



QUANTIFYING THE OCCUPATIONAL VOICE USE OF TEACHERS

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ABSTRACT

This study quantified vocal dose measures for teachers during both on-work and off-work periods using a smartphone-based ambulatory voice monitor, comparing their occupational voice use to that in other studies that have reported percent phonation ranging from 17% to 30%. Participants included 26 full-time, female teachers with and without a diagnosed voice disorder between 23 and 55 years of age across multiple grades and subjects. By estimating phonatory activity from anterior neck-surface vibration, vocal dose measures were computed for three time periods: workday (9:00am–2:30pm), off-work weekday (4:30pm–11:59pm), and off-work weekend days (through 11:59pm). The monitored teachers exhibited average percent phonation times of 16.2% (workday), 8.4% (off-work weekday), and 8.0% (off-work weekend). No statistically significant difference for vocal dose measures was found between off-work weekdays and weekend days. Overall, vocal dose measures were approximately two times higher during the workday relative to off-work time periods. This study provides values for vocal dose measures for schoolteachers using ambulatory voice monitoring technology. Future work is needed to continue to understand occupational voice use and its associated risks related to voice health, with the ultimate goal of preventing and managing voice disorders in individuals engaged in high-risk occupations.

Keywords: *voice use, teachers, ambulatory voice monitoring*

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1. INTRODUCTION

Approximately 37 million individuals in the U.S. are classified as occupational voice users [1], referring to the dependence of individuals on their voice to perform their job responsibilities (e.g., customer service representatives, lawyers, singers, dispatchers, etc.). Occupational settings can cause significant differences in vocal use from what the patient may present in a clinical setting. The teaching profession has been known to be a high-voice use occupation with elevated risk for developing voice disorders [2]. Unfortunately, there is limited information about how much time many high-risk occupations use their voices in a given day.

The percent phonation time of teachers during their occupational voice use has previously been quantified to be approximately 30%, with non-occupational phonation time of 14%. In addition, teachers exhibited a higher sound pressure level and higher fundamental frequency during the workday relative to non-work time periods [1]. This study quantified phonation time, as well as other ambulatory vocal dose measures, for teachers during both on-work and off-work periods.

2. METHODS

This study was a retrospective analysis of teacher data from a subset of participants who were enrolled via convenience and snowball sampling in an ongoing ambulatory voice monitoring study of vocal hyperfunction. Twenty-six female teachers were included in the study with an average age of 34.3 years (range of 23–55 years). An ambulatory voice monitor was provided to each teacher to record their vocal behavior for approximately one week using a neck-surface accelerometer. Voice use for each participant were evaluated via three vocal dose measures. Percent phonation time was calculated as a percent of time. Cycle dose was

calculated as the number of vocal fold oscillations that occurred. Distance dose was calculated to estimate the total distance the vocal folds traveled. These features were normalized to account for variations in monitoring time.

Descriptive statistics were computed across all teachers for each vocal dose measure during the workday (9:00 am–2:30 pm), off-work weekday (4:30 pm–11:59 pm), and off-work weekends (through 11:59 pm). One-way repeated-measures analyses of variance were performed to determine differences among the different time periods for each vocal dose measure. Post hoc t-tests determined statistically significant differences between occupational and non-occupational periods.

3. RESULTS

Statistically significant differences were found between on-work weekday and off-work weekday phonation time (Cohen’s $d = 1.28$, $p < .001$). A similar statistically significant difference was observed between on-work weekday and off-work weekday time periods ($d = 1.31$, $p < .001$). Finally, there was a statistically significant difference in distance dose between on-work weekday and off-work weekday time periods ($d = 1.01$, $p < .001$). Off-work weekday hours and off-work weekend hours were found to be statistically similar in terms of each vocal dose measure; thus, these time periods were combined to yield a combined off-work period for each teacher. Table 1 summarizes of the on-/off-work vocal dose measures in the teachers studied.

Table 1. Average (standard deviation) vocal dose measures for the teachers during on-work and off-work time periods.

Measure	On-work	Off-work
Phonation time (%)	16.2 (6.0)	8.2 (3.1)
Cycle dose (kilocycles/hr)	145.7 (56.7)	68.3 (21.2)
Distance dose (m/hr)	698.9 (345.7)	284.0 (147.4)

The average percent phonation time obtained in the teacher group of the current study (16.2%) was approximately half the phonation time (30%) computed in the literature [1]. The vocal demands of the teacher sample and voice activity detection algorithm are potential factors contributing to phonation time being on the lower end of the range. The corresponding average distance dose in the current study was greater than the distance dose in previous work. Together, these results point to the importance of

accounting for estimated SPL and fundamental frequency during daily life and not simply accumulated phonation.

4. CONCLUSION

This study adds to the literature that quantifies the voice use characteristics of the teaching profession. Such information could be used as the basis for instituting preventative measures to diminish the risks to teachers of developing voice disorders and more generally to advocate for healthcare legislation that recognizes voice load as a potential occupational hazard in occupations requiring heavy voice use such as teaching—i.e., specification of healthy limits for voice use based on quantitative measures. Vocal behavior can vary dynamically throughout the day, especially with respect to vocal fatigue and vocal demand; therefore, comprehensive full-day monitoring of vocal dose measures is essential to determine real-world voice use characteristics.

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