

The vocal symptoms and habits of professional voice users

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Abstract. *The vocal symptoms and habits of professional voice users.* **Background/Aim:** Professional voice users are a heterogeneous group of professionals at risk of developing vocal problems throughout their careers. Although this population is generally known to be at risk due to high vocal demands, limited is known about the vocal hygiene knowledge, and the occurrence of vocal symptoms. This risk is influenced by personal habits and other factors. The purpose of this study was to assess these factors and detect potential differences between subgroups of professional voice users, specifically teachers, professional actors, and student musical theater actors.

Material and methods: Forty-nine participants (17 teachers, 19 actors, and 13 student actors) were included in this study through convenience sampling. Questionnaires were used to evaluate vocal hygiene, habits, symptoms, and influencing factors in each group.

Results: The questionnaires revealed an overall high prevalence of vocally violent behaviour in all three subgroups, with a higher occurrence in the student actors. Vocal complaints were present in each subgroup, and more vocal tract discomfort was reported relative to non-professional voice users described in other studies. The mean VHI score was 10.16, with a score of 9.94 for the teachers, 6.53 for the actors, and 15.77 for the student actors.

Conclusion: There is a lack of vocal hygiene among professional voice users. Vocally abusive habits and an adverse occupational environment are major risk factors for the development of dysphonia, with potentially devastating consequences. More attention must be paid to the prevention of voice disorders in these populations.

Introduction

The voice is the key instrument of human communication, and voice training and assessment are topics of great interest.¹⁻³ Various etiological factors can disturb vocal production and lead to dysphonia with serious consequences, especially for professional voice users and elite vocal performers,⁴ a heterogeneous group of professionals who use their voices to earn a living.⁵ Examples of elite vocal performers include singers, actors, and musical theater performers, and professional voice users also include teachers and lawyers. A voice disorder could have a devastating effect on their occupations, in addition to leading to potential emotional problems.⁴⁻⁷

Teachers represent a group of professional voice users with a high vocal load, and previous reports have suggested that the prevalence of dysphonia can be very high in this group, ranging from

20-80%.⁷ Other studies have reported an incidence of approximately 11% with an overall lifetime risk for voice problems of nearly 60%.⁸

Actors are a subgroup of elite vocal performers with unique demands.⁷ They use their voices to express a full range of emotions sometimes accompanied by extreme physical exertions or outbursts, including screaming, shouting, grunting, groaning, and sobbing.^{7,9} These behaviors are collectively known as vocally violent behavior, as introduced by Roy *et al.*⁹ Little attention has been paid to the assessment of dysphonia among actors despite their heavy vocal demands.⁷ Novak *et al.* previously reported a high prevalence of vocal fatigue related to laryngeal hyperfunction. D'haeseleer *et al.* found that 34.6% of actors had vocal complaints and 23.1% suffered from vocal fatigue.⁴ In 2002, Timmermans *et al.* investigated vocal quality in future elite vocal performers and found that 27% of the participants had non-organic voice problems, due to heavy vocal demands and bad vocal habits.¹⁰ Van Houtte *et al.* reviewed 882

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dysphonic patients and reported that 41% were professional voice users with a functional voice disorder. 16% of the participants in this group were artists, a category that included actors.¹¹ In addition to intensive voice use, the work environment may be an extra risk factor for the development of voice disorders. In 2001, Hoffman-Ruddy described the unique role of the stage environment in the development of dysphonia in theater actors. Costumes can have a significant impact because of their weight or warmth, which can result in a poor posture, mobility difficulties, or even hampered voice production.⁵ Other examples include the presence of smoke on stage, a varying audience size, and dust in the theater. All of these factors can impact laryngeal functioning.^{4,5}

Musical theatre performers are another group of elite vocal performers combining acting, dancing, and singing.⁶ They are expected to participate in long rehearsals up to 8 hours a day and often perform 5 to 8 times per week.^{12,13} These extreme vocal demands all increase the risk of developing vocal problems. Gheling *et al.* investigated a group of musical theater performers in Broadway productions and found that 26.7% had been diagnosed with a vocal injury in the course of their career.¹³

It is generally understood that professional voice users and elite vocal performers are at risk of developing voice problems throughout their careers. However, precise data regarding vocal hygiene knowledge and the occurrence of vocal symptoms, habits, and other influencing factors is limited in this population. The purpose of this study was to assess these factors and to detect potential differences between subgroups of professional voice users and vocal performers, specifically teachers, professional actors, and student musical theater actors. The results of this study could lead to improved vocal hygiene knowledge and education in these at-risk populations.

Material and methods

This observational study was approved by the Ethics committee of Ghent University Hospital (B670201630063).

Participants

Forty-nine professional voice users or vocal performers were selected through convenience

Table 1
Experience and professional vocal load of the teachers, actors, and student actors

Teachers (n=17)	Range	Mean	SD
Years of experience	8-36	20.87	9.64
Number of lessons/week	10-23	20.19	2.97
Actors (n=19)	Range	Mean	SD
Years of experience	3-50	19.39	12.32
Hours of acting/week	5-40	15.33	10.53
Number of rehearsals	5-40	21.07	11.46
Student actors (n=13)	Range	Mean	SD
Years of experience	1-5	3.63	1.77
Hours of acting/week	8-20	15.63	4.02
Number of rehearsals	14-21	16.63	3.10

sampling and included in this study. The participants were divided into three groups based on their profession, and categorized as teachers, actors, and student actors.

The first group included 17 high school teachers of general secondary education (7 men, 10 women; mean age 44 yr., range 21-61 yr., SD 12.2). The teachers were contacted directly during a high school visit. The inclusion criteria were using teaching as a primary source of income and having at least 5 years of teaching experience.

The second group included 19 professional actors from several theater associations and drama schools (9 men, 10 women; mean age 42 yr., range 19-71 yr., SD 13.8). These participants were contacted by e-mail or through the official website of the Actors Guild, and the questionnaires were also circulated within several acting associations. The inclusion criterion in this group was using acting as a main or additional income source. Amateur actors were excluded from the study. The third group included 13 student actors (7 men, 6 women; mean age 21 yr., range 19-24 yr., SD 1.6), contacted in the same way as the actors. Eleven participants were recruited from a Bachelor's program in music and performing arts and 2 participated in a theater education program at a drama school. All students has passed an entrance test in order to start their education which focused on the students' potential rather than their vocal ability.

There were no specific vocal requirements for participating in the study. The years of experience and the professional vocal load in the three groups are summarized in Table 1.

Material and methods

Several questionnaires were selected to evaluate the vocal hygiene, habits, symptoms, and influencing factors in each group.

Participants first completed checklists assessing vocal abuse, vocal load, lifestyle habits, vocal habits and routines, symptoms, and medical history (De Bodt *et al.*, 2008¹, D'haeseleer *et al.*, 2016⁴, Donahue *et al.*, 2014¹²). Each question was scored by frequency of occurrence defined as never, rarely, sometimes, often, or always. The participants then rated their stress level with a visual analogue scale (VAS) ranging from 0-10.

The psychosocial impact of potential voice problems was investigated using the Dutch version of the Voice Handicap Index (VHI) (Jacobson *et al.*, 1997; De Bodt *et al.*, 2000).¹ The VHI is a patient-based self-assessment tool consisting of 30 statements, evaluating functional (10 statements, F-scale), physical (10 statements, P-scale), and emotional (10 statements, E-scale) restrictions. Every statement is scored on a 5-point Likert scale (0: never, 1: almost never, 2: sometimes; 3: almost always; 4: always). The total VHI-score ranges

from 0 to 120 with a higher score indicating a greater impact.

The third questionnaire was the Dutch version of the vocal tract discomfort scale (VTDS) (Mathieson *et al.*, 2009; Luyten *et al.* 2016).¹⁴ This scale consists of eight sensations that can be felt in or around the throat, defined as burning, tight, dry, aching, tickling, sore, irritable, and globus. Each item was scored by frequency (never, seldom, sometimes, more than sometimes, often, very often, always) and severity (none, almost none, limited, more than limited, moderate, more than moderate, severe) using a 7-point Likert scale.

Finally, participants were asked to provide a general score for their voice use using a 5-point Likert scale (severely abnormal, slightly abnormal, normal, good, very good) and their vocal quality using a VAS ranging from 0-10.

Statistical analysis

SPSS version 23 (SPSS Corporation, Chicago, IL, USA) was used for the statistical analysis, and the significance level was set at $\alpha = 0.05$. Descriptive statistics were used to present the frequencies of

Table 2
Presence of vocal abuse in the teachers, actors, and student actors

Vocal abuse	Never	Rarely	Sometimes	Often	Always
	% (n)	% (n)	% (n)	% (n)	% (n)
Throat clearing/coughing					
Teachers	23.5 (4)	47.1 (8)	17.6 (3)	11.8 (2)	0 (0)
Actors	31.6 (6)	15.8 (3)	47.4 (9)	5.3 (1)	0 (0)
Student actors	7.7 (1)	30.8 (4)	46.2 (6)	15.4 (2)	0 (0)
Whispering					
Teachers	23.5 (4)	47.1 (8)	29.4 (5)	0 (0)	0 (0)
Actors	10.5 (2)	36.8 (7)	47.4 (9)	5.3 (1)	0 (0)
Student actors	0 (0)	23.1 (3)	61.5 (8)	15.4 (2)	0 (0)
Screaming/shouting					
Teachers	29.4 (5)	47.1 (8)	11.8 (2)	11.8 (2)	0 (0)
Actors	10.5 (2)	15.8 (3)	63.2 (12)	10.5 (2)	0 (0)
Student actors	0 (0)	7.7 (1)	46.2 (6)	46.2 (6)	0 (0)
Imitating voices					
Teachers	47.1 (8)	29.4 (5)	23.5 (4)	0 (0)	0 (0)
Actors	0 (0)	21.1 (4)	57.9 (11)	21.4 (4)	0 (0)
Student actors	0 (0)	30.8 (4)	23.1 (3)	46.2 (6)	0 (0)
Imitating sounds					
Teachers	47.1 (8)	35.3 (6)	17.6 (3)	0 (0)	0 (0)
Actors	5.3 (1)	26.3 (5)	57.9 (11)	10.5 (2)	0 (0)
Student actors	0 (0)	15.4 (2)	53.8 (7)	30.8 (4)	0 (0)
Using a hard voice onset					
Teachers	5.9 (1)	5.9 (1)	52.9 (9)	35.3 (6)	0 (0)
Actors	5.3 (1)	21.1 (4)	42.1 (8)	31.6 (6)	0 (0)
Student actors	0 (0)	7.7 (1)	53.8 (7)	38.5 (5)	0 (0)

the categorical data as well as the means and SD of the continuous data. Kruskal-Wallis tests were used to compare the results of the ordinal variables between the three groups, and chi-squared tests were used for the nominal data. Fisher's exact test was used if the conditions were not met. The normality of the continuous variables (e.g. VHI or the VAS) was checked by the Kolmogorov-Smirnov and the Shapiro-Wilk tests, and the Kruskal-Wallis test was used to compare the results of the continuous variables since no parametric distribution was found. The Spearman rank correlation was used to investigate correlations between two variables (e.g. the VHI and the VTDS).

Results

The results of the checklist assessing vocal abuse are shown in Table 2. A significant difference in frequency of occurrence between the three groups can be found for the variables whispering ($p = 0.014$), screaming/shouting ($p = 0.001$), and imitating voices or sounds ($p < 0.001$). Post-hoc tests revealed that student actors whisper more often than teachers ($p = 0.010$) but there was no significant difference between student and professional actors. A comparable result was found for screaming and shouting, with a higher frequency for the student actors compared to the other groups ($p < 0.001$). The actors and the student actors imitate more voices and sounds compared to the teachers ($p < 0.001$).

Table 3 presents the results of the vocal load checklist. A significant difference was found for the use of an inappropriate pitch ($p = 0.001$), with a higher frequency in student actors ($p < 0.001$) and actors ($p = 0.020$) compared to teachers. The environmental variables speaking in large rooms ($p = 0.002$), working in an air-conditioned room ($p = 0.003$), and working in a smoky environment ($p < 0.001$) also showed a higher frequency in both student and professional actors compared to teachers.

Lifestyle habits were also investigated (Table 4). Eating late at night was significantly different between the three subgroups ($p = 0.001$), with a higher frequency in both actors (57.9% sometimes and often) ($p = 0.009$) and student actors (46.2% sometimes, 38.5% often) ($p = 0.002$) compared to the teachers (52.9% rarely). Student actors also report more sleep deprivation (53.8% often) ($p =$

0.028) and stress (69.3% often and always) ($p = 0.031$) compared to the professional actors and teachers. The same trend is seen for stress with the VAS, although no significant differences were found (Teachers: 4.94, actors: 5.12, student actors: 6.62) ($p = 0.138$). An overall high stress level was seen for all participants.

The majority of participants did not smoke (85.7%; 42/49) but did consume alcohol (85.7%; 42/49) with a range varying from one consumption a month to several consumptions a day. There was no significant difference between the three groups in smoking or drinking habits. Some professional and student actors (12.5%, 4/31) reported that they consume alcohol and/or smoke cigarettes before a performance.

Vocal habits and routines and symptoms are presented in Table 5. A significant difference was found between the subgroups for vocal warm-up ($p < 0.001$), which is more common in actors and especially student actors compared to teachers. Sufficient water intake is also more common in professional and student actors compared to teachers ($p < 0.001$).

The medical histories of the participants were also collected (data not shown). One out of three participants in the teacher and actor groups had an earlier voice disorder diagnosed by an otorhinolaryngologist. One person in both groups had received phonosurgery. There were no significant differences in medical problems, medication use, or allergies between the groups,

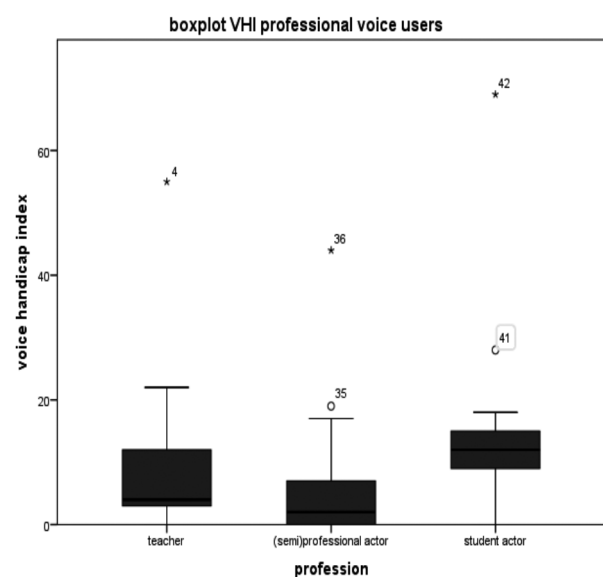


Figure 1
VHI

Table 3
Presence of vocal load in the teachers, actors, and student actors

Vocal load	Never	Rarely	Sometimes	Often	Always
	% (n)	% (n)	% (n)	% (n)	% (n)
<u>Using an inappropriate loudness</u>					
Teachers	23.5 (4)	11.8 (2)	58.8 (10)	5.9 (1)	0 (0)
Actors	15.8 (3)	21.1 (4)	42.1 (8)	15.8 (3)	5.3 (1)
Student actors	0 (0)	30.8 (4)	46.2 (6)	15.4 (2)	7.7 (1)
<u>Using an inappropriate pitch</u>					
Teachers	47.1 (8)	41.2 (7)	11.8 (2)	0 (0)	0 (0)
Actors	26.3 (5)	26.3 (5)	42.1 (8)	0 (0)	0 (0)
Student actors	7.7 (1)	15.4 (2)	38.5 (5)	38.5 (5)	0 (0)
<u>Using a tensed voice</u>					
Teachers	17.6 (3)	52.9 (9)	29.4 (5)	0 (0)	0 (0)
Actors	31.6 (6)	42.1 (8)	21.1 (4)	5.3 (1)	0 (0)
Student actors	23.1 (3)	46.2 (6)	23.1 (3)	7.7 (1)	0 (0)
<u>Speaking to large groups</u>					
Teachers	5.9 (1)	5.9 (1)	17.6 (3)	52.9 (9)	17.6 (3)
Actors	5.3 (1)	10.5 (2)	15.8 (3)	63.2 (12)	5.3 (1)
Student actors	0 (0)	15.4 (2)	23.1 (3)	53.8 (7)	7.7 (1)
<u>Speaking with irregular breathing</u>					
Teachers	35.3 (6)	23.5 (4)	29.4 (5)	11.8 (2)	0 (0)
Actors	21.1 (4)	31.6 (6)	36.8 (7)	10.5 (2)	0 (0)
Student actors	23.1 (3)	30.8 (4)	38.5 (5)	7.7 (1)	0 (0)
<u>Speaking >1h without a break</u>					
Teachers	0 (0)	17.6 (3)	52.9 (9)	23.5 (4)	5.9 (1)
Actors	5.3 (1)	10.5 (2)	21.1 (4)	52.6 (10)	10.5 (2)
Student actors	0 (0)	30.8 (4)	15.4 (2)	30.8 (4)	15.4 (2)
<u>Speaking in large rooms</u>					
Teachers	11.8 (2)	11.8 (2)	29.4 (5)	35.3 (6)	11.8 (2)
Actors	5.3 (1)	5.3 (1)	15.8 (3)	57.9 (11)	15.8 (3)
Student actors	0 (0)	0 (0)	30.8 (4)	46.2 (6)	23.1 (3)
<u>Speaking/singing above background noise</u>					
Teachers	11.8 (2)	11.8 (2)	29.4 (5)	35.3 (6)	11.8 (2)
Actors	5.3 (1)	5.3 (1)	31.6 (6)	47.4 (9)	5.3 (1)
Student actors	0 (0)	0 (0)	46.2 (6)	38.5 (5)	15.4 (2)
<u>Speaking in an air-conditioned room</u>					
Teachers	58.8 (10)	17.6 (3)	17.6 (3)	0 (0)	5.9 (1)
Actors	5.3 (1)	36.8 (7)	31.6 (6)	26.3 (5)	0 (0)
Student actors	15.4 (2)	7.7 (1)	30.8 (4)	46.2 (6)	0 (0)
<u>Speaking in a smoky environment</u>					
Teachers	94.1 (16)	5.9 (1)	0 (0)	0 (0)	0 (0)
Actors	31.6 (6)	52.6 (10)	15.8 (3)	0 (0)	0 (0)
Student actors	15.4 (2)	69.2 (9)	7.7 (1)	7.7 (1)	0 (0)
<u>Speaking in rooms with insufficient humidity</u>					
Teachers	11.8 (2)	23.5 (4)	47.1 (8)	17.6 (3)	0 (0)
Actors	5.3 (1)	36.8 (7)	52.6 (10)	5.3 (1)	0 (0)
Student actors	0 (0)	15.4 (2)	46.2 (6)	38.5 (5)	0 (0)

while a significant difference was found in the amount of voice training ($p=0.032$). Only around half of the teachers (8/16; 1 missing) had received voice training in the past and typically over a short period, compared to 92.3% (12/13) of student actors.

The results of the VHI are shown in Table 5 and presented as a boxplot in Figure 1. A significant difference was found in overall VHI between the

groups ($p=0.037$), with a mean of 6.53 for the actors, 9.94 for the teachers, and 15.77 for the student actors. There was no significant difference in the VHI-P ($P=0.067$) and VHI-E ($P=0.199$). The VHI-F ($P=0.017$) was significantly higher in student actors (5.15) compared to the actors (1.68) and teachers (2.59).

No significant differences were found in the participants' general perception of their voice use

Table 4
Lifestyle habits of the teachers, actors, and student actors

Lifestyle habits	Never	Rarely	Sometimes	Often	Always	Tot
<u>Eating late at night</u>						
Teachers	0	52.9%(9)	47.1%(8)	0	0	100%(17)
Actors	5.3%(1)	36.8%(7)	52.6%(10)	5.3%(1)	0	100%(19)
Student actors	0	7.7%(1)	46.2%(6)	38.5%(5)	7.7%(1)	100%(13)
<u>Drug abuse</u>						
Teachers	100%(17)	0	0	0	0	100%(17)
Actors	78.9%(15)	15.8%(3)	0	0	0	94.7%(18)
Student actors	69.2%(9)	23.1%(3)	7.7%(1)	0	0	100%(13)
<u>Automedication</u>						
Teachers	41.2%(7)	52.9%(9)	5.9%(1)	0	0	100%(17)
Actors	63.2%(12)	31.6%(6)	5.3%(1)	0	0	100%(19)
Student actors	38.5%(5)	38.5%(5)	7.7%(1)	15.4%(2)	0	100%(13)
<u>Gastric reflux</u>						
Teachers	47.1%(8)	17.6%(3)	17.6%(3)	5.9%(1)	5.9%(1)	94.1%(16)
Actors	36.8%(7)	26.3%(5)	21.1%(4)	5.3%(1)	5.3%(1)	94.7%(18)
Student actors	38.5%(5)	38.5%(5)	15.4%(2)	7.7%(1)	0	100%(13)
<u>Sleep deprivation</u>						
Teachers	17.6%(3)	17.6%(3)	35.3%(6)	11.8%(2)	5.9%(1)	88.2%(15)
Actors	15.8%(3)	0	57.9%(11)	15.8%(3)	0	89.5%(17)
Student actors	0	0	46.2%(6)	53.8%(7)	0	100%(13)
<u>Stress</u>						
Teachers	5.9%(1)	17.6%(3)	52.9%(9)	17.6%(3)	0	94.1%(16)
Actors	15.8%(3)	5.3%(1)	47.4%(9)	21.1%(4)	5.3%(1)	94.7%(18)
Student actors	0	7.7%(1)	23.1%(3)	61.5%(8)	7.7%(1)	100%(13)

and vocal quality. About 70% (13/17; 3 missing) of the actors thought they had at least a good voice use, while student actors and teachers were a bit more neutral.

Overall, the professional voice users were quite positive about the quality of their voices (mean 7.31, 7.47 and 8.00, data not shown).

The survey ended with the vocal tract discomfort scales (VTDS, data not shown). The mean overall score on the frequency subscale was 6.35 (+- 5.074) for the teachers, 5.17 (+- 6.862) for the actors, and 10.69 (+-5.282) for the student actors. The mean overall score for the intensity subscale was 8.27 (+- 5.021) for the teachers, 5.31 (+-7.964) for the actors, and 13.50 (+6.722) for the student actors. Both the frequency ($p=0.006$) and intensity ($p=0.018$) scores were significantly higher for the student actors compared to the professional actors.

Student actors suffer more frequently ($p=0.010$) and more intensely ($p=0.001$) from a tight feeling in the throat relative to the two other groups. Other symptoms reported by student actors as more frequent and intense compared to professional actors were a dry throat, tickling throat, and a globus sensation ($p<0.018$).

A strong correlation was found between the VHI and the VTDS ($r=0.77$ $p<0.001$), and the strongest correlation was found for the teachers ($r=0.77$), followed by the actors ($r=0.582$), and student actors ($r=0.556$).

Discussion

The heavy vocal demands and the poor vocal quality in professional voice users and elite vocal performers are extensively described in the

Table 5
Vocal habits and routines and symptoms in the teachers, actors, and student actors

Vocal habits and symptoms	Never % (n)	Rarely % (n)	Sometimes % (n)	Often % (n)	Always % (n)
<u>Vocal warm-up</u>					
Teachers	76.5 (13)	17.6 (3)	5.9 (1)	0 (0)	0 (0)
Actors	10.5 (2)	10.5 (2)	52.6 (10)	26.3 (5)	0 (0)
Student actors	0 (0)	7.7 (1)	30.8 (4)	38.5 (5)	23.1 (3)
<u>Vocal cool-down</u>					
Teachers	82.4 (14)	17.6 (3)	0 (0)	0 (0)	0 (0)
Actors	63.2 (12)	31.6 (6)	5.3 (1)	0 (0)	0 (0)
Student actors	46.2 (6)	38.5 (5)	7.7 (1)	0 (0)	7.7 (1)
<u>Sufficient water Intake</u>					
Teachers	23.5 (4)	17.6 (3)	29.4 (5)	29.4 (5)	0 (0)
Actors	5.3 (1)	5.3 (1)	21.1 (4)	42.1 (8)	26.3 (5)
Student actors	0 (0)	0 (0)	15.4 (2)	38.5 (5)	46.2 (6)
<u>Vocal complaints after a performance/teaching</u>					
Teachers					
Actors	11.8 (2)	41.2 (7)	35.3 (6)	11.8 (2)	0 (0)
Student actors	31.6 (6)	31.6 (6)	31.6 (6)	5.3 (1)	0 (0)
	0 (0)	46.2 (6)	53.8 (7)	0 (0)	0 (0)
<u>Vocal fatigue</u>					
Teachers	5.9 (1)	52.9 (9)	29.4 (5)	11.8 (2)	0 (0)
Actors	5.3 (1)	47.4 (9)	42.1 (8)	5.3 (1)	0 (0)
Student actors	0 (0)	23.1 (3)	61.5 (8)	15.4 (2)	0 (0)

literature. However, there is little precise data regarding vocal hygiene, symptoms, habits, and influencing factors. The purpose of this study was to assess and compare the presence of these factors among subgroups of professional voice users.

This study revealed that vocal abuse occurred primarily in student and professional actors. These groups whisper, imitate sounds and voices, and use an inappropriate pitch more frequently than teachers. Student actors tend to shout and scream more than both professional actors and teachers. The high prevalence of this vocally violent behavior is consistent with the results reported by D'haeseleer *et al.*,⁴ but an exact comparison is not possible due to a difference in frequency classification. Surprisingly, the frequencies of vocal abuse were higher in the student actors compared to professional actors with more experience, although this was not always statistically significant. Timmermans *et al.* previously reported poor vocal quality among future elite vocal performers due to vocally violent behavior and a lack of vocal hygiene¹⁰ and Donahue *et al.* found that individuals who received voice training had better vocal hygiene.¹² While 92.3% (12/13) of the student actors included in this study

Table 6
VHI of the teachers, actors, and student actors

VHI	Range	Mean	SD
<u>VHI-total</u>	0-69	10.16	13.88
Teachers	0-55	9.94	13.30
Actors	0-44	6.53	10.76
Student actors	0-69	15.77	17.51

did receive voice training, their vocal habits remain questionable.

Approximately 50% of the participants in each subgroup use an inappropriate loudness at least sometimes, and these results are similar to those found in teachers by Silverio *et al.* (57.14%).¹⁵ The reason for this inappropriate loudness may be due to an adverse job environment and large audience sizes. The questionnaire also revealed that singing or speaking above background noise was common in all three groups ($\pm 50\%$ often or always), with no statistical difference between them. The background noise levels in various occupational environments of professional voice users were measured by Hoffman-Ruddy *et al.* and ranged from 65 to 95 dB SPL,⁵ potentially forcing vocal professionals to use a loud and inappropriate

voice. Sander and Ripich concluded that the vocal behaviors needed to create a loud voice such as vocal attack are related to the origin of vocal fatigue,¹⁶ which may explain why vocal fatigue is a common symptom among professional voice users. The results of the current study showed that 42% of the actors experienced vocal fatigue on a regular basis. This prevalence is higher than that reported by Donahou *et al.* (27%)¹² and D'haeseleer *et al.* (37%)⁶, potentially due to the lack of a universal definition for the term 'vocal fatigue'.

The questionnaire confirmed that the majority of student and professional actors perform in an adverse environment, and large rooms with a lack of humidity are common occupational settings for this population. Although the role of the environment has not yet been extensively studied, Hoffman-Ruddy *et al.* described the hazards of a poor work environment on the laryngeal anatomy.⁵ The majority of the elite vocal performers also often speak longer than 1 hour without a break (63.1%), which is common in their profession.^{12,13} The questionnaire assessing lifestyle habits revealed differences between the student actors and the teachers. More than 50% of the teachers indicated that they rarely ate late at night, while 38.5% of the students often did. The same pattern can be seen for sleep deprivation (11.8% vs 53.8% often) and stress (17.6% vs 61.5% often). This higher occurrence in student actors may be a consequence of their scholarly and social duties, as they generally rehearse and perform late in the evening. Similar results were reported by Timmermans *et al.*¹⁰

Fourteen percent of the participants smoked, with frequencies varying from one cigarette a day to a package a day. This prevalence is rather low compared to that of the Belgian population overall (29%)¹⁷, which might indicate a good awareness of the adverse effects of tobacco on the voice by professional voice users. Timmermans *et al.* reported a much higher prevalence of 40% among vocal professionals and 61% among elite vocal professionals.¹⁰

Although actors report using vocal warm-ups more frequently than teachers, it is not a routine habit (52.6% sometimes). This result is in line with D'haeseleer *et al.*⁴, but in contrast to Gehling *et al.*¹³ and Donahue *et al.*¹¹ This might be explained by differences in inclusion criteria, as the last two studies only included musical theater performers.

The current results support this hypothesis, as more than 60% of the student actors reported using vocal warm-ups often or always. Vocal cool-downs were less common for all subgroups, in line with results found by other authors.^{4,6,10,13,18}

Past and current vocal symptoms were also assessed with the questionnaire. Half of the student actors sometimes suffer from vocal complaints after a performance, which is a high prevalence but to be expected when taking the vocally violent behaviour and adverse environment into account. A similar prevalence was found by D'haeseleer *et al.*⁴ Five participants in the current study experienced current vocal symptoms (10%), similar to the report by Roy *et al.*⁸ The lifetime occurrence of voice disorders was the highest for the teachers (35%), in agreement with the 20-50% range described by Martins.¹⁹ The high percentage of voice disorders is correlated with career length.²⁰ The classroom environment (noisy and with insufficient humidity) and the lack of knowledge about the correct use of the voice contribute to the high incidence of voice disorders in this population.²⁰

The VHI was used to examine the biopsychosocial impact of a voice disorder.²¹ The mean VHI score was 10.13 (clinical score cut-off = 20) with a higher score for student actors (15.77) and a lower score for professional actors (6.53). Twelve percent (6/49) of the total group scored higher than 20 on the VHI, which is more than the 4% found by D'Haeseleer *et al.*⁴ (2/13), but comparable to a study including university teachers in which 21% scored higher than 20.²² The higher score for future occupational voice users indicates that the student actors realize that they are dependent on their voices to perform and may be more worried than the more experienced professionals. Timmermans *et al.* found a similar higher score for future elite vocal performers (21.3).⁹ However, it is important to note that a mean score of 10.13 and 88% of the participants below the limit value of 20 is a good result, especially in light of the bad vocal habits. It is possible that the VHI is not sufficiently sensitive for the group of elite vocal performers.

The frequency of vocal tract discomfort (VTDS) found in the current study was always higher than that reported in studies of non-professional voice users, except for a globus and a burning sensation.¹⁴ The higher VTDS score indicates the vocally violent behavior in these groups and the risk of developing a voice disorder. The student

actors had the most problems of the three groups, both in frequency and intensity. This correlates with the higher VHI and the poorer vocal habits in this group and suggests that they are most at risk. These findings are consistent with the conclusions of Timmermans *et al.*¹⁰

There is a universal agreement among researchers that the focus should be on prevention rather than the treatment of voice disorders,²³ which could be managed on several levels. First, we hope that this study will improve awareness among general practitioners (GPs). GPs must be aware of the occurrence of vocally violent behaviour in vocal professionals, which may help in the prevention and early detection of voice disorders. There should also be a better guidance for future elite vocal performers, and screening by an otorhinolaryngologist and speech-language pathologist before enrolling in a vocally demanding education might help in the prevention of voice disorders. Finally, vocal hygiene awareness could be improved by information sessions.

One limitation of this study is the use of a relatively small sample size. Although our study led to some significant results that extend the observations of some previous studies, we must be careful when making generalizations in this observational setting. Larger sample sizes should be included in future studies, which would also reduce the risk of the sampling error possible with convenience sampling. A control group of non-professional voice users should also be included to compare their vocal habits with those of the vocal professionals, since our comparison with other studies including non-professional voice users suggested differences. Finally, videolaryngoscopic assessments and objective voice measurements should be implemented to evaluate vocal quality.

Conclusion

This study found a high percentage of vocally abusive habits and a poor occupational environment for professional voice users. The lack of vocal hygiene is reflected in the reported vocal symptoms, high lifetime incidence of voice disorders, and more prominent vocal tract discomfort relative to non-professional voice users. This study indicates that this population is at high risk of developing dysphonia, particularly student actors. More

attention must be paid to the prevention of voice disorders in this population.

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