Gender Differences in Speech: Correlating pulmonary function with symptoms of vocal fatigue among teachers

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Background

Females face a significantly higher risk than men of developing long-term voice problems with lifetime instances occurring in 46% of females compared to 37% of males.1 Examples of voice problems include hoarseness, vocal fatigue, discomfort while speaking, frequent throat clearing, and chronic sore throat. Another group that faces an elevated risk of voice problems is occupational voice users: individuals for whom their voice is a primary tool of the trade. Examples of occupational voice users include teachers, call center workers, air traffic controllers, dispatchers, and even lawyers. Two of these occupations (teachers and call center workers) are of particular interest to this study because their workforce is primarily female (teachers are 69% female nationally, 75% in Utah) – meaning that female employees in these occupations face a dual risk for developing prolonged voice problems. The higher incidence of prolonged problems among women has been associated with a number of gender differences including physiological differences in the laryngeal system, differences in the endocrine system, and differences in pulmonary usage.1 A previous study conducted at the NCVS has shown a link between pulmonary function and symptoms of voice problems.5

Additionally, respiration has been linked with voice quality, and inefficient pulmonary utilization and reduced lung volume have been linked with vocal health concerns. Our study sought use established spirometry measures and a relatively new questionnaire to determine if there is a relationship between pulmonary function and vocal fatigue among teachers. Additionally, if there is a relationship, to determine if that relationship is stronger in females than in males.

Materials and Procedures

Environment:

All data was collected on site at the participants’ place of work. Attempts were made, within the constraints of what type of room was available, to minimize extraneous environmental noise by locating the acoustic recording station away from doors, windows, and other researchers.

Equipment:

Spirometry measures were obtained using the Micro Direct MicroLab portable spirometer equipped with a disposable filter to prevent the spread of airborne pathogens without disrupting airflow.

Procedure:

After providing consent, subjects completed a series of questionnaires including demographics, information about their teaching/work environment, and the Vocal Fatigue Index: a self-report questionnaire recently created and validated to identify individuals with vocal fatigue – a voice problem that has been historically difficult to define and to diagnose.

After completing the questionnaires, subjects performed a forced spirometry test. From this test, the following measures of pulmonary function were calculated:

- **FET** – Forced Expiratory Time
- **FEV1** – Expiratory volume in the 1st second of exhalation
- **FVC** – Force Vital Capacity
- **PEF** – Peak Expiratory flow

Acoustic, electroglossographic, and bio-harness (breath monitor) measures were also collected and to be analyzed in future investigations.

Preliminary Results

VFI scores were tabulated and subjects were divided into two groups (labeled HI and LO to the right) according to whether they scored above or below their gender group’s mean score.

Interactions plots were drawn for the factors of VHI Group versus the dependent variables of spirometry measures FVC, FEV1, PEF, and FET.

Plots were generated using the R software environment and programming language and the ‘interaction.plot’ function.

Interaction Plots for the Factors VFI Group (see analysis section) and Gender and the dependent variable of Forced Vital Capacity, Forced Expiratory Volume in 1s, Peak Expiratory Flow, and Forced Expiratory Time.

With the exception of Forced Expiratory Time, spirometry measures for both males and females appear to follow the same trend in relation to Vocal Fatigue Index scores. More subjects are needed in order to determine the strength of these relationships, but it does appear that pulmonary function may be related to the presence of symptoms of vocal fatigue, particularly among subjects for whom vocal fatigue is most severe.

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References

2. 2006 U.S. Census

Participants

43 (34 females, 9 males) elementary and middle school teachers from the Jordan School District in northern Utah participated in this research. Participants had been teaching for at least one year and were under the age of 65.

3 female subjects were unable to complete the forced spirometry task and 1 female did not complete the VFI, resulting in a final N=39 (30 F and 9 M)