

# Immediate Impact of Vocal Demand on Musical Theater Singers in Brazil

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**Summary: Objective.** The purpose of this research was to evaluate the immediate impact of vocal demand on musical theater singers in Brazil and to explore its relationship with the presence of voice symptoms.

**Method.** A total of 264 musical theater singers participated in this research. The group was formed by 126 women and 138 men, with a mean age of 33. All of them answered two questionnaires immediately after a show: (1) demographic data, vocal self-assessment, and a voice symptoms/signs list; and (2) Evaluation of the Ability to Sing Easily (EASE) Scale, translated and culturally adapted to Brazilian Portuguese as EASE-BR.

**Results.** The data from the two scales were correlated. The results showed that EASE-BR total and subscales scores were lower in singers with more years of singing practice. Singers who had other professional activities besides musical theater, such as opera and solo singing, also presented lower scores. The singers presented only 1.56 voice symptoms/signs. Those with more voice symptoms/signs also presented higher scores in the EASE-BR. There was a weak correlation between the voice symptoms/signs and EASE-BR. No significance was found between gender, age, singing practice hours and singing lessons and the EASE-BR scores.

**Conclusion.** The immediate impact of vocal demand after a show is perceived as positive, and the singers considered their voices ready for a new performance. EASE-BR can be used to identify vocal changes, and it can also be used by itself because it has a weak correlation with the list of symptoms/signs.

**Key Words:** Voice—Dysphonia—Surveys and questionnaires—Voice quality—Singing.

## INTRODUCTION

Studies to better understand the impact of singing on voice production have been previously reported. Researchers who have studied singing styles, such as classical,<sup>1–3</sup> and nonclassical styles,<sup>4–8</sup> such as musical theater, rock, country, pop, jazz, and soul, determined that singers have to make quick and precise adjustments in the larynx and in the vocal tract to produce the vocal characteristics required for each of these styles.

These changes include the vertical position of the larynx and the subglottic pressure to adjust frequency, intensity, and control vocal folds' adduction.<sup>1,7,9,10</sup> Adjustments related to the different singing styles may cause heavy vocal load that may or may not be felt by the singer<sup>6,11</sup> owing to either the lack of knowledge of vocal demands required for a specific singing style, or the lack of habitual self-assessment to correct deviations and seek help.<sup>5,11</sup> Studies have shown that singers demonstrate a decrease in vocal quality as a consequence of vocal overload.<sup>12–16</sup> However, these vocal changes may or may not be noticed by the listener or even measured by acoustic analyses.<sup>11,17,18</sup> Some singers are aware that discomfort can be a result of vocal overload, whereas others may identify it as a way of enhancing their vocal power.

The extended use of scenic singing voice in musical theater has been related to the perception of vocal fatigue and

overload in various types of studies,<sup>6,19,20</sup> which may result in limitation of vocal function.<sup>18,21</sup> Musical theater production combines dramatic art, dance, and music, which are driven by a plot.<sup>22</sup> Thus, these productions require singers and dancers who have the ability to act, actors and singers who have the ability to dance, and actors and dancers who can also sing. Therefore, singers who work in musicals need to be physically apt and fulfill their vocal demands for the production season.<sup>23</sup> The styles and vocal qualities currently required in the music theater genre are also part of the contemporary commercial music styles such as rock, belt, and belt mix.<sup>24</sup> Among all these challenging vocal qualities, belt stands out and has been considered a style of high vocal demand, but nevertheless, it has not yet been proved.

As professional singers can be seen as vocal athletes, it is important to understand whether they are aware of their vocal vulnerability and whether they can adapt to vocal demands. By doing so, they may be able to identify differences in singing voice as this can make them susceptible to the development of vocal problems.<sup>6,11,17</sup> It is important to emphasize that even a small voice problem can have a negative impact on singers.<sup>25,26</sup> Despite the fact that some studies have already related vocal overload with acting and singing in musical theater, few studies have investigated the effects of vocal fatigue and heavy vocal load in this same group.<sup>19,20,25,27</sup> The fact that musical theater singers need to vary their vocal function to use intensity, frequency range, long phase of glottal closure, and maximum phonation time has added to the understanding that these singers may have vocal fatigue or vocal damage.<sup>7,28–32</sup>

Although there is no consensus defining vocal fatigue, it has been clinically described as a set of symptoms perceived by the individual. This set of symptoms may lead to compensatory changes and/or laryngeal pathology.<sup>18,33,34</sup> Thereby,

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vocal fatigue symptoms may cause changes in the control of the laryngeal mechanism, in the voice quality and dynamic range, in the frequency range and flexibility, in the vocal projection or power, and in the respiratory support. These symptoms may increase during the speaking day, causing a certain degree of muscle tension and discomfort which will improve after resting.<sup>12,18,33,35</sup>

Hence the need to understand the singers' awareness in relation to their own vocal fatigue is evident, both as a result of a physiological disability and/or as a consequence of vocal use.<sup>36</sup> In the case of singers as well as voice professionals, the vocal complaint has to be investigated in a range of contexts, such as physical, psychological, social, and professional.<sup>20,25,37</sup>

Recently, Phyland et al<sup>27</sup> created a scale to determine the individual perception of singers in relation to their vocal function. The scale they have developed is the Evaluation of the Ability to Sing Easily (EASE).<sup>27</sup> This scale may indicate changes in the singers' voice after a rehearsal or a show, identifying small vocal changes whether positive or negative. It also describes, verifies, and gives details about vocal characteristics at a specific time to identify the immediate impact of vocal demand, regardless of changes in the singers' voice. The questionnaire addresses issues such as Vocal Fatigue (VF), Pathologic Risk Indicators (PRI), and Vocal Concern (VC). The scale was translated and culturally adapted to Brazilian Portuguese as EASE-BR.<sup>38</sup>

The first musical theater show presented in Brazil was the Broadway production, "My Fair Lady," in 1964. Other shows have been staged since then, but it was only in the early 2000s that there was a significant increase in the number of musical theater productions, with over 20 shows being produced within the same period.

In spite of the large amount of studies that has been done to investigate voice in musical theater all over the world,<sup>7,28–32</sup> in Brazil, there is no available scientific information on this population until the present moment.

Therefore, the purpose of this study is to evaluate the immediate impact of vocal demand on Brazilian musical theater singers after a show using the EASE-BR Scale, and

to explore its possible association with the list of symptoms/signs and demographic data.

## METHOD

This study was approved by the Committee for Ethics in Research of the Universidade Federal de São Paulo—UNIFESP (CEP-UNIFESP 0806/2015) under protocol number 1.172.150. All subjects agreed to participate in the study and signed an Informed Consent Form.

### Participants

A total of 264 singers participated in this study. All were part of the cast of 21 musical theater professionals (Figure 1), across a production season. There were five shows per week plus two performances on Saturdays, with an average duration of 3 hours and a 15-minute break between the first and the second acts. All the artists agreed to participate in the study. The show's producer randomly chose the date when the questionnaires would be answered.

Only leading and ensemble singers answered the two questionnaires: (1) demographic data, vocal self-assessment, and a voice symptoms/signs list; and (2) the EASE Scale,<sup>27</sup> translated and culturally adapted to Brazilian Portuguese<sup>38</sup> as EASE-BR. The researcher gave both questionnaires to the show production team leader, who handed them out to the singers at the end of the show. Although the researcher did not have direct contact with the respondents, the show production team was asked to have the artists fill out the questionnaires immediately following the performance. Special guidance was given to verify that all questions had been answered. The investigator collected the questionnaires upon completion.

### Procedures

#### *Demographic data, vocal self-assessment, and the Voice Symptoms/Signs List*

The following personal data were included: gender, age, profession, singing style, years of singing practice, activities that use singing voice, singing lessons, singing practice hours, vocal use for other professional activities, vocal

Musical Theater Shows	Type of Musical Theater	n
4 Carreirinhas	Contemporary	3
Ataulfo Alves	Contemporary	7
Beijo no asfalto	Contemporary	11
Raia 30 o musical	Contemporary	11
Constellation – uma viagem musical pelos anos 50	Classical	9
Memórias de um gigolô	Contemporary	15
Bilac vê estrelas	Contemporary	9
Homem de la Mancha	Classical	18
S'imbora o musical	Contemporary	13
Nine – um musical Felliniano	Contemporary	13
Mudança de hábito	Contemporary	15
Barbaridade	Contemporary	13
Chacrinha	Contemporary	21
Sim! Eu aceito!	Contemporary	12
Rock in Rio – o musical	Rock/Pop	12
Ou tudo ou nada	Contemporary	13
Urinal	Contemporary	14
Lisbela e o prisioneiro	Contemporary	13
Chaplin, o musical	Contemporary	18
Antes tarde do que nunca	Contemporary	17
Ópera do malandro	Contemporary	7

**FIGURE 1.** Musical theater shows and number of participants in Brazilian Portuguese.

warm-up and cool-down habits, voice disorders, appointment with an otorhinolaryngologist or speech-language pathologist because of voice problems, roles in the show, and dancing or not during the show. Information regarding signs and symptoms of voice and vocal self-assessment of the singing voice were also addressed after the show.

The Voice Symptoms/Signs List (Appendix)<sup>39</sup> translated version,<sup>39</sup> was used to identify vocal symptoms and signs. This checklist investigates the presence of 14 symptoms and signs related to voice, such as hoarseness, vocal fatigue or changes in quality after short use, trouble speaking or singing softly, difficulty with voice projection, loss of singing range, discomfort while using voice, a monotone voice, effort to talk, chronic throat dryness, chronic throat soreness, frequent throat clearing, bitter or acid taste in the mouth, swallowing difficulties, and a wobbly or shaky voice.

### EASE-BR

The EASE-BR Scale<sup>38</sup> was used to measure the singers' perception of their voice, especially immediately after a show. This scale includes 22 questions and has four answer choices regarding the frequency of occurrence. They are "not at all," "mildly," "moderately," and "extremely." Nineteen of the 22 items are related to vocal fatigue and vocal impairment, and the other 3 are related to positive changes that have a reverse score. EASE-BR has two subscales, namely, VF and PRI, plus two additional questions related to VC.

The total score is a simple sum of all 20 items, except for the two items of VC. The responses were 0 = no, 1 = mildly, 2 = moderately, and 3 = extremely. Questions 6, 12, and 21 have a reverse score, thus, 3 = not at all, 2 = mildly, 1 = moderately, and 0 = extremely. The VC questions are not part of the original EASE and assess the singers' overall concern about their health. Therefore, the answers are analyzed separately.

A total of 264 singers answered both questionnaires: (1) personal identification and (2) EASE-BR. Their ages ranged between 18 and 72 years old, with a mean age of 33; 108 (40.91%) were less than 29 years old, 140 (53.03%) were between 30 and 49 years old, and 16 (6.06%) were more than 50 years old. There were 126 (47.73%) women and 138 (52.27%) men.

### Statistical analysis

The *SPSS software* (version 23.0, IBM Corp., Armonk, NY) and the *MS-Excel* (version MS-Office 2013, Microsoft Corporation, Redmond, Washington, USA) were used for the statistical analysis. In all of the statistical tests, the level of significance was set at 5%.

The Jonckheere-Terpstra test was used to verify any differences between ages and between the EASE-BR total and subscales (VF, PRI, and VC) scores with (1) vocal self-assessment, (2) singing practice hours, and (3) years of singing practice.

The Mann-Whitney *U* test was used to verify any differences between the EASE-BR total and subscales (VF, PRI, and VC) scores with (1) gender and (2) presence or absence of vocal disorder.

The chi-square test was used to verify possible differences between the singers/actors who reported having voice problems and sought professional help from an otorhinolaryngologist and/or speech-language pathologist.

The Spearman rank-order correlation coefficient was used to verify the correlation between the EASE-BR total and subscales (VF, PRI, and VC) scores and (1) age, (2) number of vocal signs, and (3) each one of the vocal symptoms.

The Wilcoxon signed-rank test was used to verify possible differences between the test-retest reliability and the total score of the EASE-BR.

## RESULTS

The correlation between the EASE-BR total score and the different vocal uses of the participants is indicated in [Table 1](#). The outcomes have shown that musical theater singers who also sing opera or solo have lower values in the EASE-BR total score. Singers with 3 years or more of practice have lower values in the EASE-BR total and subscales scores ([Table 2](#)).

Comparing the EASE-BR total score and subscales with self-reported voice problems, it was possible to identify higher scores in the EASE-BR Scale regardless of the VC items ([Table 3](#)). Among the 264 singers, 111 (42.05%) reported having some voice problems, and 92 (82.90%) of them sought professional help from an otorhinolaryngologist or a speech-language pathologist for treatment at any point in their past or even just as a routine voice program.

The results also indicated that there were no significant differences associated with gender or age in the EASE-BR total and subscales scores ([Table 4](#)), but the scores of singers  $\leq 29$  years old were higher ([Table 5](#)).

Regarding vocal self assessment after the show, singers had to self-rate their voices as "excellent," "very good," "good," "reasonable," or "bad." Most singers self-rated their voices as "good" ( $n = 107$ ; 40.53%), "very good" ( $n = 81$ , 30.68%), and "excellent" ( $n = 48$ , 18.18%). Only five singers (1.89%) rated their voices as "bad." The ones who self-rated their voices as "bad" and "reasonable" scored higher in both EASE-BR total and subscales ([Table 6](#)).

Approximately 30% of the singers had no voice symptoms/signs and 50% had one or more voice symptoms/signs. Most of the singers had two symptoms, with the highest occurrence being for frequent throat clearing (50.76%) and throat dryness (26.52%). The singers who reported a higher number of voice symptoms/signs also had higher scores in the EASE-BR total and subscales, although with a weak correlation ([Table 7](#)). There was also a weak correlation between each one of the voice symptoms/signs and the EASE-BR total and subscales scores, which indicates that the questionnaires investigate different vocal aspects.<sup>40</sup>

The test-retest reproducibility ([Table 8](#)) was administered to 29 singers after 15 days following the first administration of EASE-BR (38). The EASE-BR had excellent reproducibility (total,  $P$ -value = 0.764; VF,  $P$ -value = 0.985; PRI,  $P$ -value = 0.489; VC,  $P$ -value = 0.719).

**TABLE 1.**  
**EASE-BR Total Score According to Different Vocal Activities of Both Speaking Voice and Singing Voice**

Vocal Use	n	EASE-BR Total Score	Standard Deviation	Mean	P Value
<b>Choir</b>					
Yes	69	7.70	6.37	6.00	0.542
No	195	9.04	8.07	7.00	
<b>Lead vocalist</b>					
Yes	39	9.85	9.25	7.00	0.564
No	225	8.47	7.35	6.00	
<b>Solo singer</b>					
Yes	116	6.63	6.30	5.00	<0.001*
No	148	10.27	8.25	8.00	
<b>Musical theater singer</b>					
Yes	264	8.67	7.66	6.50	—
No	0	—	—	—	
<b>Backing vocal</b>					
Yes	25	7.40	8.60	5.00	0.105
No	239	8.80	7.56	7.00	
<b>Opera singer</b>					
Yes	14	4.57	3.37	5.00	0.033*
No	250	8.90	7.77	7.00	
<b>Other vocal activities</b>					
Yes	131	8.48	7.43	6.00	0.854
No	133	8.84	7.93	7.00	
<b>Total</b>	<b>264</b>	<b>8.67</b>	<b>7.66</b>	<b>6.50</b>	

\* Significance level ( $P \leq 0.05$ )—Mann-Whitney  $U$  test.  
 Abbreviation: n = number of subjects.

**TABLE 2.**  
**EASE-BR Total and Subscale Scores According to the Years of Singing Practice**

Years of Singing Practice	Average	Standard Deviation	Min	Max	Median	P Value
<b>Vocal fatigue</b>						
$\leq 1$	12.40	4.88	7.00	18.00	11.00	<0.001*
1  <  3	6.95	3.81	0.00	16.00	7.00	
$\geq 3$	4.40	3.85	0.00	20.00	4.00	
Total	4.95	4.09	0.00	20.00	4.00	
<b>Pathologic risk indicators</b>						
$\leq 1$	12.00	4.64	6.00	19.00	12.00	<0.001*
1  <  3	5.05	3.56	0.00	15.00	4.00	
$\geq 3$	3.28	3.84	0.00	22.00	2.00	
Total	3.72	4.02	0.00	22.00	2.50	
<b>EASE-BR total score</b>						
$\leq 1$	24.40	9.10	13.00	37.00	23.00	<0.001*
1  <  3	12.00	6.83	2.00	30.00	10.00	
$\geq 3$	7.68	7.22	0.00	39.00	6.00	
Total	8.67	7.66	0.00	39.00	6.50	
<b>Vocal concern</b>						
$\leq 1$	3.00	2.24	0.00	6.00	3.00	<0.028*
1  <  3	1.56	2.01	0.00	6.00	1.00	
$\geq 3$	1.04	1.56	0.00	6.00	0.00	
Total	1.16	1.68	0.00	6.00	0.00	

\* Significance level ( $P \leq 0.05$ )—Jonckheere-Terpstra test.  
 Abbreviations: Min, minimum; Max, maximum.

**TABLE 3.**  
**EASE-BR Total and Subscales Scores and Self-reported Voice Disorders**

Scales and Self-reported Voice Disorders	Average	Standard Deviation	Min	Max	Median	P Value
<b>Vocal fatigue</b>						
Presence of voice disorder	5.06	3.93	0.00	18.00	5.00	0.434
Absence of voice disorder	4.87	4.21	0.00	20.00	4.00	
Total	4.95	4.09	0.00	20.00	4.00	
<b>Pathologic risk indicators</b>						
Presence of voice disorder	3.92	4.23	0.00	21.00	2.00	0.575
Absence of voice disorder	3.58	3.87	0.00	22.00	3.00	
Total	3.72	4.02	0.00	22.00	2.50	
<b>EASE-BR total</b>						
Presence of voice disorder	8.98	7.78	0.00	37.00	7.00	0.530
Absence of voice disorder	8.44	7.59	0.00	39.00	6.00	
Total	8.67	7.66	0.00	39.00	6.50	
<b>Vocal concern</b>						
Presence of voice disorder	1.41	1.74	0.00	6.00	1.00	0.012*
Absence of voice disorder	0.97	1.61	0.00	6.00	0.00	
Total	1.16	1.68	0.00	6.00	0.00	

\* Significance level ( $P \leq 0.05$ )—Mann-Whitney *U* test.  
Abbreviations: Min, minimum; Max, maximum.

## DISCUSSION

Singing is a challenging skill that involves various body systems, such as the nervous, muscular, auditory, and respiratory.<sup>10,35,41</sup> The singer must be prepared to control different aspects of the voice such as frequency, intensity, voice resonance, and projection. Artists performing in musical theaters are also required to sing, act, and dance—activities that come with even greater challenge.

The challenges that the musical theater singers face make them more susceptible to vocal risks that may cause altered laryngeal function, inability to perform their professional activities and, in severe cases, contribute to vocal problems that may affect their psychological well-being and professional lives.<sup>5,25,26,42,43</sup> The importance of an early diagnosis

or detection of changes in vocal function in this group must not be underestimated.

This research used the EASE-BR<sup>38</sup> as it is a specific self-assessment tool for musical theater singers and for other contemporary singing styles.<sup>20,25</sup> The results obtained with this scale were compared with the demographic data, the vocal self-assessment, and the Voice Signs/Symptoms List.<sup>39</sup>

Lower scores in the EASE-BR were observed in musical theater singers with other professional activities using singing voice, especially in those who also performed opera or solo, indicating less vocal damage after presentation. These data suggest that professional singers seem to be more self-aware of their own voice and better prepared because of their musical training.<sup>25,27</sup> Previous studies with voice

**TABLE 4.**  
**EASE-BR Total and Subscale Scores According to Gender Group**

Scales and Gender	Average	Standard Deviation	Min	Max	Median	P Value
<b>Vocal fatigue</b>						
Female	5.41	4.24	0.00	20.00	5.00	0.069
Male	4.53	3.92	0.00	20.00	3.50	
Total	4.95	4.09	0.00	20.00	4.00	
<b>Pathologic risk indicators</b>						
Female	4.04	4.20	0.00	22.00	3.00	0.213
Male	3.43	3.84	0.00	19.00	2.00	
Total	3.20	4.02	0.00	22.00	2.50	
<b>EASE-BR total</b>						
Female	9.45	7.93	0.00	39.00	7.00	0.081
Male	7.96	7.36	0.00	39.00	6.00	
Total	8.67	7.66	0.00	39.00	6.50	
<b>Vocal concern</b>						
Female	1.12	1.67	0.00	6.00	0.00	0.745
Male	1.19	1.69	0.00	6.00	0.00	
Total	1.16	1.68	0.00	6.00	0.00	

Mann-Whitney *U* test.  
Abbreviations: Min, minimum; Max, maximum.

**TABLE 5.**  
**EASE-BR Total and Subscale Scores According to Each Age Group\***

Scales and Age Group	Average	Standard Deviation	Min	Max	Median	P Value
<b>Vocal fatigue</b>						
≤29	5.49	4.18	0.00	20.00	5.00	0.076
30  -  49	4.54	4.01	0.00	18.00	4.00	
≥50	4.94	3.91	2.00	18.00	3.00	
Total	4.95	4.09	0.00	20.00	4.00	
<b>Pathologic risk indicators</b>						
≤29	4.04	3.82	0.00	19.00	3.00	0.122
30  -  49	3.46	4.10	0.00	22.00	2.00	
≥50	3.88	4.69	0.00	19.00	2.00	
Total	3.72	4.02	0.00	22.00	2.50	
<b>EASE-BR total</b>						
≤29	9.53	7.46	0.00	39.00	8.00	0.074
30  -  49	7.99	7.74	0.00	39.00	6.00	
≥50	8.81	8.18	3.00	37.00	6.50	
Total	8.67	7.66	0.00	39.00	6.50	
<b>Vocal concern</b>						
≤29	1.43	1.86	0.00	6.00	1.00	0.091
30  -  49	0.92	1.50	0.00	6.00	0.00	
≥50	1.38	1.67	0.00	6.00	1.00	
Total	1.16	1.68	0.00	6.00	0.00	

\* Significance level ( $P \leq 0.05$ )—Jonckheere-Terpstra test.  
Abbreviations: Min, minimum; Max, maximum.

professionals and/or classical singers suggest that they also perceived less vocal disadvantage after performance.<sup>14,21,44</sup>

Out of the 264 musical theater singers, 182 were ensemble roles and 82 were leading roles. When we compared these data with the total EASE-BR score and subscales, there was no statistical significance. Therefore, the total number of participants was analyzed as a single group without considering the specific role.

In addition to that, a longer singing experience also positively influenced the results. Singers with a larger experience had lower values in the EASE-BR total score and in the VF and the PRI subscales. These findings may indicate that singing practice provides more vocal self-awareness and better prepares singers for this specific demand, which requires vocal endurance and consistency.<sup>14,19,27,43</sup> Thus, these singers develop a greater understanding of vocal skills, which may lead to a better vocal conditioning. They can be compared with athletes who, owing to their physical conditioning, usually suffer fewer injuries.<sup>43,45</sup>

Although gender does not seem to affect the EASE-BR Scale results, women had higher score in VF and PRI subscales, as well as in the EASE-BR total score. When analyzing each question, only question 22 (“I am having difficulty sustaining long notes”) presented higher scores for women. This may highlight the need to give greater attention to women's vocal care and conditioning. This finding confirms what has previously been reported in the literature about women being more prone to vocal changes and vocal fatigue symptoms, as well as more predisposed to miss work as a direct result of voice-related issues.<sup>14,31,39,46,47</sup>

Singers who reported having voice disorders at some point of their career presented worse scores for the VC questions in

the EASE-BR. It is noteworthy that classical and contemporary singers with vocal complaints have a greater vocal disadvantage.<sup>31,44</sup> Vocal complaint seems to be associated with a higher level of concern and awareness of voice.

A negative vocal self-assessment is not always indicative of vocal risk.<sup>14,20,43,48</sup> The results of this study showed a relationship between vocal self-assessment and the EASE-BR total and subscales (VF, PRI) scores. Singers who self-rated their voices positively after the show had lower scores on EASE-BR than those who rated their voices negatively. These results support the purpose of the scale which intends to measure the impact of vocal demand after a specific time.<sup>27</sup> Regardless of the presence of vocal problems, when applying different questionnaires that evaluate singing voice, even in EASE-BR, it was found that a negative voice self-assessment is also related to a worse result in the questionnaires.<sup>11,49,50</sup>

Although exposed to a high vocal demand, the evaluated singers had an average of 1.56 vocal symptoms, which is very similar to the Brazilian general population of 1.7 symptoms.<sup>51</sup> Forty-nine percent of the singers had only two symptoms, which suggests a healthy population. The most prevalent symptoms were throat clearing (50.76%), throat dryness (26.72%), throat soreness, and hoarseness (15.15%). In a study with teachers, Roy et al<sup>39</sup> have identified two factor groupings for the Voice Signs/Symptoms List. Factor 1 is labeled “Phonatory symptoms/signs” that represents voice-related symptoms, and Factor 2 is labeled “Laryngopharyngeal symptoms/signs” that reflects laryngeal and pharyngeal symptoms/sensations. The musical theater singers presented more symptoms from Factor 2. These symptoms/signs may be related to allergic, oral, nasal, otological, pulmonary, digestive, hormonal or neuro-vegetative disorders,<sup>52</sup> or even dehydration.<sup>48,53</sup> It is

**TABLE 6.**  
**Comparison of the EASE-BR Total and Subscales Scores With Vocal Self-assessment After the Show**

EASE-BR and Vocal Self-assessment	Average	Standard Deviation	Min	Max	Median	PValue
<b>Vocal fatigue</b>						
Excellent	2.04	2.17	0.00	9.00	2.00	<0.001*
Very good	3.46	2.55	0.00	10.00	3.00	
Good	5.79	3.47	0.00	20.00	6.00	
Reasonable	9.61	4.19	3.00	17.00	9.00	
Bad	17.80	1.48	16.00	20.00	18.00	
Total	4.95	4.09	0.00	20.00	4.00	
<b>Pathologic risk indicator</b>						
Excellent	1.29	1.87	0.00	8.00	1.00	<0.001*
Very good	2.42	2.52	0.00	11.00	2.00	
Good	4.19	3.40	0.00	21.00	4.00	
Reasonable	8.30	4.17	1.00	16.00	8.00	
Bad	17.00	6.29	6.00	22.00	19.00	
Total	3.72	4.02	0.00	22.00	2.50	
<b>EASE-BR total</b>						
Excellent	3.33	3.44	0.00	17.00	3.00	<0.001*
Very good	5.88	4.53	0.00	19.00	5.00	
Good	9.97	6.22	0.00	36.00	9.00	
Reasonable	17.91	7.86	6.00	30.00	17.00	
Bad	34.80	7.23	22.00	39.00	37.00	
Total	8.67	7.66	0.00	39.00	6.50	
<b>Vocal concern</b>						
Excellent	0.44	0.97	0.00	4.00	0.00	<0.001*
Very good	0.77	1.29	0.00	5.00	0.00	
Good	1.30	1.72	0.00	6.00	0.00	
Reasonable	2.30	1.66	0.00	6.00	2.00	
Bad	6.00	0.00	6.00	6.00	6.00	
Total	1.16	1.68	0.00	6.00	0.00	

\* Significance level ( $P \leq 0.05$ )—Jonckheere-Terpstra test.  
 Abbreviations: Min, minimum; Max, maximum.

important to highlight that these singers dance during the show, which may also contribute to dehydration caused by fluid loss from the high body temperature.<sup>54</sup> Also, this may result in an increased tissue viscosity of the vocal folds, resulting in less vocal resistance.<sup>10</sup>

The Voice Signs/Symptoms List<sup>39</sup> refers to aspects of the voice over a period of time, whereas the EASE-BR refers to aspects related to the singing voice profile and also identifies the singers' perception of their vocal abilities after a show. EASE-BR aims to monitor a possible vocal risk as a result of a more intense, variable, and challenging vocal use. Singers who presented a larger number of voice symptoms/signs had higher scores in the EASE-BR. Although the EASE-BR Scale evaluates different aspects of the Voice Symptoms/Signs List, there was a weak correlation between them.

Compared with other groups, and, most likely as a result of their training and professional demands, singers seem to be more aware of their vocal changes.<sup>14,27,38</sup> It looks as if the presence of voice symptoms/signs gives the singer a better perception of the impact of a high vocal demand.<sup>27,48</sup> Therefore, the EASE-BR results cannot be inferred from the Voice Symptoms/Signs List and vice versa. Thus, as observed in the present study, the presence of throat clearing, throat dryness, and throat soreness, does not prevent singers from finishing a show and making a positive self-assessment of their voices.

On the other hand, singers with a diagnosis of laryngeal disorder may not identify vocal disadvantages with singing protocols<sup>25</sup>; thus, singers' perception of a vocal problem does not impact directly the assessment. A negative vocal self-assessment does not necessarily reflect the presence of voice symptoms/signs of laryngeal disorder. This study reveals that Brazilian musical theater singers have a positive perception of their vocal performance after a show, which may suggest they probably have had good training.

It is known that variations in vocal frequency and intensity can cause overload and, therefore, trauma to the superficial layer of the vocal fold. This can lead to changes in the fluid composition of the vocal mechanism and may result in an increased viscosity and stiffness of the vocal folds.<sup>9</sup> As a result, voice problems might occur, such as difficulty producing high notes, reduction of fundamental frequency and of vocal range dynamics, and reduction of mucosal wave with a feeling of effort and throat discomfort.<sup>55–57</sup>

Considering that Brazilian singers who participated in this research had a similar number of voice symptoms/signs to the general population, this may indicate that the singers were vocally healthy. Their vocal self-assessment after the show demonstrates consistency with the positive and negative aspects of the EASE-BR, as well as with self-reported voice problems. Other studies have also reported that

**TABLE 7.**  
**Correlation Between EASE-BR Total and Subscales Scores and Each One of the Vocal Symptoms/Signs List (N = 264)**

Voice Symptoms/Signs List	EASE-BR	VF	PRI	VC
<b>Throat soreness</b>				
Correlation coefficient	0.321	0.316	0.298	0.217
P value	<0.001*	<0.001*	<0.001*	<0.001*
<b>Hoarseness</b>				
Correlation coefficient	0.352	0.368	0.300	0.278
P value	<0.001*	<0.001*	<0.001*	<0.001*
<b>Throat clearing</b>				
Correlation coefficient	0.222	0.201	0.215	0.120
P value	<0.001*	0.001*	<0.001*	0.052
<b>Effort to talk</b>				
Correlation coefficient	0.260	0.263	0.239	0.211
P value	<0.001*	<0.001*	<0.001*	0.001*
<b>Discomfort while using voice</b>				
Correlation coefficient	0.237	0.251	0.208	0.177
P value	<0.001*	<0.001*	0.001*	0.004*
<b>Throat dryness</b>				
Correlation coefficient	0.240	0.202	0.239	0.204
P value	<0.001*	0.001*	<0.001*	0.001*
<b>Voice tires or changes quality</b>				
Correlation coefficient	0.184	0.186	0.161	0.227
P value	0.003*	0.002*	0.009*	<0.001*
<b>Trouble speaking or singing softly</b>				
Correlation coefficient	0.131	0.121	0.132	0.113
P value	0.033*	0.049*	0.032*	0.066
<b>Difficulty projecting voice</b>				
Correlation coefficient	0.157	0.134	0.144	0.039
P value	0.010*	0.030*	0.020*	0.527
<b>Loss of singing range</b>				
Correlation coefficient	0.345	0.290	0.381	0.160
P value	<0.001*	<0.001*	<0.001*	0.009*
<b>Bitter or acid taste</b>				
Correlation coefficient	0.033	0.064	0.001	0.013
P value	0.593	0.302	0.985	0.831
<b>Swallowing difficulties</b>				
Correlation coefficient	0.159	0.142	0.156	0.229
P value	0.009*	0.021*	0.011*	<0.001*
<b>Wobbly or shaky voice</b>				
Correlation coefficient	0.237	0.236	0.223	0.157
P value	<0.001*	<0.001*	<0.001*	0.011*

\* Significance level ( $P \leq 0.05$ )—Spearman rank-order correlation coefficient.

Abbreviations: N, total number of subjects.

**TABLE 8.**  
**Test-Retest Reproducibility (n = 29) of EASE-BR Total and Subscales Scores**

Reproducibility	Total		VF		PRI		VC	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest
Average	7.86	7.45	4.24	4.28	2.9	2.55	0.72	0.62
Standard deviation	5.29	6.5	2.57	3.8	2.5	2.52	1.36	1.02
Minimum	0	0	0	0	0	0	0	0
Maximum	23	28	9	15	11	9	5	4
Median	8	6	4	3	3	2	0	0
P value	0.764		0.985		0.489		0.719	

Abbreviations: n, number of subjects—Wilcoxon signed-rank test.

singers positively self-assess their voices after long periods of rehearsals and presentations. Therefore, a high vocal demand does not always cause vocal function disorders.<sup>15,31,33</sup> Furthermore, singers whose acoustic analysis pointed to negative vocal changes after a performance also positively assessed their voices, indicating that singers do not always perceive their voices to be marked with negative vocal changes.<sup>43</sup> These data highlight that individuals have different perceptions of themselves after a heavy vocal use, resulting in specific compensatory strategies.

### CONCLUSION

This study presents a specific profile of Brazilian singers immediately after a musical theater show. The questionnaires were answered at the end of a presentation and the data report the singers' perception after vocal use.

The analysis of the immediate impact of vocal demand after a performance has shown that Brazilian musical theater singers did not present any vocal limitations. Musical singers who also sing opera and solo reported more concerns regarding their voices, whereas young singers noticed more voice changes. Gender did not seem to interfere in the ability to sing easily. Despite the weak correlation between EASE-BR and the list of symptoms/signs, singers who presented a larger number of voice symptoms/signs had higher scores in the EASE-BR.

A regular follow-up with the EASE-BR seems to be promising for an early diagnosis of vocal changes and to set a vocal profile of singers. In addition to that, by answering the EASE-BR, singers may have a better vocal self-awareness and may be able to prevent vocal problems. This may in turn lead to a faster search for professional help, if necessary.

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### APPENDIX

#### Voice Symptoms/Signs List

##### Hoarseness

Voice tires or changes quality after short use

Trouble speaking or singing softly

Difficulty projecting voice

Loss of singing range

Discomfort while using voice

Monotone voice

Effort to talk

Chronic throat dryness

Chronic throat soreness

Frequent throat clearing

Bitter or acid taste

Swallowing difficulties

A wobbly or shaky voice

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