2 (1-2)	17 (40.5)	40 (51.3)	2 (1-2)	1 (1-2)	0.418
		Mildly (2)	45 (37.5)		20 (47.6)	25 (32.1)			
		Moderately (3)	16 (13.3)		5 (11.9)	11 (14.1)			
		Extremely (4)	2 (1.7)			2 (2.6)			
PRI	16- Estou a ter dificuldades a passar de registo.	Not at all (1)	58 (48.3)	2 (1-2)	26 (61.9)	32 (41)	1 (1-2)	2 (1-3)	0.530
		Mildly (2)	41 (34.2)		15 (35.7)	26 (33.3)			

Scale	Item		All		Fado	Choir	Fado	Choir	p
			n (%)	Me (Q1-Q3)	n (%)	n (%)	Me (Q1-Q3)	Me (Q1-Q3)	
		Moderately (3)	16 (13.3)		1 (2.4)	15 (19.2)			
		Extremely (4)	5 (4.2)			5 (6.4)			
PRI	17- Estou a ter dificuldades com as notas mais agudas.	Not at all (1)	46 (38.3)	2 (1-3)	21 (50)	25 (32.1)	1.5[b] (1-2)	2[a] (1-3)	**0.004**
		Mildly (2)	41 (34.2)		16 (38.1)	25 (32.1)			
		Moderately (3)	24 (20)		5 (11.9)	19 (24.4)			
		Extremely (4)	9 (7.5)			9 (11.5)			
PRI	18- Sinto que cantar é uma tarefa difícil.	Not at all (1)	63 (52.5)	1 (1-2)	24 (57.1)	39 (50)	1[b] (1-2)	1.5[a] (1-2)	**0.005**
		Mildly (2)	33 (27.5)		10 (23.8)	23 (29.5)			
		Moderately (3)	21 (17.5)		8 (19)	13 (16.7)			
		Extremely (4)	3 (2.5)			3 (3.8)			
PRI	19- Estou a ter dificuldades em projetar a minha voz.	Not at all (1)	56 (46.7)	2 (1-2)	21 (50)	35 (44.9)	1.5 (1-2)	2 (1-2)	0.480
		Mildly (2)	50 (41.7)		17 (40.5)	33 (42.3)			
		Moderately (3)	11 (9.2)		4 (9.5)	7 (9)			
		Extremely (4)	3 (2.5)			3 (3.8)			
VC	20- Estou apreensivo(a) em relação à minha voz.	Not at all (1)	68 (56.7)	1 (1-2)	20 (47.6)	48 (61.5)	2 (1-2)	1 (1-2)	0.509
		Mildly (2)	40 (33.3)		16 (38.1)	24 (30.8)			
		Moderately (3)	9 (7.5)		5 (11.9)	4 (5.1)			
		Extremely (4)	3 (2.5)		1 (2.4)	2 (2.6)			
VF	21- A minha voz está preparada para atuar, se for necessário. ‡	Not at all (1)	52 (43.3)	2 (1-2)	24 (57.1)	28 (35.9)	1 (1-2)	2 (1-2)	0.121
		Mildly (2)	49 (40.8)		10 (23.8)	39 (50)			
		Moderately (3)	12 (10)		4 (9.5)	8 (10.3)			
		Extremely (4)	7 (5.8)		4 (9.5)	3 (3.8)			
PRI	22- Estou a ter dificuldades em manter as notas longas.	Not at all (1)	52 (43.3)	2 (1-2)	20 (47.6)	32 (41)	2 (1-2)	2 (1-2)	0.157
		Mildly (2)	54 (45)		18 (42.9)	36 (46.2)			
		Moderately (3)	12 (10)		4 (9.5)	8 (10.3)			
		Extremely (4)	2 (1.7)			2 (2.6)			

[a, b] – Different letters identify significant differences in the median value of the items according to *Mann-Whitney test. ‡ Reverse scored items.

iii. Descriptive Statistics for Scales

All scales/sub-scales revealed to be positively skewed with the VF for Fado singers and PRI scales for choir singers were moderately skewed. Therefore, this indicates that comparisons should be performed using non-parametric tests (Table 19).

Table 19 – Descriptive statistics and features of score distributions for EASE-PT scale and its sub-scales.

	EASE		**Vocal Fatigue**		**Pathologic-Risk Indicators**		**Vocal Concern**	
	Fado	**Choir**	**Fado**	**Choir**	**Fado**	**Choir**	**Fado**	**Choir**
no. of items	22	22	10	10	10	10	2	2
Mean	35.69	37.51	16.76	17.08	15.48	17.35	3.45	3.09
SD	8.84	9.83	4.20	4.83	4.10	4.94	1.55	1.47
Median	34.00	36.00	16.00	16.00	15.00	16.50	3.00	2.00
Range	22-65	23-69	10-29	11-34	10-30	10-29	2-8	2-8
VC* (%)	25.0	26.0	25.0	28.0	26.0	28.0	45.0	48.0
Skewness	0.97	0.90	0.66	1.28	1.12	0.53	0.92	1.33
Kurtosis	1.36	0.94	0.38	2.12	2.29	-0.28	0.33	1.02

*Variation coefficient

iv. Tests of Scaling Assumptions

Within each scale, item-scale correlations were found to be both comparable and substantial (Table 20). A higher range of item-scale correlations was observed for the scale and sub-scales.

Table 20. Results of item scaling tests and reliability estimates for EASE-PT scale and its sub-scales.

		Fado			Choir		
		Correlation	Scale		Correlation	Scale	
Scale	**k[a]**	**item-internal consistency[b]**	**Homogeneity[c]**	**Reliability[d]**	**item-internal consistency[b]**	**Homogeneity[c]**	**Reliability[d]**
EASE-PT	22	0.24-0.71	0.520	0.900	0.36-0.6	0.525	0.905
VF – subscale	10	0.27-0.55	0.440	0.765	0.44-0.64	0.551	0.846
PRI – subscale	10	0.31-0.67	0.529	0.829	0.31-0.67	0.507	0.824
VC – subscale	2	0.81-0.81	0.805	0.890	0.68-0.68	0.676	0.796

[a] Number of items and number of item-internal consistency tests per scale.
[b] Correlations between items and hypothesized scale corrected for overlap.
[c] Average inter-item correlation.
[d] Internal-consistency reliability (Cronbach's alpha).

a. Reliability

As shown in Table 4, all scales demonstrated high internal consistencies. Cronbach's alpha exceeded 0.80 for EASE scale for both Fado and Choir singers, and its sub-scales were close to or exceed 0.80 and ranged from 0.765 (VF) to 0.890 (VC) for Fado singers and from 0.796 (VC) to 0.846 (Vocal Fatigue) for Choir singers.

b. Known groups validity

In terms of demographic characteristics, 42 (35%) were Fado singers and 78 (65%) were choir singers. Only the PRI sub-scale of the EASE-PT scale showed significant differences between groups, being significantly higher for the Choir group (p=0.042) (Table 21).

In each of these singer groups, no significant differences were found with respect to gender (Table 22), the self-classification of the use of voice in the last 24 hours (Table 23) and age (Table 24). Regarding the singing voice load (Number of times singing in the last week, whether rehearsal or performances) for a significant week, a negative relation (Table 7; r_s=-0.252, p=0.026) was obtained between the load and the PRI for Choir singers.

Table 21 – Descriptive statistics and comparison by singer group of the EASE-PT scale and its sub-scales.

		Fado	Choir	p
Scale	**n**	42	78	
EASE-PT	**min-max**	22-65	23-69	
	Me (Q1-Q3)	34 (29-41)	36 (30-44)	0.352
VF	**min-max**	10-29	11-34	
	Me (Q1-Q3)	16 (13-19)	16 (13-20)	0.934
PRI	**min-max**	10-30	10-29	
	Me (Q1-Q3)	15 (12-18)	16.5 (13-20)	**0.042**
VC	**min-max**	2-8	2-8	
	Me (Q1-Q3)	3 (2-4)	2 (2-4)	0.154

Table 22 – Descriptive statistics and comparison by singer group and gender of the EASE-PT scale and its sub-scales.

		Fado			Choir		
		Male	**Female**	**p**	**Male**	**Female**	**p**
Scale	**n**	20	22		30	48	
EASE-PT	**min-max**	26-49	22-65		23-62	24-69	
	Me (Q1-Q3)	33 (30-42)	34 (28-42)	0.677	32.5 (29-43)	38 (32-44)	0.148
VF	**min-max**	12-25	10-29		11-27	11-34	
	Me (Q1-Q3)	17 (14-19)	16 (13-20)	0.440	14 (13-19)	17 (15-20)	0.081
PRI	**min-max**	10-22	10-30		10-29	10-29	
	Me (Q1-Q3)	16 (12-18)	15 (12-19)	0.761	15.5 (13-21)	17 (15-20)	0.480
VC	**min-max**	2-6	2-8		2-6	2-8	
	Me (Q1-Q3)	3 (2-5)	3.5 (2-4)	0.692	2 (2-4)	2.5 (2-4)	0.507

Table 23 – Descriptive statistics and comparison by singer group and self-classification of use of voice in the last 24 hours of the EASE-PT scale and its sub-scales.

		Fado			Choir		
		at maximum "Light"	at least "Moderate"	p	at maximum "Light"	at least "Moderate"	p
	n	12	30		27	51	
EASE-PT	**min-max**	26-49	22-65		23-51	24-69	
	Me (Q1-Q3)	36.5 (30-46)	34 (28-41)	0.449	36 (31-46)	38 (29-44)	0.504
VF	**min-max**	12-25	10-29		11-27	11-34	
	Me (Q1-Q3)	17 (14-22)	16 (13-19)	0.401	15 (13-19)	17 (13-20)	0.408
PRI	**min-max**	11-21	10-30		10-26	10-29	
	Me (Q1-Q3)	15.5 (13-20)	15 (12-17)	0.371	17 (13-20)	16 (13-21)	0.979
VC	**min-max**	2-6	2-8		2-5	2-8	
	Me (Q1-Q3)	3.5 (2-4)	3 (2-4)	0.899	2 (2-3)	3 (2-4)	0.067

Table 24 – Association between Age or Number of times singing (rehearsal or performances) in the last week with the EASE scales.

		Age		No. of times singing in the last week	
Scale		**Fado**	**Choir**	**Fado**	**Choir**
EASE	r_s	0.214	-0.043	0.098	-0.205
	p	0.174	0.706	0.537	0.072
	n	42	78	42	78
VF	r_s	0.283	-0.021	0.097	-0.175
	p	0.069	0.857	0.541	0.126
	n	42	78	42	78
PRI	r_s	0.139	-0.042	0.064	-0.252
	p	0.381	0.715	0.690	**0.026**
	n	42	78	42	78
VC	r_s	0.004	0.074	0.197	0.001
	p	0.978	0.517	0.212	0.991
	n	42	78	42	78

r_s = Spearman correlation coefficient

7.5. Discussion

The adaptation of EASE allowed the authors to be sure that the EASE-PT measures the same contents of the original version taking into account the cultural particularities of Portuguese singers. This paper provides all the information that was used during the process of this scale adaptation and validation. It also presents the results of the scaling assumption tests and the construct validity. Important findings were recorded in the adaptation process allowing us to achieve a more accurate version of the instrument. Ambiguities, confusions and precision of the terms were improved to ensure they match cultural issues before applying the final version to the sample.

The outcomes must be interpreted considering the methodological approach underlying the whole process, namely the convenience sampling method, the two different groups of singers, and the method of collecting data. Therefore, other groups of singers, such as musical theater and classical singers were not examined and results for the same could possibly differ and should be extrapolated carefully.

In general, EASE-PT showed a very favorable psychometric performance meeting the criteria that had been suggested for reliability (Nunnally and Bernstein, 1978), that is, having a minimum score of 0.90 for analyzing an individual singer's score. Probably due to the low amount of time for which this scale has been available, the lack of similar studies for the original scale makes it difficult to compare our results. EASE-PT proved to be a reliable instrument to assess its original aim and constructs, whether with Fado or Choir singers. No different results were found for age, gender and perceived vocal load in the last 24 hours. However, an intriguing result was obtained: as the load increases the PRI decreases, however, the variability is very high which makes it difficult to give clinical importance to this relation. Fado singers are more prone to report vocal fatigue and choir singers are more prone to report indicators related to the risk of pathology. No plausible explanations were found. However, this gives us hints regarding future studies.

The internal consistency for the overall scale matched an equally good value of the homologous Brazilian version (Rocha *et al.*, 2016). Authors of the original scale suggest that EASE will be useful as a singer-specific symptom tool. External validity is also intended to be accomplished, in the future, so that it can identify changes in aspects of vocal function, vocal load, and settings. Furthermore, EASE is expected to help with identifying the vocal load thresholds or doses, determining recovery times to assist performance scheduling and quotas, predicting the development of voice problems, monitoring therapeutic outcomes, and determining performance fitness (Phyland et al., 2013). EASE has been revealed to be useful in the investigation of vocal warm-up (Marchand *et al.*, 2017), vocal cool-down (Ragan, 2018), and surgical outcomes (Randolph *et al.*, 2015).

7.6. Conclusion

EASE is an instrument which measures singers' perception of vocal function and is divided into three different scales even though separate scores are advisable. This paper presents the outcome of the process of adaptation and validation of the EASE into the European Portuguese language. The outcome supports the ability of EASE-PT to measure the same constructs in a way similar to that of the original version.

Chapter VIII – Discussion

The primary focus of this thesis was to analyze the voice of Fado singers from a clinical standpoint. Indeed, the results allowed us to draw some main conclusions. An important finding was that many of the traditional concepts and common knowledge about voice and singing healthy are generally not supported by science as one may believe. Through the course of thesis this statement gained more accuracy.

In an ideal world every subject that requires clinical guidance, whether therapeutic or medical, should have access to state-of-art practices. This assertion has a higher importance when the one is dealing with occupational disorders, in which the likelihood of the singer losing money is greater. While researching, an important conclusion could be drawn: the gap between voice research and clinical practices is vast, whether speaking about assessment or treatment. The size of our country may result in the lack of necessity of higher specialization in the occupational health, reducing the probability of singers to find highly specialized clinicians on singing voice. However, this does not mean that there is no need for it. With this thesis, it is aimed to partially bridge this gap.

A thorough revision of literature shows a continuous growth that encompasses the interest shown by clinical experts in the field of singing voice. It is expected to continue growing, while the topics have been evolving. Based on the results, more clinical and less exploratory researches may be predicted. The prevalence of voice disorders in singers was indeed higher, than in general population. It would be even higher when speaking about traditional singers, which led us to conduct research with Fado singers. Even though some discrepancies were found regarding it, important risk factors were found in Fado singers. However, a surprisingly low number of papers on the specific topic of risk factors among singers was found. This made it more difficult to compare our population with others. Such works are urgently in need to validate the assumptions that are shared among singers and related professional groups. Future work will be driven in order to prevent or reduce the likelihood of developing voice disorders among these singers, so that they can take a great but safe advantage of their most fascinating

gift: their voice. Self-perception played a major role throughout the thesis which culminated in the adaptation and validation to European Portuguese of an innovative tool to measure singing voice: EASE-PT. It is expected to be useful in making a positive contribution to both clinical and research fields.

Along the chapters, directions towards future work were already pointed. The scientometric approach in the Chapter II is intended to be reproduced in some years, so comparisons can be made. Also, a broader strategy could be adopted through the search in more databases, in more narrow time intervals, and using the full text rather than only the title and abstract. The meta-analysis conducted on Chapter III could be expanded to measure different clinical standpoints. Also, an analogous approach could be adopted to compare risk factors when more studies in the field arise. Works similar to that of Chapter IV should be done and warned to the need of a continuous and more stringent monitoring of singers in Portugal. Two results can be combined to predict a more realistic number of Fado singers. If we look proportionally to the estimated population size in Chapter IV (n=411) in which they all did recordings and the number of recruited singers (Chapter V e VI) who recorded (n=38), 1200 singers can be predicted.

Chapter V and VI played a vital role in the thesis. The predictable steps are to increase the sample size and assess other parameters in addition to self-perception. Chapter VII will be of benefit, in a near future, of test-retest and the collection of complementary variables.

Due to reproducibility, the author tried to be as meticulous as possible while describing all the involved processes. This was also a reason why open source software was preferred whenever possible.

Finally, it is expected to motivate clinicians, especially the Portuguese speech-language pathologists, enlarging their scope of practice up to this delightful world where there is, and will always be, a lot to find, prove, discover, and discuss: the voice study.

The author perceives that some measures could be taken to prevent and therefore reduce the risk of voice disorders in singers: to establish an organism which regulates the professional practice; to create or apply the existent laws regarding occupational health to this population; to promote a formal training of the Fado singing.

Chapter IX – Conclusion

The major conclusions of this thesis are as follows.

- There is a growing interest in singing from the academic community.
- The topics of major interest have been: voice quality; occupational demands; acoustic analysis; training effects; musical perception; electroglottography.
- The prevalence of self-reported voice disorders is 46.09%, even though there is great heterogeneity due to singing styles and roles.
- Singers tend to report more voice disorders than the general population.
- Singing teachers as well as traditional and popular music singers tend to report more voice disorders than classical singers and singing students.
- A preventive approach is recommended with all singers.
- The lack of regulation of Fado singing as an occupation makes it difficult to help the singers. Probably, this is the greatest factor that is putting these singers at risk.
- At the time of data collection, there were 411 singers of Fado *de Lisboa* alive accounted for and registered at *Sociedade Portuguesa de Autores*.
- The prevalence of self-reported voice disorders among Fado singers was 39.6% and they had greater difficulty to sing during the winter and spring.
- Significant risk factors were identified: nose related disorders and associated drugs, oral contraceptives and hormone replacement therapy, previous smoking habits, and vocal fatigue after performances.

- The relative low frequency of self-reported voice disorders suggests a hypothetical combination of protective factors not studied yet.

- The EASE-PT is an available and reliable tool that can be used with Portuguese singers.

- This aims to be an epidemiological study that contributes to the prevention of vocal health of Fado singers.

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Appendix I – Complete Statistics of the Questionnaire

Title: The Voice of the Fado Singer / ***Título:*** *A Voz do Cantor de Fado*

Description: These answers will allow us to study the risk factors associated with self-perceived voice disorders among Fado singers as well as the strategies adopted to overcome it. At the end, information about vocal health in singers and voice pathology prevention will be sent.
Descrição: *Com estas perguntas poderemos estudar os factores de risco associados às alterações de voz auto-percepcionadas nos cantores de Fado, assim como as estratégias que utilizam para as ultrapassar. No final ser-lhe ão enviadas informações acerca da saúde vocal no cantor e prevenção de patologias vocais.*

ID	Variables	Categories	Statistics	Me (P25-P75)
1	Personal and demographic data / *Informação pessoal e demográfica*			
1.1	Gender / *Género*	Male	52 (46.8%)	
		Female	59 (53.2%)	
1.2	Age (years) / *Idade (anos)*	min-max	18-74	38 (28-59)
		ave (st.dev)	42.2 (16.5)	
1.3	Where do you sing most frequently? (You can select multiple answers) *Onde canta com mais frequência? (pode selecionar várias respostas)* n=180 (162.1%)	North	72 (64.9%)	
		Center	48 (43.2%)	
		South	27 (24.3%)	
		Islands	7 (6.3%)	
		Other countries than Portugal	26 (23.4%)	
2	Musical experience and knowledge / *Experiência e conhecimento musical*			
2.1	Mark your preferred music style *Assinale o tipo de música que canta com mais frequência*	Fado	107 (96.4%)	
		Popular	3 (2.7%)	
		Musical theater	1 (0.9%)	
		Others	0 (0.0%)	
2.2	Have you ever taken singing lessons? / *Tem ou já teve aulas de canto?*	Yes	40 (36.0%)	
2.3	How many phonograms (CD's, K7's, LP's ou EP's) have you recorded so far? *Quantas obras (CD's, K7's, LP's ou EP's) publicou?*	min-max	0-100	1 (0-3)
		average (S.D.)	4 (12.3)	
2.4	Do you currently sing? / *Atualmente canta?*	Yes	111 (100.0%)	
	If not, why? (Please answer the following questions based on your past experience.) *Se não, porquê? (Por favor, responda às próximas perguntas segundo a sua experiência passada.)*	Retired	n/a	
		Sick	n/a	
		Other	n/a	

ID	Variables	Categories	Statistics	Me (P25-P75)
3	Performance demands and habits / *Hábitos e exigências performativas*			
3.1	How many times did you sing (rehearsals and performances included) in the last month? *No último mês quantas vezes cantou (ensaio e atuação)?*	min-max	0-62	10 (5-20)
		average (S.D.)	13.2 (11.2)	
3.2	How many songs did you sing in each performance, on average, in the last month? *No último mês, em média, quantos temas cantou em cada atuação?*	min-max	0-30	8 (5-12)
		average (S.D.)	8.9 (5.0)	
3.3	After a performance, do you usually get tired? *Depois de uma atuação costuma ficar cansado?*	Never	21 (18.9%)	Occasionally (Occasionally-Sometimes)
		Occasionally	49 (44.1%)	
		Sometimes	36 (32.4%)	
		Often	4 (3.6%)	
		Always	1 (0.9%)	
3.4	Do you feel hoarse after a performance? *Sente-se rouco depois de uma atuação?*	Never	35 (31.5%)	Occasionally (Never-Sometimes)
		Occasionally	46 (41.4%)	
		Sometimes	29 (26.1%)	
		Often	1 (0.9%)	
		Always	0 (0%)	
3.5	Does the environment in which you perform usually have smoke? *O ambiente em que atua costuma ter fumo?*	Never	59 (53.2%)	Never (Never-Occasionally)
		Occasionally	37 (33.3%)	
		Sometimes	14 (12.6%)	
		Often	0 (0%)	
		Always	1 (0.9%)	
3.6	Where do you sing most often? *Em que sítio canta com mais frequência?*	Fado venues	58 (52.3%)	
		Restaurants and similar venues	44 (39.6%)	
		Stages	1 (0.9%)	
		Others	8 (7.2%)	
3.7	Do you sing with an amplification system? *Canta com sistema de amplificação?*	Never	12 (10.8%)	Occasionally (Occasionally-Sometimes)
		Occasionally	44 (39.6%)	
		Sometimes	42 (37.8%)	
		Often	12 (10.8%)	
		Always	1 (0.9%)	

ID	Variables	Categories	Statistics	Me (P25-P75)
3.8	Do you usually perform vocal warm ups before singing? *Costuma fazer aquecimento vocal antes de cantar?*	Never	34 (30.6%)	Occasionally (Never-Often)
		Occasionally	24 (21.6%)	
		Sometimes	24 (21.6%)	
		Often	12 (10.8%)	
		Always	17 (15.3%)	
3.9	Do you usually perform vocal cool downs after singing? *Costuma fazer arrefecimento vocal depois de cantar?*	Never	79 (71.2%)	Never (Never-Occasionally)
		Occasionally	13 (11.7%)	
		Sometimes	12 (10.8%)	
		Often	2 (1.8%)	
		Always	5 (4.5%)	
3.10	How many performances have you canceled because of voice problems since the beginning of your career? *Desde o início da sua atividade quantas atuações cancelou por causa de problemas na voz?*	min-max	0-10	0 (0-2)
		average (S.D.)	1.3 (2.2)	
3.11	What is your voice category? (You can select multiple answers) (n=114) *Qual é a sua categoria vocal? (Pode selecionar várias respostas)*	Do not know	59 (51,8%)	
		Soprano	17 (14,9%)	
		Contralto	17 (14,9%)	
		Tenor	10(8,8%)	
		Baritone	10(8,8%)	
		Bass	1 (0,9%)	
3.12	Are you satisfied with your vocal quality? *Está satisfeito com a sua qualidade vocal?*	Sim	98 (88.3%)	95%CI: 80.9%-93.6%
3.13	Are certain times of the year harder to sing in than others? / *Hà épocas do ano mais difíceis para cantar do que outras?*	Sim	98 (88.3%)	
3.14	What season(s) do you find it harder to sing in? (n=98) *Em que estação/estações do ano tem mais dificuldade a cantar?*	Spring	26 (23.4%)	
		Summer	5 (4.5%)	
		Autumn	15 (13.5%)	
		Winter	48 (43.2%)	

ID	Variables	Categories	Statistics	Me (P25-P75)
4	Personal and social habits / *Hábitos pessoais e sociais*			
4.1	Do you practive regular physical activities? *Pratica atividades físicas com regularidade?*	Yes	53 (47.7%)	
4.1.1	What physical activities do you practice regularly? (Leave blank if you do not practice any.) (n=70) *Que atividades físicas pratica regularmente? (Deixe em branco se não praticar nenhuma.)*	Walking	22 (31.4%)	
		Gymnasium	11 (15.7%)	
		Running	9 (12.9%)	
		Swimming	7 (10.0%)	
		Cycling	4 (5.7%)	
		Bodybuilding	3 (4.3%)	
		Dancing	3 (4.3%)	
		Horse riding	3 (4.3%)	
		Soccer	2 (2.9%)	
		Athletics	1 (1.4%)	
		Basketball	1 (1.4%)	
		Cardio-fitness	1 (1.4%)	
		Fit-cross	1 (1.4%)	
		Golf	1 (1.4%)	
		Water aerobics	1 (1.4%)	
4.1.2	How many hours per week? *Quantas horas por semana?*	min-max	1-4	4 (2-6)
		average (S.D.)	4.9 (5.3)	
4.2	At what time do you take your last meal? *A que horas costuma ser a sua última refeição?*	min-max	18-27	25 (24-26)
		average (S.D.)	21.6 (1.8)	
4.3	At what time do you usually go to bed? *A que horas costuma deitar-se?*	min-max	21-30	25 (24-26)
		average (S.D.)	25.0 (1.8)	
4.4	Time between last meal and bedtime (hours) (calculated posteriorly) *Tempo entre última refeição e deitar-se (horas) (calculado posteriormente)*	min-max	0-10	3 (2-4)
		av (st.dev)	3.4 (1.8)	
		≤2 hours, n (%)	36 (32.4%)	
4.5	Do you currently have any other occupations or jobs? / *Atualmente tem outras ocupações profissionais ou empregos?*	Yes	57 (51.4%)	

ID	Variables	Categories	Statistics	Me (P25-P75)
4.5.1	Do these occupations depend on the use of voice? *Essas ocupações dependem do uso da voz?* (n=57)	Never	13 (22.8%)	Muitas vezes (Poucas vezes – Sempre)
		Occasionally	9 (15.8%)	
		Sometimes	5 (8.8%)	
		Often	8 (14%)	
		Always	22 (38.6%)	
4.6	Do you currently smoke? / *Atualmente fuma?*	Sim	35 (31.5%)	
4.6.1	Approximately how many cigarettes do you smoke per day? (n=35) Aproximadamente, quantos cigarros fuma por dia?	min-max	2-34	12 (6-20)
		average (S.D.)	13.1 (8.6)	
4.6.2	How long have you been smoking (years)? *Há quantos anos fuma?* (n=35)	min-max	0-58	14 (8-28)
		average (S.D.)	18.1 (14.7)	
4.6.3	At the time of performances: (n=35) *Na altura das atuações:*	Quit smoking	4 (11.4%)	Decrease (Quit-Decrease)
		Decrease the number of cigarettes smoked	8 (22.9%)	
		Maintain the number of cigarettes smoked	17 (59.6%)	
		Increase the number of cigarettes smoked	6 (17.1%)	
4.7	Did you smoke in the past? / *Já fumou?* (n=35)	Yes	29 (26.1%)	
4.7.1	Since you quit smoking, your voice: (n=29) *Desde que parou de fumar, a sua voz:*	Worse	1 (3.4%)	Slightly better (Maintains-Better)
		Slightly worse	1 (3.4%)	
		Maintains	5 (17.2%)	
		Slightly better	5 (17.2%)	
		Better	17 (58.6%)	
4.8	Regarding the quantity of water, at the time of the performances: *Em relação à quantidade de água, na altura das atuações:*	Stops	5 (4.5%)	Increases (Maintains-Increases)
		Decreases	9 (8.1%)	
		Maintains	23 (20.7%)	
		Increases	49 (44.1%)	
		Increases a lot	25 (22.5%)	
4.9	What is your caffeine intake per day (amount of expressos)? *Aproximadamente, quantos cafés bebe por dia?*	min-max	0-50	2 (1-3)
		average (S.D.)	2.7 (4.9)	
4.10	Approximately how many glasses of sparkling drinks do you consume per day? *Aproximadamente, quantos copos de líquidos com gás ingere por dia?*	min-max	0-10	0 (0-1)
		average (S.D.)	0.4 (1.1)	

ID	Variables	Categories	Statistics	Me (P25-P75)
4.11	Do you use recreational drugs? / Consome drogas recreacionais?	Yes	3 (2.7%)	
4.12	Do you drink alcoholic beverages? / Consome bebidas alcoólicas?	Yes	63 (56.8%)	
4.12.1	In relation to alcoholic beverages, at the time of performance: (n=63) *Em relação a bebidas alcoólicas, na altura das atuações:*	Stops	11 (17.5%)	Maintains (Decreases-Maintains)
		Decreases	20 (31.7%)	
		Maintains	27 (42.9%)	
		Increases	5 (7.9%)	
		Increases a lot	0 (0.0%)	

ID	Variables	Categories	Statistics	Me (P25-P75)
5	Vocal health and well-being / *Saúde e bem-estar vocal*			
5.1	Do you have or have you had any illnesses? / *Tem ou já teve alguma doença?*	Yes	43 (38.7%)	
5.2	What diseases do you have/had? (You can select multiple answers) (n=83) *Que doenças tem/teve? (Pode selecionar várias respostas)*	None	0 (0.0%)	
		Diabetes	4 (4.8%)	
		Thyroid	5 (6.0%)	
		Sinusitis/ rhinitis	16 (19.3%)	
		Allergies	17 (20.5%)	
		Gastroesophageal / laryngopharyngeal reflux disease	9 (10.8%)	
		Asthma	8 (9.6%)	
		Autoimmune	2 (2.4%)	
		Neurologic disorders	0 (0.0%)	
		Cervical issues	8 (9.6%)	
		Others	14 (16.9%)	
5.3	What medications do you take regularly? (You can select multiple answers) (n=125) *Que medicações toma regularmente? (Pode selecionar várias respostas)*	None	44 (35.2%)	
		Thyroid	2 (1.6%)	
		Decongestants/antihistamines	13 (10.4%)	
		Antidepressants	7 (5.6%)	
		Antihypertensives	9 (7.2%)	
		Steroids and / or steroids	1 (0.8%)	
		Chemotherapy	0 (0.0%)	
		Asthma medication	8 (6.4%)	
		Oral contraceptive or hormone replacement therapy	13 (10.4%)	
		Statins for blood pressure	9 (7.2%)	
		Others	19 (15.2%)	

ID	Variables	Categories	Statistics	Me (P25-P75)
5.4	In the past, have you had a problem with your voice? / *No passado, já teve algum problema na sua voz?*	Yes	44 (39.6%)	95%CL: 31.0%-48.9%
5.4.1	Did you seek medical help for this vocal problem? / *Procurou ajuda médica para esse problema vocal?* (n=44)	Yes	(n=40, 90.9% of 44; 36% out of the 111; 95%CL: 27.7%-45.3%)	
5.4.2	What was the diagnosis? (n=44) *Qual foi o diagnóstico?*	**Single**		
		Vocal fold nodules	7 (15.9%)	
		Functional dysphonia	6 (13.6%)	
		Laryngitis	6 (13.6%)	
		Undefined or poorly defined	6 (13.6%)	
		Vocal fold polyp	5 (11.4%)	
		Tonsillitis	4 (9.1%)	
		Gastroesophageal reflux disease (GERD)	3 (6.8%)	
		Reinke's edema	1 (2.3%)	
		Sinusitis and/or rhinitis	1 (2.3%)	
		Pulmonary disease	1 (2.3%)	
		Entubation related	1 (2.3%)	
		Combined		
		GERD; Sinusitis and/or rhinitis	1 (2.3%)	
		GERD; Vocal fold nodules	1 (2.3%)	
		Functional dysphonia; Sinusitis and/or rhinitis	1 (2.3%)	
5.4.3	For your past vocal problems, you received: (n=44) *Para o seu problema vocal passado recebeu:*	Medication	30 (68.2%)	
		Voice therapy	13 (29.5%)	
		Surgery	7 (15.9%)	
		Anything	4 (9.1%)	
		Other	3 (6.8%)	

ID	Variables	Categories	Statistics	Me (P25-P75)
5.4.4	Which categories best describe your past vocal problem? (You can select multiple answers) (n=117) Que categorias descrevem melhor o seu problema vocal passado? (Pode selecionar várias respostas)	Loss of high notes	13 (11.1%)	
		Loss of low notes	4 (3.4%)	
		Loss of ability to speak or sing loudly	14 (12.0%)	
		Loss of ability to speak or sing quietly	8 (6.8%)	
		Tired voice	28 (23.9%)	
		Breathy voice	8 (6.8%)	
		Hoarse voice	27 (23.1%)	
		Effortful voice	15 (12.8%)	
5.5	Do you currently have a problem with your voice? / *Atualmente tem algum problema na sua voz?*	Yes	4 (3.6%)	95%CL:1.1%-9.2%
5.5.1	Did you seek medical help for this vocal problem? / *Procurou ajuda médica para esse problema vocal?* (n=4)	Yes	1 (25.0%)	
5.5.2	What is the diagnosis? (n=4) *Qual é o diagnóstico?*	Glottal incomplete closure	1 (25.0%)	
		Undefined or poorly defined	2 (50.0%)	
		Voice overuse	1 (25.0%)	
5.5.3	For your current vocal problem, you receive: (n=4) *Para o seu problema vocal actual recebe:*	Medication	0 (0.0%)	
		Voice therapy	1 (25.0%)	
		Surgery	0 (0.0%)	
		Anything	3 (75.0%)	
		Other	0 (0.0%)	
5.5.4	Which categories best describe your current vocal problem? (You can select multiple answers) (n=9) Que categoria descreve melhor o seu problema vocal actual? (Pode selecionar várias respostas)	Loss of high notes	2 (22.2%)	
		Loss of low notes	1 (11.1%)	
		Loss of ability to speak or sing loudly	0 (0.0%)	
		Loss of ability to speak or sing quietly	0 (0.0%)	
		Tired voice	2 (22.2%)	
		Breathy voice	1 (11.1%)	
		Hoarse voice	3 (33.3%)	
		Effortful voice	0 (0.0%)	

ID	Variables	Categories	Statistics	Me (P25-P75)
5.6	Do you have any access to information that helps you maintain a healthy voice? *Tem acesso a informações que o ajudem a manter a voz saudável?*	No	49 (44.1%)	
		Yes, from my record company	1 (0.9%)	
		Yes, from my voice teacher	15 (13.5%)	
		Yes, from my doctor	28 (25.2%)	
		Yes, from my speech-language pathologist	9 (8.1%)	
		Yes, from my fellow musicians	22 (19.8%)	
		Others	8 (7.2%)	

6	Strategies / Estratégias		
6.1	What are the strategies you usually adopt to overcome vocal difficulties? (e.g., warm tea, drops, exercises) *Quais são as estratégias que costuma adoptar para ultrapassar dificuldades vocais? (ex: chá morno, pastilhas, exercícios)*	n (% answers)	n (% singers)
Vocal behaviour 38 (34.2% singers)	Vocal exercises (warm up, breathing, vocalises)	24 (10.2%)	24 (21.6%)
	Change singing style (musical key, registry, softer)	3 (1.3%)	3 (2.7%)
	Sleep	9 (3.8%)	9 (8.1%)
	Rest	4 (1.7%)	4 (3.6%)
	Speech Therapy	1 (0.4%)	1 (0.9%)
	Avoid bad vocal habits (speak loud, whisper, long phone calls)	2 (0.8%)	2 (1.8%)
	Stop singing	1 (0.4%)	1 (0.9%)
Personal habits 82 (73.9% singers)	Water (natural, tepid, warm, cold)	33 (14%)	33 (29.7%)
	Tea/infusions (purple perpetual tea, honey and milk, ginger, lemon...)	77 (32.6%)	77 (69.4%)
	Honey spoon	3 (1.3%)	3 (2.7%)
	Protect the neck	1 (0.4%)	1 (0.9%)
	Bubble gum	1 (0.4%)	1 (0.9%)
	Tepid red wine	1 (0.4%)	1 (0.9%)
	Stop or avoid bad habits (smoking, sparkling drinks, wine, acid food...)	9 (3.8%)	9 (8.1%)
	Promote good food habits	5 (2.1%)	5 (4.5%)
Airway effects 42 (37.8% singers)	Nasal hygiene with saline solution	4 (1.7%)	4 (3.6%)
	Pills (Euphon ®, Strepsils ®, Mebocaína ®, CantaDrill ®, crystallized ginger, similars)	36 (15.3%)	36 (32.4%)
	Drugs (expectorant, ibuprofen, saliva spray, anti inflammatory, corticosteroid, injectable, Biprol Propólis, Prednisone)	11 (4.7%)	11 (9.9%)
	Nebulization	1 (0.4%)	1 (0.9%)
	Oral hygiene (elixir gargle)	2 (0.8%)	2 (1.8%)
No strategy 8 (7.2%)	None or not necessary	8 (3.4%)	8 (7.2%)
	Total	*236 (100%)*	*236 (212.6%)*

Appendix II – Leaflets for Vocal Hygiene of Singers

Higiene Vocal para Cantores

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01 Hidratação, cafeína e álcool

As pregas vocais estão banhadas em muco que atua como lubrificante para proteger as pregas vocais do aquecimento e da fricção que resulta da vibração que acontece quando fala ou canta. O muco deve ser fino e escorregadio. No entanto, a desidratação pode torná-lo grosso e viscoso. Uma hidratação pobre aumenta o esforço para cantar. Existem dois tipos de hidratação: a interna e a superficial.

A hidratação interna pressupõe a ingestão de líquidos. A hidratação superficial é conseguida através da respiração, mas os seus benefícios são de curto prazo, ao contrário da hidratação interna.

Não existe melhor líquido do que a água para ficar hidratado. A cafeína é um diurético e pode desidratar se for consumida em grandes quantidades.

O álcool é um diurético e, tal como o café, pode desidratar. Para além disso, em algumas pessoas promove o refluxo de ácido gástrico, que pode danificar as pregas vocais. Mais importante do que a possível desidratação são as consequências de um estado embriagado. A baixa inibição e a baixa capacidade de decidir fazem com que seja menos capaz de controlar a sua voz. A coordenação fica afetada e a técnica vocal durante uma atuação também pode ficar.

Tente beber pelo menos 2 litros de água por dia, que é o equivalente a 6 ou 8 copos. No entanto, se praticar alguma atividade física exigente, pode ser preciso aumentar esta quantidade. Se, para si, esta quantidade for grande, aumente progressivamente e não de uma vez só. Pode criar um registo onde anote a quantidade de água e definir objetivos para os dias ou semanas seguintes.

A inalação ou nebulização pode humedecer as pregas vocais através de gotículas. Isto pode ser conseguido através da inalação simples do vapor de uma bebida quente, do vapor do chuveiro ou banho turco, ou através de um nebulizador.

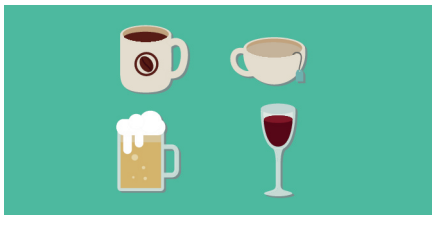
A cor da urina pode ser um bom indicador do seu estado de hidratação – quanto mais transparente for, mais hidratado está o seu corpo. Se realmente não gosta de beber água, experimente acrescentar algum sabor ou substituir por um chá de ervas, nem muito quente nem muito frio.

Limite o consumo de bebidas alcoólicas a 1 ou 2 copos por dia.

Tente manter o consumo de cafeína menor do que 250mg por dia. Pode usar esta tabela para calcular a quantidade de cafeína em diferentes bebidas.

Os humidificadores ou vaporizadores também podem ser úteis, especialmente se o sítio onde ensaia, dorme ou trabalha estiver seco. É muito importante que estes aparelhos estejam sempre limpos de forma a evitar a transmissão de substâncias irritantes e de bactérias.

Para medir o nível de humidade pode recorrer a um higrómetro. Este aparelho vende-se nas grandes superfícies comerciais. Humidifique o seu estúdio e o seu quarto nos meses de inverno. No entanto, se tem alergias ao bulor tente não aumentar a humidade em demasia.



	Tamanho	Cafeína
Chá	200 ml	47 mg
Café	30 ml	88 mg
Ice-Tea ®	330 ml	20 mg
Coca-Cola ®	330 ml	29 mg
RedBull ®	350 ml	74 mg
Chocolate de leite	100 g	16 mg
Chocolate preto	100 g	64 mg

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02 Gritar, pigarrear e sussurrar

Deve evitar gritar e falar alto. Este tipo de uso vocal pode causar tensão e provocar lesões vocais. Isto significa que deve arranjar uma alternativa a, por exemplo, gritar em casa - tal como usar um sino, um assobio para chamar os seus filhos, ou até telefonar-lhes ou enviar uma mensagem.

Quando estamos em ambientes ruidosos falamos mais alto – a isto chama-se efeito de Lombard. Acontece em eventos desportivos, dentro de aviões ou em bares e discotecas. Em vez de falar alto ou gritar, poderá usar outras coisas que façam barulho, tais como apitos ou línguas da sogra para se divertir num evento.Pode ainda usar amplificação em ambientes com mais ruído, deslocar-se até um local com menos barulho, ou comunicar através da escrita.

O pigarreio serve para tentar limpar a garganta. É um comportamento traumático para as pregas vocais e pode tornar-se um ciclo vicioso: o pigarreio traumatiza as pregas vocais e o corpo produz mais muco para acalmar o tecido. Aumentar a hidratação fará com que o muco fique mais fino e diminua a necessidade de pigarrear. Beba um golo de água ou engula quando sentir necessidade de pigarrear. Se isto já é um hábito, irá demorar algum tempo para o ultrapassar. Seja paciente e tente contrariá-lo. O pigarreio excessivo é indicador de problema e, se persistir, deverá ser avaliado por um otorrinolaringologista.

Outro comportamento aparentemente inofensivo ou até benéfico é sussurrar. Ao sussurrar pode causar tensão na sua garganta. Se sentir necessidade de conservar a voz, faça exercícios vocais eficientes ou faça repouso vocal.

Se tem uma lesão vocal e, para si, cantar é uma prioridade, deve pôr algumas atividades de parte ou arranjar alternativas que impliquem um uso diminuído da voz, pelo menos a curto prazo.

03 Medicação, pastilhas e sprays

Há alguns medicamentos que podem secar a garganta e tornar o muco mais espesso – por exemplo, os anti-histamínicos orais e descongestionantes.

Se tem alergias ou uma constipação pergunte ao seu médico se pode substituir essa medicação por um tratamento tópico – tal como corticóides nasais ou sprays anti-histamínicos.

Pode também rever toda a sua medicação com o médico, em relação ao impacto que pode ter na voz. Não partilhe a medicação com outros cantores ou atores (ex: antibióticos). Evite medicação de venda livre. A sua voz é muito importante! Consulte um otorrinolaringologista especialista no cuidado de profissionais da voz ou em foniatria.

Pastilhas ou drageias não fazem mal, desde que não tenham substâncias irritantes ou anestésicas.

Mentol e eucalipto são substâncias comuns nos rebuçados para a tosse – devem ser evitadas, porque irritam a garganta.

A benzocaína é um anestésico tópico que pode ser encontrado em muitas pastilhas para a garganta – pode mascarar a dor de garganta e também deve ser evitada.

Existem alguns sprays que lubrificam a garganta. Não estão provados os seus efeitos permanentes na voz. No entanto, se sente que eles são benéficos, não há problema em usá-los. Verifique nos ingredientes se não existe álcool, porque pode irritar a sua garganta.

Se for mulher, selecione a medicação contracetiva com a ajuda de um médico que entenda os efeitos das hormonas na voz.

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Higiene Vocal para Cantores

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04 Fumo e drogas

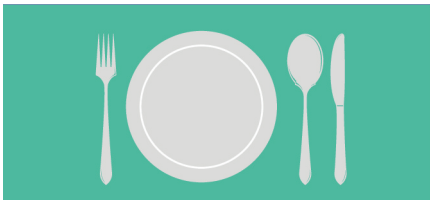
Fumar cigarros danifica as pregas vocais e pode causar cancro de laringe. Fumar e cantar são práticas que não combinam! Ainda não se sabe com certeza se os cigarros eletrónicos são seguros. No entanto, muitos contêm propilenoglicol que é um irritante laríngeo e também é usado no fumo de palco. Até sabermos mais acerca da sua segurança, deve evitar o risco e parar de fumar de uma vez! Deve também evitar ser fumador passivo – ou seja, respirar o fumo dos outros.

Tal como o fumo do cigarro, as drogas podem danificar as pregas vocais, dependendo da droga e da forma como é administrada. Por exemplo, fumar erva (ou cannabis) pode provocar uma lesão térmica (ou seja, por aquecimento) nas pregas vocais.

Para além disso, qualquer substância que altere a sua consciência terá um impacto negativo na coordenação vocal e na sua capacidade de fazer um bom julgamento sobre o quanto e como está a usar a voz.

05 Bem-estar e auto-cuidado

Pode imaginar o corpo como um estojo onde guarda o seu instrumento – neste caso a voz. Faça questão de ter um descanso suficiente, fazer exercício físico e comer bem. Garanta que fica em repouso quando está cansado(a) ou lesionado(a). Nestas alturas deve também reduzir o uso da voz. Deve descansar antes de todas as atuações. Quando tiver uma viagem de avião, faça questão de descansar antes de um ensaio ou atuação. Tome medidas para reduzir a ansiedade. Exercício, repouso, e aconselhamento são formas provadas de redução da ansiedade.



Uma nutrição adequada também faz parte de um bom programa de higiene vocal. O peso excessivo pode levar ao uso inadequado de músculos respiratórios que são importantes para produzir voz. Para além disso, também faz com que exista cansaço generalizado e pode restringir a sua participação em alguns papéis que exijam um grande nível de atividade física. Coma refeições ligeiras com bastante água, antes de ensaios ou atuações. Ter uma infeção respiratória alta, uma constipação, ou gripe pode afetar a sua voz. Cantar quando está constipado pode provocar uma lesão crónica, sobretudo se acontecer repetidamente. Lave sempre bem as mãos e com frequência, utilizando sabão e água, combinados com soluções alcoólicas para as mãos antes de comer, tocar nos olhos, nariz ou boca.

Não cante enquanto está doente – uma constipação ou infeção respiratória alta altera a forma como usa a musculatura respiratória e pode causar o inchaço das pregas vocais, afetando a forma como ouve a sua voz. O aquecimento vocal não é só para as atuações. Aqueça sempre antes dos ensaios.

Verifique a sua audição regularmente. Use proteção auditiva quando o som está forte.

Reveja gravações antigas da sua voz e repare se houve diferenças.

Evite telefonemas prolongados antes dos ensaios ou atuações.

Se for ao ginásio, tenha cuidado ao levantar pesos que exijam gemer ou fazer tensão. Use pesos mais leves e repita mais vezes os exercícios.

Uma voz rouca, uma alteração no som da sua voz, uma fadiga vocal evidente por duas semanas ou mais, requerem a atenção de uma equipa qualificada para o tratamento da voz – otorrinolaringologista, terapeuta da fala ou da voz e um professor de canto ou voz.

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Appendix III – Final version of EASE-PT

Avaliação da Capacidade para Cantar com Facilidade (EASE-PT)

ID _____

Idade _____	Género:	Masculino _____	Feminino _____		
Neste momento tem algum problema de voz?	Sim	Não			
Nas últimas 24 horas como classifica o uso da sua voz?	Nenhum	Mínimo	Ligeiro	Moderado	Pesado
Número de vezes que cantou (ensaios e atuações) na última semana	_____				

Por favor, responda às seguintes perguntas baseando-se no estado atual da sua voz. Se a voz variou ao longo do dia, escolha a resposta que melhor se adequa neste momento, fazendo um circulo na categoria de resposta escolhida.

1. A minha voz está rouca	FV	De modo nenhum	Suavemente	Moderadamente	Extremamente
2. A minha voz está seca/áspera	FV	De modo nenhum	Suavemente	Moderadamente	Extremamente
3. A minha voz quebra e falha	IRP	De modo nenhum	Suavemente	Moderadamente	Extremamente
4. Os músculos da minha garganta estão hiper contraídos	FV	De modo nenhum	Suavemente	Moderadamente	Extremamente
5. A minha voz está com ar/soprada	IRP	De modo nenhum	Suavemente	Moderadamente	Extremamente
6. Ao cantar sinto que a minha voz está bem *	FV	De modo nenhum	Suavemente	Moderadamente	Extremamente
7. Os ataques das minhas notas não são colocados ou têm ar/soprados	FV	De modo nenhum	Suavemente	Moderadamente	Extremamente
8. A minha voz está tensa	FV	De modo nenhum	Suavemente	Moderadamente	Extremamente
9. Estou preocupado(a) com a minha voz	PV	De modo nenhum	Suavemente	Moderadamente	Extremamente
10. Estou a ter dificuldades com a minha respiração em frases longas	IRP	De modo nenhum	Suavemente	Moderadamente	Extremamente
11. As minhas notas mais agudas têm ar/são sopradas	FV	De modo nenhum	Suavemente	Moderadamente	Extremamente
12. A minha voz soa de forma rica e sonante *	FV	De modo nenhum	Suavemente	Moderadamente	Extremamente
13. A minha voz falha em alguns notas	IRP	De modo nenhum	Suavemente	Moderadamente	Extremamente
14. Estou a ter dificuldades em cantar suavemente	IRP	De modo nenhum	Suavemente	Moderadamente	Extremamente
15. A minha voz está cansada	FV	De modo nenhum	Suavemente	Moderadamente	Extremamente
16. Estou a ter dificuldades a passar de registo	IRP	De modo nenhum	Suavemente	Moderadamente	Extremamente
17. Estou a ter dificuldades com as notas mais agudas	IRP	De modo nenhum	Suavemente	Moderadamente	Extremamente
18. Sinto que cantar é uma tarefa difícil	IRP	De modo nenhum	Suavemente	Moderadamente	Extremamente
19. Estou a ter dificuldades em projetar a minha voz	IRP	De modo nenhum	Suavemente	Moderadamente	Extremamente
20. Estou apreensivo(a) em relação à minha voz	PV	De modo nenhum	Suavemente	Moderadamente	Extremamente
21. A minha voz está preparada para atuar, se for necessário *	FV	De modo nenhum	Suavemente	Moderadamente	Extremamente
22. Estou a ter dificuldades em manter as notas longas	IRP	De modo nenhum	Suavemente	Moderadamente	Extremamente

*Itens que são pontuados de forma inversa. FV = função vocal; IRP = indicadores de risco patológico; PV = preocupação vocal

A preencher pelo investigador:

Pontuação total = _____ Pontuação FV = _____ / 40 Pontuação IRP = _____ / 40 Pontuação PV = _____ / 8

Adaptado por Pestana, Vaz-Freitas, Manso (2018) a partir de Phyland, D. J., Pallant, J. F., Benninger, M. S., Thibeault, S. L., Greenwood, K. M., Smith, J. A., & Vallance, N. (2013). Development and preliminary validation of the EASE: A tool to measure perceived singing voice function. *Journal of Voice*, *27*(4), 454–462. https://doi.org/10.1016/j.jvoice.2013.01.019

Appendix IV – Ethical committee authorization

Universidade Fernando Pessoa
www.ufp.pt

Exmo. Senhor
Prof. Doutor Luís Martins
Director da FCS

Porto, 06 de Fevereiro de 2017

Exmo. Senhor Prof. Doutor,

A Comissão de Ética, depois de apreciado o projeto de Doutoramento em Desenvolvimento e Perturbações da Linguagem, de João Pedro de Melo Pestana Mouga Malheiro, intitulado "A Voz do Cantor de Fado", considera nada haver a opor ao mesmo, desde que esteja previsto um consentimento informado para a 3ª fase do estudo.

Com os melhores cumprimentos.

A Presidente da
Comissão de Ética da UFP

Teresa Martinho Toldy

Appendix V – Authorization for adapting the EASE

From: **Debbie Phyland** debbieph@bigpond.net.au
Subject: Fwd: EASE authorization - Portugal
Date: 16 August 2015 at 01:40
To: melopestana@gmail.com

DP

Dear Pedro, thank you for your very kind email.
Sadly I will not be able to go PEVOC this year although several of my colleagues will be there including a speech pathologist who works with me. Her name is Sally Armstrong so please see if you can find her and introduce yourself and I will let her know that you are interested in the EASE.
You absolutely have my permission to use the EASE and I would be delighted to hear whether it is useful for your purposes. As you no doubt know there is a team in Brazil with Mara Behlau who translated it into Portuguese and found if very useful. I am still in the throes of writing up the next paper about its ability to predict pathology. As you may have read, it was devised for use with music theatre singers but I have been using it with other genres (pop, classical) and it has been still appropriate.
Please let me know what else you want to know. I am happy to meet on skype if this is useful,
I attach a link to my PhD thesis so you can see more information regarding the instrument and you will need to press view/donwload after the abstract, http://arrow.monash.edu.au/hdl/1959.1/1145496

Best wishes, Debbie Phyland

Dr Debbie Phyland
PhD, BAppSc, MAppSc,Grad DipEd, FSPAA
Speech Pathologist/Voice consultant

Voice Medicine Australia
Suite 7, 169-171 Victoria Pde
Fitzroy 3065
Melbourne Victoria
+61409306238
Appointments +61 394160633

> **From:** Pedro Pestana [mailto:melopestana@gmail.com]
> **Sent:** Friday, 14 August 2015 3:38 AM
> **To:** mvac@unite.com.au
> **Subject:** EASE authorization - Portugal
>
> Dear Dr Debby Phyland,
>
> I have been following your most recent research on singing voice, particularly the development of EASE. As portuguese speech therapist and singer I consider it really interesting as it is the only tool, as far as I know, that has not a voice with dysphonia as assumption.
> My PhD has just begin and it is based on the study of a particular singing style form my country widely known as fado. As part of it me and my mentor defined as goal the implementation of a auto perception protocol on singing voice. After deep research we found EASE would be the most suitable. In order to accomplish it I would be really interested on the translation, cultural adaptation, as well as it primary validation.
> We would like to hear your standpoint about this matter as well as gather authorization from yours to begin the process.
> I will be in Firenze at PEVOZ 11 - let me know if you are going as well - it would be wonderful to have a meeting!
>
> Let us know if you have further questions.
>
> Sincerely yours,

Appendix VI – Translators certificates

Dennis J. Delany
Translator
Avenida Augusta 20, Portal 2, Apartment 9
Javea, 03730 Alicante, Spain
dennisdelany62@hotmail.com

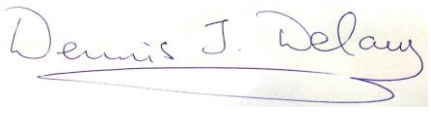
22 April. 2017

To whom it may concern:

This is to certify that the translation attached of a research instrument for the evaluation of singing voices is a translation from Portuguese to English.

I, Dennis J. Delany, hereby state that I am a bilingual translator certified by the Chartered Institute of Linguists and am thoroughly familiar with the English and Portuguese languages. I have translated the attached document to the best of my knowledge from Portuguese into English and the English text is an accurate and true translation of the original document to the best of my knowledge and belief.

Signed:



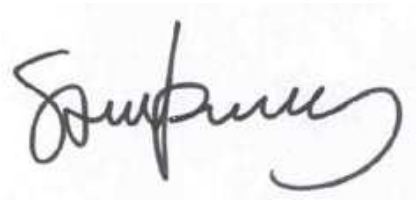
Dennis J. Delany Med, Dip Trans CIOL

Porto, May 29th, 2017

To whom it may concern:

This is to certify that the translation attached of a research instrument for the evaluation of singing voices is a translation from Portuguese to English.

I, Sandra Cidade Rodrigues, hereby state that I am a Portuguese translator and I'm thoroughly familiar with the Portuguese and English languages. I have translated the attached document to the best of my knowledge from English into Portuguese and the Portuguese text is an accurate and true translation of the original document to the best of my knowledge and belief.



To whom it may concern:

This is to certify that the translation attached of a research instrument for the evaluation of singing voices is a translation from Portuguese to English.

I, Pedro Lamy Ribeiro, hereby state that I am a translator certified by the Chartered Institute of Linguists and am thoroughly familiar with the English languages. I have translated the attached document to the best of my knowledge from English into Portuguese and the Portuguese text is an accurate and true translation of the original document to the best of my knowledge and belief.

25/05/2017

Pedro Lamy Ribeiro

Pedro Lamy Ribeiro

John E. Ellis
AKA Translation
Rua Tucuna, 1143
Vila Pompeia CEP 05021-010
São Paulo, SP
BRAZIL
john@akatranslation.com

To whom it may concern:

This is to certify that the translation attached of a research instrument for the evaluation of singing voices is a translation from Portuguese to English.

I, John E. Ellis, hereby state that I am a translator and interpreter certified by Associação Alumni and am thoroughly familiar with the Portuguese, Spanish, French and English languages. I have translated the attached document to the best of my knowledge from Portuguese into English and the English text is an accurate and true translation of the original document to the best of my knowledge and belief.

Best regards,

July 4, 2017

John E. Ellis