

# Prevalence of Hoarseness in School-aged Children

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**Summary: Objectives.** The purpose of this cross-sectional study was to determine the prevalence of hoarseness in children attending the first or second grade of primary school and to explore possible background factors for hoarseness in children.

**Methods.** The participants were 217 children, aged 6–10 years, from 10 different schools. Questionnaires were filled in by the parents and the teachers of the children and voice samples were recorded. The voice samples from the children were perceptually evaluated by eight trained listeners and intra- and inter-rater reliability was calculated. Additionally, the parents and teachers were in the questionnaires asked to rate the children's voices. Connections between background factors and voice quality were explored.

**Results.** Both the intra- and inter-rater reliability for the trained listeners were relatively high and significant. The prevalence of hoarseness for the whole group was 12.0% as judged by the trained listeners. For girls, the prevalence of hoarseness was 7.8% and for boys 15.8%. A lower teacher rating of degree of maturity correlated significantly with the voice quality. Additionally, there was a significant negative correlation between the amount of talking at home and voice quality. For girls, heavy voice use as an infant correlated significantly with voice quality. For boys, being the youngest sibling correlated significantly with voice quality.

**Conclusions.** The results from the present study indicate that more attention should be paid to hoarseness in children and that background factors should be further explored.

**Key Words:** Prevalence–Hoarseness–Dysphonia–Children–Background factors–Personality traits–Perceptual evaluation.

## INTRODUCTION

Dysphonia is an increasing health problem<sup>1</sup> and combined with an increase of voice demanding professions<sup>2</sup>; this might be a substantial problem in the future when the children of today become part of the working population. It is estimated that 25% of the working population in the United States<sup>3</sup> and Finland<sup>4</sup> have voice demanding jobs. In 2010, 72.9% of the jobs in Finland were in the service industry where many employees depend on their voice to perform at work. Since 2001, there has been an increase of 5.6% points in the employments in the service industry.<sup>2</sup> Because of the large number of people depending on their voice in their profession, missed work hours because of dysphonia can be expensive to society as shown in a previous cost calculation for teachers.<sup>3</sup>

Dysphonia is estimated to be prevalent in 6% of the adult population.<sup>5,6</sup> Among children, the reported prevalence varies between 0.12%<sup>7</sup> and 28%.<sup>8</sup> The wide variation of the reported prevalence numbers is likely caused by different choices of methodology, for example, how participants are selected and the dysphonia definition used (Table 1). Living in city or countryside environment has also been shown to have an impact on the prevalence of dysphonia.<sup>9,10</sup>

Dysphonia can be defined as a voice that differs from other persons' of the same age, gender, and social group.<sup>11,12</sup> Sederholm<sup>9</sup> used the term hoarseness that, based on a previous study,<sup>13</sup> was argued to correspond well to our perceptual sys-

tem. Overall severity parameters, eg, hoarseness, are generally the easiest for listeners to rate and agree on.<sup>14–17</sup> Dysphonia in children can be divided into four subcategories: voice quality problems, resonance problems, pitch problems related to mutation, and loudness regulation problems.<sup>18</sup> In the present study, focus will be on voice quality deviations, and the term hoarseness will be used. Hoarseness in the present study defined as a voice quality that deviates from the voice quality perceived as normal for other children of the same age and gender in Finland. Because of the use of varying terminology and definitions in previous studies, dysphonia will be used as an umbrella term when referring to the results of previous studies.

In adults, more women than men are diagnosed with dysphonia and laryngeal pathologies.<sup>5,19,20</sup> For children, this gender distribution is reversed, with more boys than girls having dysphonia.<sup>21,22</sup> The results of a study by Shah et al<sup>23</sup> showed that vocal nodules were the most common in boys up to the age of 10 years, but that teenage girls more often had nodules than teenage boys.

## Background factors for dysphonia

The background of dysphonia is multifactorial and depends on vocal loading factors in the environment, such as background noise, room acoustics, air quality, ergonomics, and psychosocial factors.<sup>4</sup> Individual factors such as gender, vocal endurance, health condition, life habits, personality,<sup>4</sup> and genetics<sup>24</sup> contribute. The way the different factors interact is not fully elucidated.

In adults, voice disorders often emerge as a result of vocal load and hyperfunction leading to vocal fatigue or vocal loss.<sup>25</sup> Chronic hoarseness in children is often associated with strenuous speaking, singing, or screaming.<sup>18</sup> If the heavy voice use is persisting, repeated microtrauma might lead to the formation of vocal nodules or other changes in the vocal folds.<sup>18,25</sup> In a study where school speech-language pathologists were

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**TABLE 1.**  
**A Brief Review of Some Previous Studies of Prevalence of Dysphonia in Children**

Author	Year	Age Group	N	Participants	Prevalence (%)	Definition
Silverman and Zimmer	1975	5–14	162	Boys and girls	23.4	Chronic hoarseness
Powell, Filter, and Williams	1989	6–10	203	Boys and girls	23.9	Voice disorder
Sederholm	1995	10	205	Boys and girls	14	Acute hoarseness
Koivusaari	1998	7–13	1694	Boys and girls	28	Phonation and resonance deviation
Duff, Proctor, and Yairi	2004	2–6	2445	Boys and girls	3.9	Hoarseness
Carding, Roulstone, Northstone and the ALSPAC Study Team	2006	8	7389	Boys and girls	6	Atypical voice
McKinnon, McLeod, and Reilly	2007	5–12	10 425	Boys and girls	0.12	Husky and hoarse voice

asked to estimate the portion of their voice clients that were dysphonic because of vocal misuse, 44% reported that most of their voice cases were related to vocal misuse and 34% that some were.<sup>26</sup> Elastin and collagen stabilizes the vocal folds and gives them their elastic features,<sup>27</sup> and because children have lower levels of elastin in their vocal folds<sup>28</sup> and have not yet developed the stabilizing three-layer structure, their vocal folds vibrate with more force and are at higher risk for injury as a consequence of heavy voice use.<sup>29</sup>

The results of previous studies showed that personality traits had a significant connection to hoarseness<sup>22</sup> and vocal nodules.<sup>30,31</sup> Koivusaari<sup>8</sup> found a significant connection between tense, leaking, and toneless voice and restlessness, lack of concentration, over activity, and impatience. The results of Sederholm<sup>22</sup> showed that the hoarse children were rated as less mature and more sensitive to changes by their parents. Both parents and teachers rated the hoarse children as more talkative.<sup>22</sup> Although psychobehavioral traits cannot be ignored in the etiology of dysphonia, these factors become significant only when they are combined with a physiological or anatomical predisposition.<sup>30,31</sup>

Birth order has been mentioned among the background factors for dysphonia in a previous study by Carding et al.<sup>32</sup> The results of their study showed that there was a connection between having older siblings and dysphonia. In studies on asthma, hay fever, eczema, and atopic sensitization, the reverse has been reported with having many siblings (older or in all) as a protective factor.<sup>33,34</sup> This has been thought to be because of microbial exposure in early life or immunologic or hereditary factors.<sup>33</sup>

The purpose of this study was to determine the prevalence of hoarseness and occurrence of vocal symptoms in children attending the first or second grade of primary school. Another purpose is to investigate possible background factors for hoarseness and compare the ratings made by different types of listeners.

## MATERIALS AND METHODS

### Participants

The participants were 217 children aged 6:4 to 9:10 years with a mean age of 8:3 years. The age group was chosen by weighing up a sufficiently mature vocal fold structure and the age of onset of puberty, which in a Swedish study was 11:1 years for girls

and 12:1 years for boys.<sup>35</sup> The gender distribution of the participants was 47.5% (n = 103) female and 52.5% (n = 114) male responding fairly well to the general population of Finland where the age group of 6–10 year old consisted of 48.9% female and 51.1% male in 2011.<sup>36</sup>

The children lived in families with an average of 2.92 children (standard deviation = 1.46, mode = 3) ranging from one to 12. There were fewer children living in families with one child (4.6%, n = 10) than in the general population (23.9%) but more children living in families with four or more children (17.6%, n = 38) than in the general population (12.7%).<sup>37</sup>

Seventy percent of the participating children (n = 152) lived in densely populated areas, ie, small towns or residential areas. The participating children attended the first or second grade of primary school in 10 different schools situated in the Swedish speaking regions in the west or south of Finland. The children spoke standard Finland Swedish or local dialects of Finland Swedish.

### Data collection

Permission for data collection was granted from the directors of education in the municipalities where the schools were situated. In addition to this, the parents signed a written consent for the recording and use of the voice samples of their child.

The data were collected through questionnaires filled in by the parents and the teachers of the children, and voice samples were recorded for a perceptual evaluation. The parent questionnaire was adapted from the questionnaire used by Sederholm.<sup>22</sup> The modifications to the questionnaire were based on recent research and the focus of the present study. Fourteen new questions were added to the questionnaire, 16 questions were modified on wording or scale, and 14 questions, mainly on musicality, were excluded as they were not of interest in the present study. The adapted questionnaire used in this study had 61 questions and 21 statements that the parents rated in relation to their child. The parent questionnaire consisted of questions concerning family circumstances, living environment of the family, personality and temperament of the child, vocal habits and speaking culture of the family, speech and language development, medical history, and statements on the child's voice and vocal habits. The statements were adapted from the study by Lee et al<sup>38</sup> and Simberg et al.<sup>39</sup> Among the statements,

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