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ABSTRACT

Purpose:
Voice problems in teachers have been extensively studied; however, the relationship between voice disorders and work ability has not been thoroughly explored. Existing studies

have often used self-reporting and cross-sectional designs. This 16-year longitudinal cohort study aimed to explore the association between sick leave due to diagnosed functional voice disorders and work ability.

Method:
Utilizing data from the Finnish Public Sector Cohort (FPS) covering 3,060 schoolteachers from 2000 to 2016, we linked the FPS data to a register containing sickness absences due to voice disorders. Work ability was assessed using the Work Ability Score (WAS).

Results:
Sickness absence periods due to voice disorders increased, peaking at 29 periods during 2013–2016. Initially, during 2001–2004, sick leave periods were generally observed at 2.8%, which increased to 10% during 2013–2016. Analysis of the WAS indicated a statistically significant decline from 8.30 (SD = 1.38) to 8.08 (SD = 1.48) during the 16-year follow-up period. The proportion of those reporting good work ability has decreased by 3.9 percentage points over time. The association between sick leave due to voice disorders and work ability remains unclear because of the limited number of cases.

Conclusions:
Register data from diagnostic records may not capture the incidence of voice disorders optimally. Despite the commonality of self-reported voice symptoms, the lack of diagnostic specificity makes it challenging to detect these problems in sick leave registers. There is a pressing need for more specific and systematic national follow-up on voice problems, particularly in occupational groups with known voice ergonomic risk factors.

Sickness Absences Due to Diagnosed Voice Disorders and Work Ability in Teachers: Results From the Finnish Register Study

Vertanen-Greis et al.: Diagnosed Voice Disorders in Teachers

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Voice disorders among teachers have been extensively studied; however, most findings have been based on self-reported data and cross-sectional studies (Byeon, 2019; Cantor Cutiva et al., 2013; Castillo-Allendes et al., 2023; Martins et al., 2014). These disorders have been strongly associated with decreased work ability (OR: 9.5; Giannini et al., 2015). The term "work ability" consists of different dimensions, such as health and functional capacity (Tengland, 2011). Since work ability is also closely linked to absence due to sickness, it is important to examine voice disorders in relation to work ability.

Similar findings have been reported in various studies, including those conducted in Finland (Behlau et al., 2012; de Medeiros & de Vieira, 2019; Giannini et al., 2015; Lyberg Åhlander et al., 2011; van Houtte et al., 2011; Vertanen-Greis et al., 2022). For instance, Roy et al. (2004) found that 18% of teachers had been absent for at least 1 day and 3% for more than 5 days during the past year because of voice problems, which was significantly higher than that of other professions (7% and 1%, respectively). Their study included 1,243 teachers and 1,158 representatives of other professions. In Germany, 24% of teachers reported sick leave due to voice disorders, averaging 1.2 days per year (Nusseck et al., 2018). Although teachers generally have fewer sick leaves than

many other worker groups, such as health care workers (Cantor Cutiva & Burdorf, 2015; Nusseck et al., 2018; Työterveyslaitos, n.d.), teachers with voice disorders clearly have more sick leaves than their healthy counterparts (Lyberg Åhlander et al., 2011).

Although cross-sectional studies have provided valuable insights, there is a pressing need for longitudinal data to better understand the relationship between voice disorders and work ability over time (de Medeiros & de Vieira, 2019). We aimed to study the association between sickness absence due to diagnosed functional voice disorders and work ability among Finnish teachers from 2001 to 2016. We address three key research questions: (a) What is the incidence of newly diagnosed functional voice disorders among teachers during sick leave periods? (b) Are there changes in work ability among teachers with voice problems over the study period? (c) Is there an association between the incidence of functional voice disorders and changes in work ability among teachers?

Method

Data were obtained from the Finnish Public Sector Cohort (FPS; Kivimäki et al., 2007). The data covered the period from 2000 to 2016, with 2000 serving as the baseline year. The follow-up periods were structured in 4-year intervals, starting from 2001. The FPS is an ongoing dynamic cohort study involving local government employees in 11 Finnish cities, with repeated questionnaires administered every 2–4 years. The sample included permanent employees and long-term substitutes from these municipalities. In the present study, the response rate at baseline was 68% (n = 32,299; Kivimäki et al., 2007). The present study included a cohort of 3,060 teachers who responded to the FPS survey in 2000 and participated in the FPS at least twice in 2000, 2004, 2008, 2012, and 2016. Among them were class teachers (responsible for Grades 1–6), subject teachers (primarily teaching Grades 7–9), and special education teachers. To homogenize the study sample, we excluded principals who tended to talk less than teachers. To examine new sickness absence periods due to diagnosed voice disorders, we extracted data from the registries of those who responded to the FPS study in 2000 but did not have these periods that year. Subsequently, data from these subjects were collected from the registers until 2016. Participants were informed in the cover letter that their responses will be used for scientific research, participation is voluntary, and specific consent is requested to link survey data with registry data. This study was approved by the Helsinki University Hospital (HUS) Regional Committee on Medical Research Ethics (HUS/1210/2016) and was registered in the Open Science Framework (Vertanen-Greis & Lybeck Åhlander, 2023).

To explore the association between sickness absences due to diagnosed functional voice disorders and work ability, the FPS data were linked to three data sets: (a) the national patient register, (b) the register of sickness absences, and (c) background information from employers' registers. (a) A data set from the National Patient Register of the Finnish Institute for Health and Welfare encompassed sickness absence periods and the dates of hospitalization from January 1, 2000 to December 31, 2016. We focused on functional voice disorders in this study because they are frequently associated with the extensive voice use required in teaching (Naqvi & Gupta, 2025). They were diagnosed using the International Classification of Diseases, Tenth Revision (ICD-10) classification codes R49 (voice disturbances excl. psychogenic voice disturbance F44.4), R49.0 (dysphonia), R49.1 (aphonia), and R49.8 (other and unspecified voice disturbances; ICD-10). (b) The register of sickness absence from the Social Insurance Institution consists of the annual total for each respondent, including all dates of hospitalization and sickness absence periods without diagnosis codes within the same timeframe. By "sickness absence periods," we mean the specific time intervals during which an individual was absent from work due to illness. We classified all sick leaves into duration categories of 1–3 days, 4–14 days, and ≥ 15 days. (c) Information on sex and age was obtained from the employers' registers.

The study sample comprised 76.1% females (n = 2,329), and the mean age was 42.9 years (SD = 8.9, range 22–61) at baseline. In total, 24.1% (n = 711) of participants were past or current smokers. The sample was a representative of the FPS cohort in terms of sex (females: 77% in FPS) but was slightly younger than in the FPS cohort (44.6 years; Kivimäki et al., 2007). Overall, 46.7% were class teachers (n = 1,428), 40.7% were subject teachers (n = 1,246), and 12.6% were special education teachers (n = 386).

In the FPS study, work ability was assessed using the Work Ability Score (WAS), a validated single-item question (Tuomi et al., 1997) with a scale from 0 (*completely unable to work*) to 10 (*work ability at its best*; Ahlstrom et al., 2010). Decreased work ability was defined as a score below 8, which is the cutoff point between good and moderate work ability (Ahlstrom et al., 2010). Of our baseline cohort, 22% (677/3,060) provided data on the WAS in each survey. Altogether, 26% of the participants participated twice, 25% participated 3 times, and 26% participated 4 times. General health was assessed using a single question, "How do you rate your health?" (good [good/fairly good/average]/poor [fairly bad/poor]; Robine & Jagger, 2003).

Statistical Analysis

Categorical variables were summarized as counts and percentages (%) and continuous variables as

mean and standard deviation. Statistical significance was set at $p < .05$ (two-tailed) were used to determine statistical significance. Changes in work ability over time were analyzed using the nonparametric Friedman test. The association between background variables and the diagnosis or absence of sickness could not be modeled using generalized linear mixed models because of the low number of voice disorder diagnoses. Data analysis was performed using SAS software (Version 9.4) of the SAS System for Windows (SAS Institute Inc.).

Results

Between 2001 and 2016, Finnish teachers experienced up to 29 new sick leave periods due to diagnosed voice disorders, with no instances recorded between 2001 and 2004 (see Figure 1). From 2005 to 2008, there were 11 new sick leave periods, and from 2009 to 2012, there were 12 new periods. The highest number of new sick leave periods, 29, was recorded from 2013 to 2016. Of these, 20 were short-term absences lasting 1–3 days, while nine were longer, ranging from 4 to 14 days or more. When considering all sick leave periods, short periods lasting 1–3 or 4–14 days increased during the follow-up period. From 2001 to 2004, there were 40 periods, and from 2013 to 2016, there were nearly seven more periods, totaling 268 periods. Simultaneously, the number of long sick leave periods (> 14 days) decreased from 46 to 36.

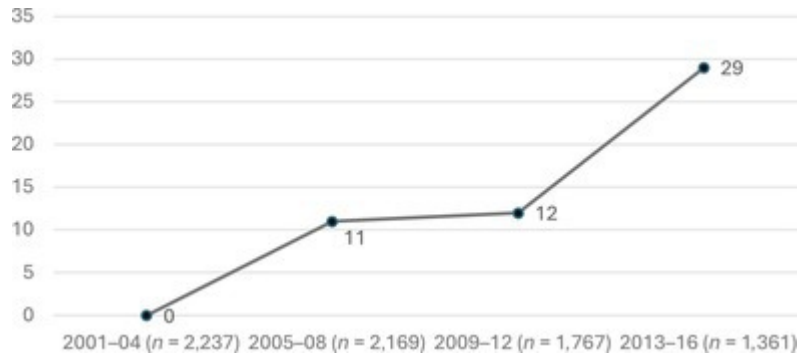

Figure 1. Number of diagnosed voice disorders in Finnish teachers from 2001 to 2016. The *y*-axis represents the number of sick leave periods due to voice disorders. The study included 3,060 teachers who had no voice disorder diagnoses at the baseline in 2000.

Alt text: The number of diagnosed voice disorders was 0 during 2001 to 2004, 11 during 2005 to 2008, 12 during 2009 to 2012, and 29 during 2013 to 2016. The number of

participants was n equals 2237 during 2001 to 2004, n equals 2169 during 2005 to 2008, n equals 1767 during 2009 to 2012, and n equals 1361 during 2013 to 2016.

The proportion of participants who reported good work ability decreased by 4.1 percentage points during the follow-up period (see Table 1). This decrease was statistically significant ($p < .05$). Despite this, self-assessed health remained consistently high, with approximately 97% of participants rating their health as good throughout the follow-up period. Although the WAS decreased over the 16-year period and the number of sick leave periods due to voice disorders increased, the low incidence of diagnosed voice disorders prevented a definitive assessment of the association between these variables.

Table 1. Changes in Work Ability Scores and sick leave periods due to voice disorders in Finnish teachers from 2000 to 2016 (N = 3,060).

Variable		2000				2004				2008				2012				2016			
		n **= 3,060**	**(%)**	***M***	**(*SD*)**	***n*** **= 2,237**	**(%)**	***M***	**(*SD*)**	***n*** **= 2,169**	**(%)**	***M***	**(*SD*)**	***n*** **= 1,767**	**(%)**	***M***	**(*SD*)**	***n*** **= 1,361**	**(%)**	***M***	**(*SD*)**
Self-related health	Good	2,918	(96.7)			2,123	(95.9)			2,096	(96.8)			1,703	(96.8)			[a]			
	Poor	100	(3.3)			92	(4.2)			69	(3.2)			56	(3.2)						
Work Ability Score				8.3	(1.4)			8.1	(1.5)			8.2	(1.4)			8.1	(1.4)			8.1	(1.5)
	≥ 8	2,419	(80.2)			1,655	(75.1)			1,665	(76.9)			1,338	(76.0)			1,033	(76.1)		
	< 8	598	(19.8)			549	(24.9)			500	(23.1)			422	(24.0)			325	(23.9)		
						2001–2004				2005–2008				2009–2012				2013–2016			
Number of sickness absence periods	1–3 days					23				24				97				201			

Variable		2000				2004				2008				2012				2016			
		n = 3,060	(%)	*M*	(*SD*)	*n* = 2,237	(%)	*M*	(*SD*)	*n* = 2,169	(%)	*M*	(*SD*)	*n* = 1,767	(%)	*M*	(*SD*)	*n* = 1,361	(%)	*M*	(*SD*)
	4–14 days					17				32				25				67			
	15 days or more					46				68				68				36			
Number of sickness absence periods due to voice disorder	1–3 days					0				0				10				20			
	4–14 days					0				6				1				6			
	15 days					0				5				1				3			

Variable		2000				2004				2008				2012				2016			
		n = 3,060	(%)	*M*	(*SD*)	*n* = 2,237	(%)	*M*	(*SD*)	*n* = 2,169	(%)	*M*	(*SD*)	*n* = 1,767	(%)	*M*	(*SD*)	*n* = 1,361	(%)	*M*	(*SD*)
	or more																				

[a] The information was not available.

Discussion

Our aim was to explore the association between sickness absence due to diagnosed functional voice disorders and work ability among Finnish teachers from 2001 to 2016. We identified only 29 sick leave periods owing to the diagnosis of functional voice disorders. Although the work ability of the participants declined over time, the low number of diagnosed voice disorders hindered the demonstration of a clear association.

Compared with previous studies based on self-assessment (da Rocha et al., 2017; Lyberg Åhlander et al., 2019), the incidence of sick leave due to voice disorders in this study was unexpectedly low. In Brazilian teachers, the incidence is 17.1% (da Rocha et al., 2017), and in Stockholm, the prevalence is 19.3% (Lyberg Åhlander et al., 2019). This discrepancy suggests underdiagnosis in occupational health care and highlights the challenges of using registries to study voice disorders. Hong et al. (2024) reported that individuals with voice disorders often do not seek treatment, and the unique nature of dysphonia can complicate accurate diagnosis. Presenteeism is especially common among teachers (Aronsson et al., 2000; Coledam & da Silva, 2020).

The sickness absence periods increased over the 16-year period, which is consistent with the results of previous studies. Teachers with voice disorders tend to have more absences than healthy teachers (Coledam & da Silva, 2020; Vertanen-Greis et al., 2022), although they are typically short (de Medeiros & de Vieira, 2019). In Finland, employees can take 1–3 days of sick leave with their own notification but must see a health care professional for longer absences (Main Municipal Agreement, n.d.). Teachers may underestimate the severity of their voice symptoms by using only this short sick leave. Additionally, preparing instructions for substitutes during sick leave can be so burdensome that teachers prefer to work while sick.

Presenteeism in teachers has been associated with burnout (Ferreira & Martinez, 2012). A qualitative study investigating the reasons for presenteeism showed that teachers felt irreplaceable (Garcia & Juliani, 2024). In studies on human resources and management, the feeling of being irreplaceable has been associated with the wish to relocate or find another job (turnover intentions; Haque et al., 2019). Even in vocally demanding professions, voice symptoms may not be deemed sufficiently serious for sick leave (de Medeiros & de Vieira, 2019; Leão et al., 2015). Voice disorders can affect teachers' work ability and students' learning, as poor voice quality can distract the subject being taught (Imhof et al., 2014; Lyberg Åhlander et al., 2015). Teachers' voice disorders can impair lesson understanding, especially in noisy environments (Rodrigues et al.,

2017). However, teachers' voice disorders are often dismissed, and many Finnish teachers have never received voice training (Ilomäki, 2008).

Teaching requires extensive voice use, but a lack of information can prevent teachers from seeking treatment (Da Costa et al., 2012). Emphasizing good voice ergonomics and vocal hygiene and using aids such as sound-field amplification systems can promote work ability (Bottalico et al., 2023; Morrow & Connor, 2011; Trinite & Barute, 2023). Highlighting the prevalence of voice disorders can prevent teachers from feeling isolated due to voice problems. Occupational health care is crucial for supporting vocal health, making voice disorders an occupational concern. The economic consequences of teachers' voice problems include absenteeism and loss at work (Cantor Cutiva & Burdorf, 2015), underscoring the need for targeted interventions.

Although our analysis showed a significant decline in work ability, the low number of voice diagnoses limited our exploration of causality. Using register data from diagnosis registers is ineffective for addressing the incidence of voice disorders. Self-reported voice problems are common, but the lack of specificity in diagnosis complicates the detection in sick leave registers.

Employers play a crucial role in preventing voice disorders by providing optimal vocal ergonomic conditions for their employees (Occupational Safety and Health Act, 2002). Supervisors should identify and assess stress factors, whereas occupational health services should evaluate these conditions and work with occupational safety experts to develop improvements. Ultimately, an employer is responsible for identifying and preventing health risks at work. Simberg et al. (2009) found that 65% of differences in the prevalence of voice problems were due to nonshared environmental factors, highlighting the importance of voice ergonomics.

Early diagnosis and identification of voice disorders in occupational health care are essential, especially for those who use their voices extensively, such as teachers. Employees should also be encouraged to seek medical evaluations for voice disorders, as these are associated with decreased work ability (Behlau et al., 2012; de Medeiros & de Vieira, 2019; Giannini et al., 2015; Lyberg Åhlander et al., 2011; van Houtte et al., 2011; Vertanen-Greis et al., 2022), and they can cause confusion and even shame. Systematic screening and follow-up, such as a screening questionnaire, can detect voice problems early (Holmqvist-Jämsén et al., 2024; Simberg et al., 2001). Epidemiological studies over the past three decades (Lyberg Åhlander et al., 2019; Roy et al., 2005), and research on voice ergonomic risk factors (Sala & Rantala, 2019), have provided substantial knowledge on the etiology and risk factors of voice disorders, particularly functional voice disorders. Screening high-risk groups allows for systematic monitoring and analysis of

predictive variables.

Workplace measures to improve vocal ergonomics are necessary, as mere voice use guidance is insufficient. These measures enhance employee well-being and listener concentration and can reduce costs related to sick absences and decreased work ability. In high-risk professions such as teaching, assessing the cost impacts of voice disorders could promote their classification as occupational diseases, motivating better prevention and treatment.

Effective voice ergonomics should be a key part of future occupational health strategies, requiring a comprehensive approach to address various risk factors such as continuous voice use, awkward postures, stress, and environmental deficiencies. Recent studies show that work-related voice intervention programs have a positive effect on teachers' mental and vocal health (Cantor-Cutiva & Cantor-Cutiva, 2023; Nusseck et al., 2021). Collaboration between employers, occupational health services, occupational safety, employees, and researchers is crucial for developing effective practices and early interventions.

This study, which is unique to Finland and internationally, had the strength of involving the same individuals in the FPS at least twice. Over the 16-year period, some participants retired, passed away, or dropped out because of illness, explaining the decrease in respondents. The limited number of sickness absence periods due to diagnosed voice disorders prevented statistical analysis of background variables such as teacher groups and age, which is a limitation. Considering common organic voice disorder diagnoses might have increased the number of diagnosed cases and improved the possibility of analysis. Although these results may be unclear because of the small number of cases, they still indicate the need for enhanced reporting of sick leaves due to both diagnosed and self-assessed voice disorders. Therefore, further research is required in this field.

To conclude, sick leave periods based on diagnoses of functional voice disorders increased among Finnish teachers from 2001 to 2016. At the same time, the work ability of the participants declined. However, the association between these two variables remains unclear due to the small number of cases. The low number of diagnosed cases contrasts sharply with previously self-reported results from the same professional group.

There is a need for more precise and systematic national monitoring of voice disorders, especially among professionals with known vocal ergonomic risk factors. Further research should assess the direct and indirect costs of voice problems, particularly for high-risk professions.

Author Contributions

Hanna Vertanen-Greis: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Sofia Holmqvist-Jämsén:** Investigation, Writing – original draft, Writing – review & editing. **Eliisa Löyttyniemi:** Conceptualization, Formal analysis, Methodology, Validation, Writing – review & editing. **Viveka Lyberg Åhlander:** Conceptualization, Methodology, Supervision, Writing – review & editing.

Data Availability Statement

The data sets generated and analyzed during the current study are not publicly available because of the requirements of the data owner.

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