The prevalence and risk factors for perceived voice disorders in public school teachers

Shuxiu Feng MS1 | Chingfeng Weng MD, MS2 | Shaofang Cai MS1 | Zijiang Yang BM1 | Meina Wu MS1 | Ning Kang MS1

1From the Second Affiliated Hospital of Xiamen Medical College, Xiamen, Fujian, China
2From the Xiamen Medical College, Xiamen, Fujian, China

Abstract

Objectives: The aim of this study was to explore the prevalence and risk factors in public kindergarten and elementary school teachers in the Jimei district in Xiamen. We took particular interest in the relationship between work-related factors and voice disorders.

Study Design: A cross-sectional investigation; a General Investigation.

Methods: This study was conducted from September 14 to 18, 2020 at public kindergarten and elementary schools in Xiamen, China. A total of 3140 teachers were separated into a perceived voice disorder group (PVD) and no perceived voice disorder group (NPVD) according to the Voice Handicap Index. The chi-square test was applied to explore the differences between the PVD and NPVD groups. The univariate logistic regression models were used to identify the risk factors in terms of unadjusted odds ratio and 95% confidence interval. Stepwise logistic regression was then used to ascertain independent determinants.

Results: We found that the prevalence of PVD was 47.52%. The results showed that risk factors of PVD included being female (OR = 1.574), middle-rank technical title and higher (OR = 2.199), continuous lecturing for more than 3 classes (OR = 3.034), lectured more than 10 classes a week (OR = 1.436) and taught art or physical education (OR = 1.742).

Conclusions: Teachers' work-related characteristics were associated with PVD. This proves that a preventive voice care program for teachers, administered by the school or education bureau, is urgent. This could include components such as the reasonable arrangement of timetables and recruitment of a sufficient number of kindergarten and elementary school teachers.

Level of evidence: Case-series
1 | INTRODUCTION

As far as we know, the voice is the most important tool of teaching in the group of teachers. As occupational voice users, teachers would speak loudly and use their voices continuously for long periods. It is an ordinary procedure for them to manipulate their voice tone for class discipline. Therefore, they are exposed to much more risk factors and more prone to have a higher prevalence for developing voice disorders than the general population.1–6 due to the overuse and misuse of voices. One Byeon's systematic review indicated that the prevalence of voice disorders in teachers ranged from 10% to 70%.7 Furthermore, Mattiske's study demonstrated that the voice issues of kindergarten and elementary school teachers were more than that of middle or high school teachers.8

Voice disorders may have adverse effects on the quality of life and professional performance of teachers, which would result in a poorer quality of teaching, lower attendance, and even resignation.9–13 The economic burden of teachers' voice disorders is staggering, as it involves lost wages, increased cost for substitute teachers, and the high cost of treatment for voice disorders.14 Rosow et al.15 reported that the social cost of US teachers' voice disorders cost roughly $2.5 billion annually. Meanwhile, Morton et al.16 showed that the voice disorder combined with voice-related disruptions may impact students' learning. Thus, voice disorders in teachers are an urgent medical condition that should not be overlooked.

The development of voice disorders is multifactorial, including endogenous and exogenous factors. Previous researches have reported that demographic characteristics are the possible risk factors of voice disorders,17,18 work environment,19–22 health,17,23–25 psychological factors,22,26 and voice overuse.12,18,22,27,28 However, the muscles of the vocal apparatus that were incorrectly used is one of the most reasons.29 For example, teachers overuse and misuse their voice frequently. In China, the number of students has risen with the full implementation of the second-child policy in 2016, which led to the increasing number of available teachers and unreasonable class schedules, including the daily continuous lecturing by teachers.

Quite a lot of researchers identified related factors that affected teachers' voice disorders in various countries, including work-related factors (e.g., daily hours of teaching)12,18, however, the studies focusing on the continuous lecturing per day are limited. In a qualitative study conducted by Yung,30 11 of 19 teachers at a school in Hong Kong complained that vocal problems occurred when they had to teach more than three consecutive lessons in a day.

Therefore, we conducted an epidemiological analysis to investigate the prevalence and risk factors in public kindergarten and elementary school teachers in the Jimei district of Xiamen, China, particularly the relationship between work-related factors and voice disorders, with the aim of providing scientific reference for schools in arranging teaching tasks and protecting the voices of teachers.
| Variable                                      | NPVD (n = 1648) | PVD (n = 1492) | p    |
|-----------------------------------------------|-----------------|----------------|------|
| Demographic characteristics                   |                 |                |      |
| Gender                                        |                 |                |      |
| Male                                          | 382 (59.42)     | 155 (40.58)    | .004*|
| Female                                        | 2758 (51.52)    | 1337 (48.48)   | -    |
| Age                                          |                 |                |      |
| <30                                           | 1654 (60.76)    | 649 (39.24)    | <.001*|
| ≥40                                           | 492 (43.50)     | 278 (56.50)    | -    |
| Living habits                                  |                 |                |      |
| Smoking                                       |                 |                |      |
| Yes                                           | 110 (54.55)     | 50 (45.45)     | .659 |
| No                                            | 3030 (52.41)    | 1442 (47.59)   | -    |
| Drinking                                      |                 |                |      |
| Yes                                           | 491 (52.75)     | 232 (47.25)    | .898 |
| No                                            | 2649 (52.43)    | 1260 (47.57)   | -    |
| Work-related characteristics                  |                 |                |      |
| School type                                   |                 |                |      |
| Kindergarten                                  | 751 (64.85)     | 264 (35.15)    | <.001*|
| Elementary                                    | 2389 (48.60)    | 1228 (51.40)   | -    |
| Technical title                               |                 |                |      |
| No Technical title                            | 1220 (65.66)    | 419 (34.34)    | <.001*|
| Primary technical title                       | 984 (47.97)     | 512 (52.03)    | -    |
| Middle-rank technical title and higher        | 936 (40.06)     | 561 (59.94)    | -    |
| Years of teaching                             |                 |                |      |
| 0–5                                           | 1541 (62.10)    | 584 (37.90)    | <.001*|
| 6–10                                          | 780 (44.87)     | 430 (55.13)    | -    |
| >10                                           | 819 (41.64)     | 478 (58.36)    | -    |
| Teaching method                               |                 |                |      |
| Multimedia teaching                           | 667 (63.27)     | 245 (36.73)    | <.001*|
| Blackboard teaching                           | 27 (48.15)      | 14 (51.85)     | -    |
| Both multimedia and blackboard teaching       | 2446 (49.59)    | 1233 (50.41)   | -    |
| Classes of continuous lecturing per day       |                 |                |      |
| No continuous lecturing                       | 503 (73.96)     | 131 (26.04)    | <.001*|
| Continuous lecturing 2 classes                | 1430 (53.15)    | 670 (46.85)    | -    |
| Continuous lecturing 3 or 4 classes           | 1207 (42.75)    | 691 (57.25)    | -    |
| Number of classes per week                    |                 |                |      |
| 0–10                                          | 799 (66.33)     | 269 (33.67)    | -    |
| ≥10                                           | 2341 (47.76)    | 1223 (52.24)   | <.001*|
| Number of students per class                  |                 |                |      |
| ≤20                                           | 43 (65.12)      | 15 (34.88)     | .150 |
| 21–59                                         | 3073 (52.23)    | 1468 (47.77)   | -    |
| ≥60                                           | 24 (62.50)      | 9 (37.50)      | -    |
| Grade                                         |                 |                |      |
| Kindergarten                                  | 747 (64.79)     | 263 (35.21)    | <.001*|
| Grade 1–3                                     | 947 (50.26)     | 471 (49.74)    | -    |
| Grade 4–6                                     | 979 (48.11)     | 508 (51.89)    | -    |
questionnaire, so that we may make necessary modifications as needed. This study was approved by the Medical Ethics Committee of The Second Affiliated Hospital of Xiamen Medical College and informed consent of all participants was obtained. The participants remained anonymous and the collected data were used only for investigational research purposes.

2.3 | Data analysis

The Statistics Analysis System (SAS v9.2, SAS Institute Inc., Cary, NC) was applied for data analysis. The chi-square test was used to explore the significant differences between the PVD and NPVD groups with respect to demographic characteristics, work-related characteristics, and living habits. Univariate logistic regression models were used to confirm the risk factors in terms of unadjusted odds ratio (OR) and 95% confidence interval (CI), and a stepwise logistic regression was done to identify independent determinants through estimating OR and 95% CI after adjusting results for potential confounders between the two groups. Variables were entered and dropped from the stepwise model using the 0.10 and 0.15 levels of significance, respectively. The NPVD group was considered the reference for the PVD group. The significance level was set at \( p < .05 \) for all analyses.

3 | RESULTS

3.1 | Prevalence of PVD

Nearly half of the 3140 public kindergarten and elementary school teachers who completed our questionnaire reported having PVD (47.52%). Furthermore, the mean VHI score was 23.55 ± 23.04.

3.2 | Demographic characteristics, living habits, and PVD

The chi-square test and univariate logistic regression results showing female teachers had a higher chance to develop PVD than male teachers (OR = 1.378, \( p = .004 \)). Age was a risk factor for PVD (OR = 2.039, \( p < .001 \); OR = 2.012, \( p = .001 \)). However, no intergroup differences existed regarding the smoking and drinking history (\( p > .05 \)). The specific results of chi-square test and univariate logistic regression are shown in Tables 1 and 2.

3.3 | Work-related characteristics and PVD

Tables 1 and 2 showed the results of chi-square test and univariate logistic regression between work-related characteristics and PVD.

The elementary school teachers had a higher chance of developing PVD than kindergarten school teachers (OR = 1.951, \( p < .001 \)). We found that the technical title and years of teaching were risk factors of PVD (OR = 2.074; OR = 2.860; OR = 2.013; OR = 2.297; all \( p < .05 \)). This study showed that the amount of teaching was a risk factor of PVD; teachers who continuously taught 2 or more classes a day were more likely to have PVD than those who had no continuous lectures (OR = 2.503; OR = 3.803; all \( p < .05 \)) and teachers who lectured ≥10 classes a week had a higher chance of developing PVD than those who lectured <10 classes a week (OR = 2.155, \( p < .001 \)). No significant differences were found in the number of students per class and teaching method between the PVD group and the NPVD group.
The univariate logistic regression results about the relationship of PVD and NPVD groups among demographic characteristics, living habits and work-related characteristics

| Variable                                      | b   | $S_b$ | Wald $\chi^2$ | p    | OR  | 95% CI          |
|-----------------------------------------------|-----|-------|----------------|------|-----|-----------------|
| **Demographic characteristics**               |     |       |                |      |     |                 |
| Gender                                        |     |       |                |      |     |                 |
| Male*                                         | -   | -     | -              | -    | 1   | -               |
| Female                                        | 0.321 | 0.111 | 8.350          | .004 | 1.378 | 1.109–1.713     |
| Age                                           |     |       |                |      |     |                 |
| <30*                                          | -   | -     | -              | -    | 1   | -               |
| ~40                                           | 0.242 | 0.055 | 19.392         | <.001 | 2.039 | 1.738–2.393     |
| ≥40                                           | 0.228 | 0.066 | 11.822         | .001 | 2.012 | 1.641–2.466     |
| **Living habits**                             |     |       |                |      |     |                 |
| Smoking                                       |     |       |                |      |     |                 |
| Yes*                                          | -   | -     | -              | -    | 1   | -               |
| No                                            | 0.076 | 0.102 | 0.194          | .659 | 1.018 | 0.716–1.390     |
| Drinking                                      |     |       |                |      |     |                 |
| Yes*                                          | -   | -     | -              | -    | -   | -               |
| No                                            | 0.013 | 0.098 | 0.016          | .898 | 1.013 | 0.835–1.228     |
| **Work-related characteristics**              |     |       |                |      |     |                 |
| School type                                   |     |       |                |      |     |                 |
| Kindergarten*                                 | -   | -     | -              | -    | 1   | -               |
| Elementary                                    | 0.668 | 0.087 | 59.430         | <.001 | 1.951 | 1.646–2.312     |
| Technical title                               |     |       |                |      |     |                 |
| No Technical title*                           | -   | -     | -              | -    | 1   | -               |
| Primary technical title                       | 0.135 | 0.052 | 6.825          | .009 | 2.074 | 1.746–2.463     |
| Middle-rank technical title and higher        | 0.457 | 0.053 | 73.826         | <.001 | 2.860 | 2.398–3.411     |
| Years of teaching                             |     |       |                |      |     |                 |
| 0~5*                                          | -   | -     | -              | -    | 1   | -               |
| 6~10                                          | 0.189 | 0.056 | 11.310         | .001 | 2.013 | 1.691–2.397     |
| >10                                           | 0.321 | 0.056 | 33.109         | <.001 | 2.297 | 1.932–2.731     |
| Teaching method                               |     |       |                |      |     |                 |
| Multimedia teaching*                          | -   | -     | -              | -    | 1   | -               |
| Blackboard teaching                           | 0.225 | 0.259 | 0.759          | .384 | 1.855 | 0.858–4.011     |
| Both multimedia and blackboard teaching       | 0.167 | 0.134 | 1.564          | .211 | 1.751 | 0.968–2.088     |
| Classes of continuous lecturing per day       |     |       |                |      |     |                 |
| No continuous lecturing *                     | -   | -     | -              | -    | 1   | -               |
| Continuous lecturing 2 classes                | 0.167 | 0.053 | 10.007         | .002 | 2.503 | 2.000–3.134     |
| Continuous lecturing 3 or 4 classes           | 0.585 | 0.054 | 115.326        | <.001 | 3.803 | 3.023–4.784     |
| Number of classes per week                    |     |       |                |      |     |                 |
| 0~10*                                         | -   | -     | -              | -    | 1   | -               |
| ≥10                                           | 0.768 | 0.086 | 80.586         | <.001 | 2.155 | 1.822–2.548     |
| Number of students per class                  |     |       |                |      |     |                 |
| ≤20*                                          | -   | -     | -              | -    | 1   | -               |
| 21~59                                         | 0.319 | 0.178 | 3.206          | .073 | 1.707 | 0.908–3.209     |
| ≥60                                           | −0.103 | 0.301 | 0.117          | .733 | 1.120 | 0.397–3.160     |
| Grade                                         |     |       |                |      |     |                 |
| Kindergarten*                                 | -   | -     | -              | -    | 1   | -               |
| Grade 1–3                                     | 0.091 | 0.060 | 2.336          | .126 | 1.821 | 0.926–2.217     |
| Grade 4–6                                     | 0.177 | 0.059 | 9.027          | .003 | 1.985 | 1.632–2.414     |
excluding math or English \( (p = .330, \ p = .068, \ \text{respectively}). \) Due to the outbreak of COVID-19, social isolation was imposed on the teachers and students, and many teachers had to switch to online lecturing in March 2020 which continued through July 2020. In this study, online lectures was a risk factor for PVD \( (\text{OR} = 1.913, \ p < .001). \) Among the teachers who switched to online lecturing, continuous lectures was a risk factor for PVD \( (\text{OR} = 1.864, \ p = .013), \) excluding continuous teaching of 2 classes \( (p = .884). \)
3.4 | Risk factors of PVD in public kindergarten and elementary school teachers through stepwise logistic regression

Stepwise logistic regression was performed to identify unique risk factors for developing PVD. There were 11 statistically significant variables from the univariate logistic regression that were added into the stepwise logistic regression, including gender, age, school type, technical title, years of teaching, number of continuous lectures per day, number of classes per week, grade, course, online lectures, and number of continuous online lectures per day. The remaining variables met the criterion and those could explain the prevalence of PVD (Table 3). These results show being female (OR = 1.574, p = .001), having a middle-rank technical title and higher (OR = 2.199, p < .001), continuously lecturing for ≥3 classes per day (OR = 3.034, p < .001), lecturing >10 classes a week (OR = 1.436, p = .013) and teaching arts or physical education (OR = 1.742, p < .001) could be risk factors of PVD.

4 | DISCUSSION

The results from this extensive epidemiological study gave useful insights into the prevalence of PVD and the work-related risk factors. This study is unique in the fact that it focused on investigating work-related characteristics by comparing public kindergarten and elementary school teachers with PVD and those without PVD through general investigation, and we elucidated some risk factors which could potentially contribute to PVD.

4.1 | Prevalence of PVD

In this study, 1492 public kindergarten and elementary school teachers reported to have PVD (47.52%). This is higher than the study from da Rocha et al., which reported the incidence of a PVD among elementary and middle school teachers was 17.1%. However, a study conducted by Kyriakou et al. showed the prevalence of self-perceived voice disorders was 69.9% among the public kindergarten and elementary school teachers in Cyprus. The difference seen in the prevalence of voice disorders may be due to differences in culture, region, and tests conducted to determine the vocal complications of teachers. In addition, because of the outbreak of COVID-19, many teachers had to do online lecturing. The perceived voice disorders may be a result of vocal effort, with difficulties in wearing headphones and speaking while wearing a mask during online lecturing.

4.2 | Demographic characteristics, living habits, and PVD

Female teachers were more prone to have PVD than male teachers in our study, which is in keeping with other studies that reported that female teachers are more prone to have voice disorders. This may be owing to the fact that females have a smaller larynx, shorter vocal cords, and higher fundamental voice frequencies than males. In addition, females have a lower concentration of hyaluronic acid (HA) in the superficial layer of the lamina propria. And HA plays a notable part in wound repair. Therefore, there is potentially a reduced wound healing response after damaging vocal structures in female teachers. In this study, age did not significantly influence the onset of PVD, which is consistent with the study of Chen et al. In the aspect of living habits (smoking and drinking habits), these were not significantly related to PVD. Similar results were found by Roy et al., Chen et al., Bolbol et al., and Alva. One presumable possibility is that most of research subjects were female. Because of culture and traditions in China, smoking and drinking are not prevalent among females.

4.3 | Work-related characteristics and PVD

A significant finding of the survey revealed that teachers with a middle-rank technical title and higher had a 2.199-fold higher chance to have PVD than those with no technical title. One possible cause for this is that teachers with a middle-rank technical title and higher undertake more teaching tasks, having richer experience in teaching, as seen by Mattiske et al. who demonstrated that voice disorders exist most often in experienced teachers. Furthermore, they have more opportunities to act as homeroom teachers or head of pre-prep classes. This means that they have more staff meetings, more communication with parents and counsel more students, leading to vocal overuse. Lee et al. reported that homeroom teachers showed higher voice disorders because they overused their voice by providing student counseling and guidance outside of the classroom.

Our investigation is the first study in Mainland China that showed that teachers who continuously lecture 3 or 4 classes a day had a higher risk of PVD than those who have no continuous lecturing. These results were consistent with the finding of Yeung, who showed that teachers in Hong Kong complained of vocal problems occurring when they had to teach more than three consecutive lessons in a day. For kindergarten and elementary school, the duration of a class is 40 min in China. The duration of breaks between classes is 10 min, which is not enough time for the voice to recover. Thus, as the number of continuous classes increases, the time and frequency of voice usage also increase. These long periods of voice usage are due to poor time management. Many schools arrange for teachers to continuously lecture more than three classes a day. Roy et al. assumed that long periods of vocal use has a cumulative effect in developing a voice disorder. Long periods of vocal use leads to vibration overdose and injury of vocal fold tissue, which leads to the injury of voices. Thus, it is not recommended for schools to arrange teachers to continuously lecture more than three classes a day.

It was found that teachers who lectured ≥10 classes a week had a 1.436-fold higher chance to have PVD than those who lectured <10 classes. Similar to previous findings, the study conducted by Lee et al. revealed that teaching more than 20 class hours per week was...
positively associated with PVD in secondary school teachers. Domínguez-Alonso et al.18 showed that total class hours per week significantly affected the disturbance of the voice. The frequency and duration of talking were connected to voice disorders in all these studies, as it leads to microvascular trauma with local edematous remodeling processes and accompanying inflammation.44

These results additionally showed that teachers who taught art or physical education had a 1.742-fold higher chance to have PVD than those who taught kindergarten subjects. This corresponds to the results reported by other authors,19,45,46 who showed that those who teach music and sports have a higher risk of voice disorders. One possible reason may be that teachers in these courses have to raise their voices more often to make the students hear. The relationship between school type, years of teaching, number of students per class and grade were not found to be significant in our study. This finding is in accordance with the study of Alva.17 Chen et al.,31 and Van Houtte et al.47 The relationship of online lecturing and continuous online lecturing and PVD had no statistical significance. This result is different from the data reported by Nemr et al.,48 which showed that online classes/meetings deteriorated the voices of teachers during the COVID-19 outbreak in Brazil. This may be a result of vocal effort, with difficulties in wearing headphones and speaking while wearing a mask during online classes.

5 | CONCLUSIONS

This study suggested that continuous lecturing ≥3 classes per day may be an important risk factor for the development of PVD in public kindergarten and elementary school teachers in Xiamen city. In light of this finding, a preventive voice care program is necessary and should be conducted by the school or education bureau for teachers. The results of the study also concluded that gender, technical title, number of classes taught per week, and course may contribute to the development of PVD. Thus, regular follow-ups of teachers’ work-related characteristics and voice disorders are needed. We will focus on the voice behavioral treatment for teachers in the follow-up research.

ACKNOWLEDGMENTS

The authors would like to thank all teachers for their participation and the Jimei District Education Bureau for providing the data on the number of schools and teachers. We also thank the financial support by the Science and Technology Bureau of Xiamen.

CONFLICT OF INTEREST

No author has any conflicts of interest to disclose.

ORCID

Shuxiu Feng https://orcid.org/0000-0002-6572-7388

REFERENCES

1. Lyberg-Ahlander V, Rydell R, Fredlund P, Magnusson C, Wilén S. Prevalence of voice disorders in the general population, based on the Stockholm public health cohort. J Voice. 2019;33(6):900-905.

2. Seifpanahi S, Izadi F, Jamshidi A-A, et al. Prevalence of voice disorders and associated risk factors in teachers and nonteachers in Iran. J Voice. 2016;30(4):506.e19-506.e23.

3. Roy N, Merrill RM, Thibeault S, Parsa RA, Gray SD, Smith EM. Prevalence of voice disorders in teachers and the general population. J Speech Lang Hear Res. 2004;47(2):281-293.

4. Behlau M, Zambon F, Guerrieri AC, Roy N. Epidemiology of voice disorders in teachers and nonteachers in Brazil: prevalence and adverse effects. J Voice. 2012;26(5):665.e9-665.e18.

5. Gadeppalli C, Fullwood C, Ascott F, Homer JJ. Voice burden in teachers and non-teachers in a UKpopulation: a questionnaire-based survey. Clin Otolaryngol. 2019;44(6):1045-1058.

6. Natour YS, Sartawi AM, Al Muhaiber O, Ethemiyew E, Marie BS. Emirati teachers’ perceptions of voice handicap. J Voice. 2016;30(3):378.e13-378.e20.

7. Byeon H. The risk factors related to voice disorder in teachers: a systemic review and meta-analysis. Int J Environ Res Public Health. 2019;16(19):1-14.

8. Mattiske JA, Oates JM, Greenwood KM. Vocal problems among teachers: a review of prevalence, causes, prevention, and treatment. J Voice. 1998;12(4):489-499.

9. Naunheim MR, Goldberg L, Dai JB, Rubinstein BJ, Courey MS. Measuring the impact of dysphonia on quality of life using health state preferences. Laryngoscope. 2020;130(4):E177-E182.

10. Giannini S, Latorre MRDO, Fischer FM, Ghirardi A, Ferreira LP. Teachers’ voice disorders and loss of work ability: a case-control study. J Voice. 2015;29(2):209-217.

11. Vertanen-Greis H, Loyttyniemi E, Uitti J, Putus T. Work ability of teachers associated with voice disorders, stress, and the indoor environment: a questionnaire study in Finland. J Voice. 2020;50892-1997 (20)30366-0.

12. Lee YR, Kim HR, Lee S. Effect of teacher’s working conditions on voice disorder in Korea: a nationwide survey. Ann Occup Environ Med. 2018;30(4):1-10.

13. da Rocha LM, de Lima BS, do Amaral PL, Behlau M, de Mattos Souza LD. Risk factors for the incidence of perceived voice disorders in elementary and middle school teachers. J Voice. 2017;31(2):258.e7-258.e12.

14. Williams NR. Occupational groups at risk of voice disorders: a review of the literature. Occup Med. 2012;62(7):588.

15. Rosow DE, Szczupak M, Saint-Victor S, Gerhard JD, Dupont C, Lo K. The economic impact of vocal attrition in public school teachers in Miami-Dade County. Laryngoscope. 2016;126(3):665-671.

16. Morton V, Watson DR. The impact of impaired vocal quality on children’s ability to process spoken language. Scand J Logop Phoniatr. 2001;26(1):17-25.

17. Alva A, Machado M, Bhojwani K, Sreedharan S. Study of risk factors for development of voice disorders and its impact on the quality of life of school teachers in Mangalore, India. J Clin Diagn Res. 2017;11(1):MC01-MC05.

18. Domínguez-Alonso J, López-Castedo A, Núez-Lois S, Portela-Pino I, Vázquez-Varela E. Disturbance of the voice in teachers. J Voice. 2019;93(9):e1-e13.

19. Trinite B. Epidemiology of voice disorders in Latvian school teachers. J Voice. 2017;31(4):508.e501-508.e509.

20. Rantala L, Sala E, Kankare E. Teachers’ working postures and their effects on the voice. Folio Phoniatr Logop. 2018;70(1):24-36.

21. Abo-Hasseba A, Waaramaa T, Alku P, Geneid A. Difference in voice problems and noise reports between teachers of public and private schools in upper Egypt. J Voice. 2017;31(4):508.e511-508.e516.

22. Medeiros AMD, Barreto SM, Assunso AA. Voice disorders (dysphonia) in public school female teachers working in Belo Horizonte: prevalence and associated factors. J Voice. 2007;22(6):676-687.
23. Devadas U, Bellur R, Maruthy S. Prevalence and risk factors of voice problems among primary school teachers in India. J Voice. 2016;31(1):117.e1-117.e10.
24. Cantor Cutiva LC, Fajardo A, Burdorf A. Associations between self-perceived voice disorders in teachers, perceptual assessment by speech-language pathologists, and instrumental analysis. Int J Speech Lang Pathol. 2016;18(6):550-559.
25. Vertanen-Greis H, Loyttyniemi E, Uitti J. Voice disorders are associated with stress among teachers: a cross-sectional study in Finland. J Voice. 2020;34(3):488.e481-488.e488.
26. Luise MDR, Behlau M, Luciano DDMS. Behavioral dysphonia and depression in elementary school teachers. J Voice. 2015;29(6):712-717.
27. Akinbode R, Lam KB, Ayres JG, Sadhra S. Voice disorders in Nigerian primary school teachers. Occup Med (Lond). 2014;64(5):382-386.
28. Welham NV, Maclagan MA. Vocal fatigue: current knowledge and future directions. J Voice. 2003;17(1):21-30.
29. Karagama YG, McGlashan JA. Structural disorders of the vocal cords. Scott-Brown's Otorhinolaryngology and Head and Neck Surgery. CRC Press; 2018:985-1004.
30. Yeung HM. Perceptions of Environmental Barriers to Effective Voice Use in Teaching. University of Hong Kong; 2008.
31. Kyrilakou K, Theodorou E, Petinou K, Phinikettos I. Risk factors for voice disorders in public school teachers in Cyprus. J Prev Med Hyg. 2020;61(2):E221-E240.
32. Bolbol SA, Zalat MM, Hammam RA, Elnakeb NL. Risk factors of voice disorders and impact of vocal hygiene awareness program among teachers in public schools in Egypt. J Voice. 2017;31(2):251.e9-251.e16.
33. Lia L, De Francesco S, Mannocci A, Di Nucci V, La Torre G. A cross sectional study on the vocal handicap index applied to a sample of teachers in nurseries and primary school. Ann Ig. 2019;31(3):230-235.
34. Johnson A, Jacobson BH, Grywalski C, Silberglied AK, Benninger MS. The voice handicap index (VHI): development and validation. Am J Speech Lang Pathol. 1997;6(3):66-70.
35. Xu W, Li HY, Hu R, Hu HY, Han DM. Analysis of reliability and validity of the chinese version of voice handicap index (VHI). Chin J Otorhinolaryngol Head Neck Surg. 2008;43(9):670-675.
36. Behlau M, Madazio G, Moretti F, Oliveira G, Junior E. Efficiency and cutoff values of self-assessment instruments on the impact of a voice problem. J Voice. 2016;30(4):506.e509-506.e518.
37. Sebastian S, Suresh BA, Simon S, Balraj A. Risk factors for hyperfunctional voice disorders among teachers. Online J Health Allied Sci. 2012;11(2):6-7.
38. Sousa ED, Goel HC, Fernandes V. Study of voice disorders among school teachers in Goa. Indian J Otolaryngol Head Neck Surg. 2018; 71(3):679-683.
39. Preciado J, Perez C, Calzada M, Preciado P. Frequency and risk factors of voice disorders among teaching staff of La Rioja, Spain. Clinical study: questionnaire, function vocal examination, acoustic analysis and videolaryngostroboscopy. Acta Otorrinolaringol Esp. 2005;56(4):161-170.
40. Ward PD, Thibeault SL, Gray SD. Hyaluronic acid: its role in voice. J Voice. 2002;16(3):303-309.
41. Shen SH, Chiang SC, Chung YM, Hsiao LC, Hsiao TY. Risk factors and effects of voice problems for teachers. J Voice. 2010;24(2):183-192.
42. Roy N, Merrill RM, Thibeault S, Parsa RA, Smith EM. Voice disorders in teachers and the general population. J Speech Lang Hear Res. 2004;47(2):281-293.
43. Titze IR, Martin DW. Principles of voice production. J Acoust Soc Am. 1998;104(3):1148.
44. Reiter R, Hoffmann TK, Pickhard A, Brosch S. Hoarseness—causes and treatments. Dtsch Arztebl Int. 2015;112(19):329-337.
45. Kovač M, Leskošek B, Hadžič V, Jurak G. Occupational health problems among Slovenian physical education teachers. Kinesiology. 2013;45(1):92-100.
46. Thibeault SL, Merrill RM, Roy N, Gray SD, Smith EM. Occupational risk factors associated with voice disorders among teachers. Ann Epidemiol. 2004;14(10):786-792.
47. Houtte EV, Claeyss W, Wuyts F, Liearde KV. Voice disorders in teachers: occupational risk factors and psycho-emotional factors. Logop Phoniatr Vocol. 2012;37(3):107-116.
48. Nemr K, Simoes-Zenari M, Almeida VC, Martins GA, Saito IT. COVID-19 and the teacher’s voice: self-perception and contributions of speech therapy to voice and communication during the pandemic. Clinics (Sao Paulo). 2021;76(1):e2641.

How to cite this article: Feng S, Weng C, Cai S, Yang Z, Wu M, Kang N. The prevalence and risk factors for perceived voice disorders in public school teachers. Laryngoscope Investigative Otolaryngology. 2022;7(3):790-798. doi:10.1002/lio2.803