PREVALENCE AND RISK FACTORS OF VOICE PROBLEMS IN PRIMARY SCHOOL TEACHERS OF ONE DISTRICT OF KARNATAKA

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Introduction

The professional voice users (PVU) encompass a broad range of people with vocal sophistication and voice needs. The PVU include singers, teachers, lawyers, call-centre operators etc. These individuals depend on their vocal endurance and voice quality for their livelihood. Hence, they are at greater risk than the normal population for developing voice problems. Among the different professional voice users, teachers face greater risk of developing voice problem because teaching as a profession puts high demands on vocal endurance. Teachers need to constantly speak loudly and continuously for long periods (Vilkman, 2000). They use their voice often under unfavourable circumstances caused by loud background noise and poor classroom acoustic conditions. Further, they often require a tone of voice authority not only to maintain discipline but also to inspire students to follow instructions, without question. Further, they are thrust into the classroom with little knowledge of vocal hygiene, vocal awareness, vocal symptomology, and vocal overloading factors. These factors may lead to vocal fatigue causing damage to the vocal fold tissues. There is a considerable body of literature to show that teachers have a higher prevalence of voice disorders compared to general population (Gotaas & Starr, 1993; Mattiske, Oates, & Greenwood, 1998; Sapir, Keidar & Mathers-Schmidt, 1993; Yiu, 2002; among others).

The data on prevalence rates of voice disorders in teachers varies depending on the method used to estimate the prevalence. Lower prevalence rates of 2.7% to 7% were reported based on auditory perceptual evaluation (Brindle & Morris, 1979; Laguaite, 1976) and 9.7% to 13% based on laryngoscopic examination (Urrutikoetxea, Ispizua, Matellanes, & Aurrekoetxea, 1995). Whereas, studies based on self-reported questionnaire have reported higher prevalence of 73% (Sapir et al., 1993) to 81% (Gotaas & Starr, 1993; Munier & Kineslla, 2008).

Voice disorders in teachers can be attributed to many reasons. One frequently hypothesized causal factor is vocal abuse and misuse. Vocal abuse and misuse occur due to the vocal

demands of teaching, speaking loudly to address many students, speaking for long durations, depending on oral rather than written communication (in primary school teachers), and greater speaker to listener distances (physical education teachers). Other reasons include poor acoustic environment due to noises generated in and around the classroom, speaking without amplification devices, and using excessive loudness levels. Systemic illnesses, hormonal problems, gastro-intestinal reflux are some other causes for voice problems in teachers. Teachers exposed to repeated upper respiratory tract infections, (due to dust pollution and tropical weather in India) and other air borne irritants complicates the problem. Due to these causes the physiology of voice production is affected.

The structural changes of the vocal apparatus include vocal nodules, hypertrophy of vocal folds, weakness of internal laryngeal muscles adducting and tensing vocal folds with incomplete glottal closure during phonation, and permanent dysphonia (Sliwinska-Kowalska, Niebudek-Bogusz, Fiszer, Los-Spychalska, Kotylo & Sznurowska-Przygocka, 2006). Apart from the anatomical and physiological changes, others such as stress, anxiety and psychological factors may play an important role for the development of voice problems in teachers (Calas, Verhulst, Lecoq, Dalleas, & Seihean, 1989). Personality factors, health issues, and lifestyle issues like untimely food, skipping breakfast, fast-food culture, consumption of alcohol and tobacco, caffeinated, and carbonated drinks are also some causes for the development of voice problems. Furthermore, limited knowledge of the principles of voice care and the lack of training in effective use of the speaking voice and voice projection are thought to contribute to this problem.

Calas et al. (1989) reported that the impact of voice disorders in teachers, their students and the community is immense. Symptoms such as vocal fatigue, throat discomfort, hoarseness, and loss of voice have many significant effects. Vocal dysfunction may mean extensive periods of sick leave and vocal rehabilitation, surgical intervention, or both, which involves

great financial costs. A teacher with a dysfunctional voice is far less effective in establishing classroom control and in developing effective working relationship with students. The most common consequence of voice problems were reported to be of missing work, affecting job performance, social activities and emotions (Yiu, 2002). Serious personal, emotional, and economic consequences may also result for the individual teacher. This in turn contributes to reducing the professional effectiveness of the teacher (Katz Wilner & Sataloff, 1987).

Need for the study

In order to develop occupational voice care for teachers, it is essential to demonstrate the relationship between their occupational demands, associated risk factors, and voice problems.

In Indian context, unfortunately teachers do not receive any instructions or training about proper voice use or knowledge about vocal hygiene during their teachers training course. There is limited research data existing regarding voice problems in school teachers in Indian Scenario. The concept of voice ergonomics i.e., the awareness of work-related risk factors for voice disorders, knowledge about how to improve voice production and speech intelligibility in different work environments to prevent occupational voice disorders is unaware to the primary school teachers in India. In the absence of these data, it is difficult to delineate the cause and effects of voice problems. Hence, there is a great need to improve the knowledge of professional voice use as well as the work characteristics and environment in primary school teachers. This knowledge can help to plan health care services designed to prevent or treat such problems.

Aim of the study;

Aim of the present study was to investigate the prevalence of voice problems and associated risk factors in primary school teachers in Mysore district.

Objectives of the study

(1) To investigate prevalence of self-reported voice problems in primary school teachers in Mysore District, Karnataka.

(2) To identify the potential risk factors associated with voice problems in primary school teachers.

Review of Literature

Nowadays many occupations (singers, teachers, actors, lawyers, call centre operators, dubbing artists etc.,) rely on their ability to speak with clear and pleasant voice. Good vocal health is of general interest for these occupational voice users. Voice problems compromise the communicative efficiency of those whose voice is their main professional tool. Teachers are the biggest professional group who have the highest demand in voice usage, and are at greater risk of developing voice problems (Vilkman, 2000). Among the teachers, primary school teachers are particularly at greater risk for developing voice problems as their day is characterised by 5 hours of continuous teaching with short breaks in between (Munier & Kinsella, 2008; Smith, Lemke, Taylor, Kirchner, & Hoffman, 1998). Apart from teaching, these teachers need to use their voices in situations like lunch room, schoolyard, and extracurricular activities (Roy, Weinrich, Gray, & Tanner, 2002).

Simberg, Sala, Vehmas, and Laine (2005) reported that there was increased incidence of voice problems in teachers from 1998 to 2004 having two or more vocal symptoms quite frequently. Teachers were reported to be proportionately over-represented in treatment seeking population (Fritzell, 1996; Morton & Watson, 1998; Titze, Lemke, & Montequin, 1997). Considering teachers at higher risk of developing voice problems several studies have been conducted (Miller & Verdolini, 1995; Roy, Merrill, Thibeault, Parsa, Gray, Smith, 2004; Russell, Oates & Greenwood,1998; Sala, Laine, Simberg, Pentti & Suonpää, 2001). These studies have reported higher prevalence of voice problems in teachers. However, the study results are found to be quite variable depending on the study population, study design, and how a voice disorder is defined.

Prevalence of Voice Problems in Teachers

The teaching voice has been of special interest in several studies conducted in different parts of the world. The prevalence rates in these studies have ranged between 11% to 57%. The results of these studies show that teachers frequently report vocal symptoms (Pekkarinen, Himberg & Pentti, 1992; Sapir, Keidar, & Mathers-Smith 1993; Russell et al., 1998; Sala, Laine, Simberg, Pentti, & Suonpää, 2001; Smith, Gray, Dove, Kirchner & Heras, 1997; Roy, Merril, Thibeault, Parsa, Gray, & Smith, 2004). The statistical data in published reports concerning voice problems among teachers vary depending on the study populations, on the methods used in the studies and on how voice problems and voice disorders are defined.

In most of these studies, data was collected through questionnaires. However some have been supplemented with laryngoscopic examinations. Although the questionnaires used in different studies vary considerably, the results are in broad agreement as to the self-reported vocal symptoms. The most frequently reported vocal symptoms in several studies seem to be voice tiring, hoarseness, sensations of pain or discomfort in the throat, weak voice, and lower pitch (Pekkarinen et al., 1992; Sapir et al., 1993; Smith et al., 1997; Smith et al., 1998; Sala et al., 2001; Roy et al., 2004). The definition of the prevalence period also varies considerably and probably has an impact on the results, at least partly due to the inability of the respondents to remember how long the symptoms persisted. The results of a study by Pekkarinen et al. (1992) showed that 12% of the teachers reported one vocal symptom and 5% reported two symptoms or more occurring weekly or more frequently during a two-year period. In another study by Roy et al. (2004), 58% of the teachers reported that they had experienced adverse vocal symptoms during their lifetime, and 11% reported current symptoms. In some studies reporting the prevalence of current vocal symptoms, the frequency of symptoms was higher with about 30% of the teachers reporting two symptoms

(Smith et al., 1998) to 52% of the teachers reporting three or more symptoms (Sapir et al., 1993). The discrepancies in the results reported in different studies is partly due to the differences in sample sizes (Roy et al., 2004).

Questionnaire studies reporting vocal symptoms among classroom teachers and day-care centre teachers have been reviewed from 1992 to 2001. Of the studies mentioned in Table 1, two study populations included an unspecified number of day-care centre teachers (Russell et al., 1998; Sapir et al., 1993). In another study by Sala et al. (2001), which focused entirely on day-care centre teachers, 54% of the teachers reported one symptom and 37%, two symptoms or more occurring weekly or more frequently during the past year. This study also included a phoniatric examination of all the 262 participants. The results of the examination revealed that almost 30% of the day-care centre teachers had organic findings on their vocal folds. Table 1 shows the summary of the studies related to the prevalence of voice problems in teachers tabulated from 1992 till 2008.

Table 1: Prevalence of vocal Symptoms among teachers

Author	**N**	**Percent of teachers reporting symptoms**
Pekkarinen et al., (1992)	478	12%
Gotaas & Starr (1993)	201	28%
Sapir (1993)	237	52%(reported three or more symptoms) 22%(one or two symptoms)
Smith et al., (1997)	242	43%(two or more symptoms) 26%(one symptom)
Russell et al., (1998)	877	20% (during teaching year)
Smith et al., (1998)	554	30%(two or more symptoms) 20%(one symptom)
Sala et al., (2001)	262	54%(one symptom) 37%(two or more symptoms)

Higgins (2004)	100	45%
Roy et al., (2004)	1243	11%(current symptoms)
Preciado (2005)	527	57%
Thomas, Gong & Kooijman (2006)	457	39.6%
Medeiros,Barreto & Assunc¸a˜o (2007)	2103	15%
Munier& Kinsella(2008)	550	27%

A lot many studies have been done in different parts of the world focussing on teachers to find out the prevalence of the voice disorders using different approaches. In a study by Roy et al. (2004) teachers had a higher rate of current prevalence of dysphonia when compared with non-teachers (11% versus 6.2%), and also had higher lifetime prevalence of dysphonia when compared with non-teachers (57.7% versus 28.8%). The incidence of voice problems among teachers in Spain is reported to be 3.9 new cases per year per 1000 teachers (Preciado-Lopez, Perez-Fernandez, Calzada-Uriondo & Preciado-Ruiz, 2008).

In most studies the current or point prevalence of voice disorders is less when compared to the past year prevalence and career prevalence. Most teachers report that they experience voice problems sometime in their career than the non-teachers. In a study by Roy et al. (2004), the current prevalence of voice problems in teachers when compared to non-teachers was 11% and the career prevalence was 58% when compared with 29% among the non-teacher group. Ferreira, Latorre, Giannini, Ghirardi, Karmann, and Silva et al., (2010) reported prevalence of 60% (253 subjects) among 422 elementary and secondary school teachers. Alvear, Baron, and Martinez-Aquero (2011) using a self-administered questionnaire on elementary and kindergarten school teachers found out the prevalence to be 59%; whereas Lyberg-Ahlander, Rydell and Lofqvist (2011) found the prevalence of voice problems to be 13% among Swedish teachers. Out of 214 primary school teachers, Charn and Mok (2011) found that the point prevalence of voice problem was 13.1%, whereas the past year

prevalence and career prevalence of voice problem were 25.4% and 32.1% respectively. Behlau, Zambon, Guerieri, and Roy (2012) using a standardized questionnaire on 1651 teachers and 1614 non-teachers, reported 11.6% current prevalence of voice disorders for teachers and 7.5% for non-teachers, and a past prevalence of 63% for teachers and 35.8% for non-teachers.

In a study by Kankare, Geneid, Laukkanen, and Vilkman (2012) on kindergarten teachers using a self-administered questionnaire along with phoniatric examination using rigid laryngoscope, only 6% of subjects had no symptoms while nearly half of the subjects reported suffering from at least five different symptoms monthly or more often. Ohlsson, Andersson, Sodersten, Simberg, and Barregard (2012), reported 17% prevalence of voice problems in teacher students on questionnaire study.

Prevalence studies in India

Sebastian, Suresh, Simon, and Ballraj (2012) investigated the prevalence of voice problems and associated risk factors for voice problems using self-reported questionnaires in 448 (400 females & 48 males) primary and secondary school teachers. They found 9% (n=39) reporting voice problems. The voice problems among teachers were found to be associated with rhinitis, laryngitis, asthma, GERD, and hearing loss.

Factors contributing to voice problems in teachers

The etiology of voice problems among teachers is though considered as a consequence of their profession, it can be also considered as a multifactorial (work related, environmental related and health related) phenomena. Voice problems in teachers can be due to several factors such as; vocal loading, physical aspects (neck and shoulder problems, mucosal problems), psycho-emotional aspects (stress, emotions), environmental aspects (acoustics,

humidity, temperature), training (usage of voice during training period) (Kooijman, DeJong,Thomas, Huinck, Donders, & Graamanrs, 2006).

Demographic related factors

Age: Most studies have reported older age group is more susceptible for developing voice problems. The age range of 40-59 years is reported to represent a high risk age group for reporting voice problems (Roy et al., 2004), whereas some studies found higher prevalence of voice problems in teachers older than 50 years (Russell et al., 1998; Smith et al., 1998). Behlau et al. (2012) reported that the life time prevalence of voice disorders in teachers started to increase in the age group 30-39 and persisted across increasing age. The age factor have been attributed to the factors like work for many years in the profession, cumulative effect of voice use and tissue injury, effect of biological aging, and also effect of other predisposed health factors.

Even though studies show significant association with respect to age and years of teaching experience, the significant risk contribution from these factors are more controversial. Few studies also have reported that age was not correlated to vocal symptoms at all (Sapir et al., 1993; Thibeault, Merrill, Roy, Gray, & Smith, 2004; de Jong, Kooijman, Thomas, Huinck, Graamans, & Schutte, 2006)

Gender: Various experimental studies have reported significant gender difference in developing voice problems, showing overrepresentation of females compared to that of males (Behlau et al. 2012; Ohlsson et al. 2012; Vilkman, 2004; among others). Various studies conducted in the literature in teachers reported higher prevalence of voice problems in female teachers compared to that of male teachers. The reported statistics of different studies related to voice problems in women versus male teachers being 71% vs. 28% (Sebastian et al., 2012), 67.5% vs. 48.5% (Alvear et al., 2011), 46.3% vs. 36.9% (Roy et al., 2004), 38% vs.

26% (Smith et al., 1998). These gender differences have been justified by researchers based on structural differences in the laryngeal anatomy, and molecular differences existing among males and females. Structurally, females have shorter vocal folds which produce voice at higher fundamental frequency but consequently there is only less tissue mass to dampen a larger amount of vibratory force. Similarly at molecular level female's vocal fold have less hyaluronic acid (HA) in the superficial layer of lamina propria, which is most important for wound repair. The age of the pupil have also been associated with these gender differences, saying that female teachers more often teach younger and smaller pupil than do male teachers, where their working postures and working culture entails more risk factor to them (Rantala, Hakala, Holmqvist, & Sala, 2012).

Work related factors

Vocal loading: Most of the communication in classrooms is verbal and teaching involves sustained and extensive use of the voice, usually referred to as vocal loading. Vocal loading is a combination of prolonged voice use and additional loading factors (background noise, acoustics, and air quality) affecting the fundamental frequency, loudness of phonation, and vibratory characteristics of the vocal folds (Vilkman, 2004). Tendency of a person to habitually speak loud, excessive, and at rapid rate are contributing factors for vocal loading (Sapir, Attias & Shahar, 1992). Apart from this, Vilkman (2000) reported background noise, room acoustics, speaking distance, air quality, inappropriate posture also increases vocal loading effects. Speaker increases the sound pressure level, fundamental frequency, and prolongs the phonation time when exposed to noise (Soderston, Ternstrom, & Behman, 2005). Dry air is associated with strenuous voice production and vocal loading symptoms (Vilkman, 2004;Vintturi, Alku, Lauri, Sala, Sihvo & Vilkman 2001). Females are reported to be experiencing higher vocal loading effects than males as they have higher fundamental

frequency and greater vocal fold collisions (Baker, 2010; Titze, Hunter & Svec, 2007;Vilkman, 2004).

Background noise: Vocal abuse or misuse along with poor classroom acoustics have been frequently reported to be the cause for voice problems in teachers (Sebastian et al., 2012). Speaking in background noise is a well-known factor for vocal strain. Various studies have done in this regard to find out the level of background noise and the speaker's voice simultaneously. Södersten, Granqvist, Hammarberg, and Szabo (2002) using a portable binaural DAT recorder, recorded the background noise and teachers' voice in ten pre-school teachers during all activities all through a working day. The recordings were then analysed to separate the voice from the noise and was found that the pre-school teachers raised both vocal intensity and fundamental frequency significantly during a working day as compared to normal conversation in a silent room. The background noise levels were found to be about 76dBLeq for all the ten teachers, which is very high for verbal communication. A level of 55dB is desired as per American Foundry Society (AFS) 2005:16, so that the speaker does not have to raise the voice level.

Health related factors

It has also been reported in literature that upper airway conditions predispose voice problems (Roy et al., 2004; Simberg et al., 2005). Upper airway conditions such as nasal allergy, asthma, sinusitis, upper respiratory tract infections etc. are also reported to be possible risk factors among teachers (Charn & Mok, 2011). Calas et al. (1989), reported gastro intestinal reflux disorder to be the risk factor for hoarseness in 100 teachers who reported to have dysphonia. Hypothyroidism has been found to be the cause of hoarseness in a minority of teachers (Charn & Mok, 2011; Sebastian et al., 2012). Endocrinologic changes have the capacity to alter the fluid content of the mucosa of vocal folds leading to changes in vocal

fold bulk and shape, thereby affecting the quality of voice. Some vocally dehydrating daily habits such as poor water intake, use of mints or balm sprays were frequent in more than 25% of the teachers (Alvear et al., 2011). Among the different risk factors identified, smoking, air-born allergies, infection to the upper air-way system, gastro-oesophageal reflux and alcohol consumption were identified as the major risk factors for voice problems in teachers (Sebastian et al. 2012; Ohlsson et al., 2012; Chen, Chiang, Chung, Hsiao and Hsiao, 2010).

Signs and Symptoms

In most of the studies, teachers reported multiple vocal symptoms and physical discomfort. In the literature the most salient vocal symptoms reported were hoarseness, strained voice, and vocal fatigue (Chen et al., 2010; Sapir et al.,1993), throat clearing and a sensation of pain or lump in the throat (Ohlsson et al., 2012).

The prevalence of various vocal symptoms among teachers reported in literature are: chronic hoarseness - 15.1% (Sliwinska-Kowalska et al., 2006); recurrent hoarse voice - 45% (Sapir et al., 1993); 47.5% (Smith et al., 1998), 44% (Roy et al., 2004), 53.3% (Sliwinska-Kowalska et al., 2006); dryness of throat – 55% (Sapir et al., 1993), 62.2% (Sliwinska-Kowalska et al., 2006).

In a study comparing the frequency and effect of voice problems among teachers and non-teachers, Behlau et al. (2012) found out that teachers experienced a substantially higher number of voice symptoms than non-teachers. About 77.4% of symptoms were reported, in which the phonatory symptoms were loss of singing range and trouble speaking or singing softly, the laryngopharyngeal symptoms were chronic dryness and chronic throat soreness, and the pharyngoesophageal symptoms were acid and/or bitter mouth taste.

Though different studies used different questionnaires, the vocal symptoms and the risk factors found out are in consensus with these studies. In most studies the most frequent vocal

symptoms reported are vocal tiring/vocal fatigue/strained voice, hoarseness, and low pitched voice, weak voice, throat clearing and sensation of lump in the throat (Sebastian et al., 2012; Ohlsson et al., 2012; Kankare et al., 2012; Chen et al., 2010; Sapir et al., 1993).

Consequences: Studies have found out that voice problems have economic consequences for teachers. The reported voice related absenteeism among teachers when compared with non-teachers was 11% vs. 3.5% (Behlau et al., 2012), 18.3% vs. 7.2% (Roy et al., 2004). In a study by Smith et al. (1998), they reported that 39% of teachers had to cut back in their teaching activities because of voice problems.

Recovery pattern: Studies have found out that teachers are less likely to report chronic problems than non-teachers, which indicates that teachers are prone to frequent but short lived voice problems (Roy et al., 2004). Teachers usually experience some kind of voice rest over the weekends and holidays which contribute to some vocal recovery. According to the results of Behlau et al. (2012), 86% of the subjects recovered from the vocal loading by the next working day, which is also in line with Hunter and Titze (2009) study who reported teachers to have 90% recovery within 12-18hrs after vocal loading.

However, studies reveal higher percentage of voice disorders/problems in teachers compared to non-teaching professionals, none of the studies reported reduction in percentage over the years. In a study by Simberg et al. (2005), they reported that the vocal symptoms among teachers have increased during a 12 year period. This shows the lack of awareness of proper voice use and knowledge of voice disorders among teaching professionals. However in most studies the percentage of teachers who seek treatment for their voice problems is very less despite the adverse impact on their carrier performance and quality of life. Roy et al. (2004) reported only 14.3% of teachers had consulted a physician or SLP for their voice problem. Teachers often view dysphonia as a normal part of their profession, and also are many times

unaware of the fact that a physician or SLP could help their dysphonia and also unaware about the treatment options available like voice therapy. Apart from the unawareness teachers also possess multiple barriers like inability to take time off because of time, family, and financial constraints which prevents them from seeking evaluation for their voice problems.

Most studies done have compared the prevalence of voice problems in teachers to that of non-teachers and have found that teachers are more vulnerable to have voice problems than non-teachers. These studies done around the world has contributed to the better understanding of potential symptoms and risk factors that are associated with voice problems in teaching profession. However India being culturally, geographically and economically being different from the rest of the world, there is only limited studies in this regard. Whatever work has been done, is limited to few number of teachers. Large scale study investigating the prevalence of voice disorders, delineating causes and effects of voice disorders has not been done. Such a study will help us provide better health care facilities in preventing and treating voice disorders in teachers.

Method

The main purpose of the current study was to investigate the prevalence of voice problems in primary school teachers. The second purpose was to identify different risk factors associated with the development of voice problem.

The study was conducted in three stages:

1. Development of the self-reported questionnaire
2. Data collection from primary school teachers
3. Analysis and drawing inferences

1. Development of the self-reported Questionnaire

Self-report of voice problem is reported to be a useful method for establishing the extent to which teachers experience vocal dysfunction (Alvear et al., 2011; Behlau et al., 2012; Charn & Mok, 2011;Chen et al., 2010; Ferreira et al., 2012; Kooijman et al. 2006; Ohlsson et al. 2012; Roy et al. 2004; de Jong., 2006 etc.). For the present study a self-reported questionnaire in English was developed (Appendix 1). This was done based on the questionnaires from other similar studies conducted with teachers. The questionnaire included questions to investigate the prevalence of voice problems in primary school teachers, identify the variables associated with the increased risk of voice problems in teachers, vocal symptoms experienced by the teachers, physician or SLP consultation by the teachers for their voice problems, the functional impact of voice problems in teachers, and the knowledge of voice care among teachers. Initially the questions were designed in English and then they were translated to Kannada language. The questionnaire addressing the above mentioned issues was distributed among five experienced speech language pathologists (SLPs) and was asked to give their comments on the content of the questionnaire. Their suggestions and comments were incorporated in the questionnaire. The questionnaire was then distributed to 30

primary school teachers for familiarity check, and they were asked to answer the following questions:

(1) Does this questionnaire include relevant information related to teaching profession?

(2) Did we miss anything that is important for teachers?

(3) Were there any questions you were not sure how to answer? If yes why you are not sure?

As teachers reported no ambiguity or difficulty in understanding the terminologies in the questionnaire, it was accepted to use in the present study.

Description of the questionnaire

The questions in the questionnaire were divided in the following sections;

1. Demographic details: Age, gender, and phone number.
2. Teachers work organization at school: Number of years as a teacher, average number of classes per day, duration of each class, average strength of students in the class, vocal loudness while teaching (whether soft, loud or too loud), use of amplification devices if any, whether he or she is a trained singer, if yes, then years of training and type of singing.
3. Work environment: Presence of back ground noise, level of noise in the classroom, measures taken to reduce noise level in the classroom, stress experienced by the teachers.
4. Description of vocal behaviours of teachers in the classroom: This section included eight yes/no questions pertaining to various vocal behaviours of teachers during their teaching like; (1) stop speaking when voice gets tired, (2) Seeking attention in the class by yelling /shouting, (3) Holding breath while talking, (4) Clenching jaw while talking, (5) Taking class ignoring noise, (6) Getting closer to the students while taking class, (7) Stop using chalk when irritates, (8) Involved in singing or mimicry.
5. Voice problem: To identify the prevalence of voice problem, teachers were asked to reply yes/no pertaining to the question “Any time your voice does not work, perform, or sound as it normally should, so that it interfered with communication and job performance”(Roy,

Merrill, Thibeault, Parsa, et al., 2004). Further, teachers were asked to describe their voice problem: history of frequent voice problem, when did they notice the problem, onset of the voice problem, and any variation of the problem (getting worse or better).

6. Vocal symptoms experienced by teachers; (1) loss of voice, (2) excessive coughing, (3) frequent throat clearing, (4) shortness of the breath, (5) neck muscle tension, (6) vocal fatigue, (7) difficulty raising the voice, (8) strain in the voice, (9) husky/hoarse voice (10) difficulty projecting the voice, (11) monotone voice (12) need to put extra effort to talk.
7. Physician or SLP consultation; In this section teachers were asked to indicate whether they have taken any treatment to their voice problem like; (1) whether they had consulted a physician for their voice problem, (2) whether they had consulted a Speech Language Pathologist (SLP) for their voice problem, if yes how many times, (3) did their voice improved after consultation with an SLP, (4) Did teachers attend any voice care related programs.
8. Past medical history: This section comprised of five questions out of which 3 are yes/no questions and 2 are multiple choice questions. The questions were: (1) whether they had any major illnesses in the past, (2) whether they had any major surgeries in the past, (3) whether they suffer from any allergy, (4) whether they suffered from any medical condition associated with voice disorder such as pharyngitis, laryngitis, thyroid problems etc., and (5) whether they had taken any medication or treatment in the past that may have an effect on voice like anti-histamines, steroids, hormone replacement therapy etc.,
9. Personal lifestyle: This section comprised of six yes/no questions that may have an effect on the voice like (1) smoking cigarettes, beedi or chewing tobacco, (2) consumption of beverages like alcohol, tea and coffee (3) consumption of fast/fried/oily/spicy food, (4) duration of participation in physical activities like exercise, (5) water consumption per day and (6) whether they sleeps approximately 2 hours after dinner.

10. Knowledge about voice care: This section contains five statements which may or may not be harmful to one's voice and the subject is asked to indicate 'yes/no' based on their knowledge about voice care.
11. Effect of voice problem on job performance: This section included three multiple choice questions related to the impact of voice problem such as (1) how many days they were functionally impaired due to voice problem, (2) the number of missed working days due to voice problem (voice related absenteeism), and (3) the degree of impairment to which voice limits or makes them unable to perform certain tasks or work related activities.

Data collection

This cross sectional survey was conducted by obtaining permission from Deputy Director of Public Instruction (DDPI) of Mysore district. The DDPI office had list of aided and unaided schools in Mysore district, and number of teachers working in each school. As per the list provided by the DDPI, the research officer contacted principals/head teachers of each school by sending a letter explaining the purpose of the study, permission letter obtained from the DDPI, and were asked to indicate if their teachers are interested in participating in this study. The principal/head teacher was assured about maintaining confidentiality about the obtained data.

The self-reported questionnaires were given to principal/head teacher of each school who responded positively for the request, and were requested to distribute them among their school teachers. The data was collected from teachers actively working in primary schools (grade 1- 7) in Mysore district of Karnataka state between September 2012 to October, 2013. The questionnaire included a cover letter explaining the purpose of the study and a consent form. Teachers were requested to return the filled questionnaires within a week to their principal/head teacher and the researcher collected the filled questionnaires from the principal/head teacher.

Statistical analysis

The following statistical methods were used for analysis and interpretation of the data.

- Percentage was used to summarize the prevalence of voice problem
- Pearson's Chi-square test was used to compare the differences in demographic details, vocational information, vocal behaviours in the classroom while teaching, vocal symptoms, physician/SLP consultation, medical history, life style, voice care knowledge among teachers reporting voice problems, and teachers not reporting voice problem.
- Adjusted odds ratio with corresponding 95% confidence interval with multiple logistic regression using Wald forward selection criteria was used to assess the association between reporting voice problem and different influencing risk factors.

Results

The objectives of the present study were to: (a) to investigate the prevalence of voice problems in primary school teachers in Mysore District, Karnataka; and (b) to identify the different potential risk factors associated with voice problems. For this purpose, using a self-reported questionnaire, a survey was done among primary school teachers. A total of 1,250 questionnaires were distributed altogether, out of which 1,082 questionnaires were collected back which accounted for a response rate of 85.2%.

Prevalence of voice problems

The prevalence of voice problems was determined by asking the teachers to report the presence of voice problems during their career as teacher since they began working in this profession which prevented them doing their job. Out of 1,082 teachers participated in the study, 188 of them reported they had voice problem with the prevalence rate of 17.4%. Forty three percent of them (n = 82) reported they noticed voice problem since more than a year, 27% (n=50) of them noticed it since one year, and 30% (n=56) of them indicted they had noticed voice problem since last six months. Further, when teachers were asked to indicate the onset of the voice problem, 37% (n=69) of them reported it as intermittent, 34% (n=65) of them reported it as gradual, and 29% (n=55) of them reported it as sudden onset. Since the onset, there was not much of a variation in voice problem for 41% (n=78) of teachers, voice problem was getting better for 33% (n=60), and voice problem was getting worse for 26% (n=50) of the teachers.

Below, the teachers reporting voice problems are referred as voice problem (VP) group, and teachers who did not report voice problems were considered as no voice problem group (NVP). Out of 894 NVP participants, 744 participants were randomly selected in order to maintain a ratio of 1:4 between VP and NVP group for further analysis. The results of the

study are presented by comparing differences between VP and NVP groups using Chi-square analysis.

Demographic and vocational information

Demographic details with respect to voice problem (VP) group and no voice problem (NVP) are discussed in Table 2.

Table 2. Comparison of demographic and vocational details between teachers with VP and NVP.

Characteristics		**VP (n = 188)**	**NVP (n= 744)**	χ^2	**P value**
		N (%)	**N (%)**		
Gender	Male	29 (19.2%)	122 (80.8%)	0.15	0.746
	Female	159 (20.4%)	622 (79.6%)		
Age	20-29 years	53 (28)	223 (30)	7.08	0.131
	30-39 years	60 (32)	213 (29)		
	40-49 years	36 (19)	191 (26)		
	50-59 years	35 (19)	111 (15)		
	60-69 years	4 (2)	6 (0.8)		
Teaching experience	< 10 years	96 (51)	403 (54)	7.26	**0.026**
	10-20 years	51 (27)	237 (32)		
	>20 years	41(21)	104 (14)		
No. of classes per day	< 5 classes	53 (28)	224 (30)	0.26	0.608
	> 5 classes	135 (72)	520 (70)		
Duration of each class	< 45 mints	182 (97)	704 (95)	1.52	0.217
	> 45 mints	6 (3)	40 (5)		
Average student strength	< 50 students	134 (71)	564 (76)	1.63	0.201
	> 50 students	54 29)	180 (24)		
Medium	Kannada	87 (46)	353 (47)	0.082	0.774

	English	101 (54)	391 (53)		
Presence of background noise	No	24 (13)	144 (19)	10.63	**0.014**
	yes, students noise	127 (68)	452 (61)		
	yes, external noise	34 (18)	108 (15)		
	yes, fan or ac noise	3 (2)	40 (5)		
Reduction of noise prior to	yes	179 (95)	705 (95)	0.064	0.801
	no	9 (5)	39 (5)		
Noise level in classrooms	low	82 (44)	432(58)	39.11	**<0.001**
	medium	91(48)	305(41)		
	high	15 (8)	7(1)		
Vocal loudness while teaching	low	3(2)	16 (2)	5.48	0.064
	medium	145(77)	621 (83)		
	high	40 (21)	107 (14)		
Stress feeling while teaching	yes	96 (51)	155 (21)	69.69	**<0.001**
	no	92 (49)	589 (79)		
Training in singing	no	164 (87)	681 (92)	10.12	**0.006**
	yes, <5 years	13 (7)	50 (7)		
	yes, >5 years	11 (6)	13 (1)		

Note: Data are number (percentage) of teachers with voice problems and no voice problems unless otherwise specified. Percentages were calculated with the number of respondents in each group. P values were derived from the Chi-square test. Boldface values indicate statistical significance ($p < 0.05$).

As shown in Table 1, the teacher group comprised of 781 (83.7%) female teachers and 151 (16.5%) male teachers between the age range of 20 to 69 years (mean age of 37.5 years, standard deviation = 10.7 years). Significantly higher number of teachers who had more than 20 years of teaching experience reported having voice problem compared to the teachers in NVP group. Presence of background noise found to have significant influence on teachers reporting the voice problems. Higher percentage of teachers in the NVP group reported that

there is no background noise, whereas higher percentage of teachers in the VP group reported the presence of student noise in the classroom. None of the teachers were using any amplification devices during classroom teaching. Significantly higher number of teachers in the VP group reported that they are stressed while teaching in the classroom. Teachers who are involved in singing for more than five years were found to report voice problem at higher rate than teachers with no voice problem. In terms of other vocational related factors such as number of classes/day, average student strength, medium of instruction, and vocal loudness while teaching there was no significant difference between two groups of teachers. Similarly, there was no significant difference between two groups with respect to gender and age.

Vocal behaviours exhibited by the teachers during classroom teaching

Further, the teachers were asked to explain the vocal behaviours they exhibited while teaching in the classroom. The responses obtained from the teachers are discussed in Table 3.

Table 3. Comparison of vocal behaviours exhibited between the teachers with VP and NVP in the classroom

Vocal behaviours		**VP**	**NVP**	χ^2	**P value**
		N (%)	**N (%)**		
Stop speaking	Yes	134 (71%)	416 (56%)	14.64	**<0.001**
	No	54 (29%)	328 (44%)		
Yelling & shouting	Yes	131 (70%)	384 (52%)	19.81	**<0.001**
	No	57 (30%)	360 (48%)		
Holding **breath**	Yes	47(25%)	62 (8%)	40.36	**<0.001**
	No	141 (75%)	682 (92%)		
Clench teeth	Yes	37 (20%)	41 (6%)	39.29	**<0.001**
	No	151 (80%)	703 (94%)		
Ignore noise	Yes	134 (71%)	481 (65%)	2.93	0.087
	No	54 (29%)	263 (35%)		
G oi ng cl	Yes	115 (61%)	462 (62%)	0.055	0.815

	No	73 (39%)	282 (38%)		
Stop using c	Yes	71 (38%)	213 (29%)	5.91	0.170
	No	117 (62%)	531 (71%)		
Mimcking sounds	Yes	101 (54%)	358 (48%)	1.88	0.170
	No	87 (46%)	386 (52%)		

Note: Data are number (percentage) of teachers with voice problems and without voice problems unless otherwise specified. Percentages were calculated with the number of respondents in each group. P values were derived from the Chi-square test. Boldface values indicate statistical significance ($p< 0.05$).

The comparison of the vocal behaviours exhibited by the teachers in VP and NVP group suggested that significantly higher number of teachers in the VP group reported they shout in the classroom to get the attention of students, hold breath before they begin to speak, and clench their teeth while teaching in the classroom than their NVP counterparts. At the same time, higher number of teachers in VP group reported they stop speaking when their voice gets tired compared to the teachers in NVP group.

Vocal symptoms experienced by teachers

Table 4. Frequency of vocal symptoms among the VP & NVP groups.

Symptoms		**VP(N =188)**	**NVP(N=744)**	χ^2	***P* value**
		N(%)	**N(%)**		
Loss of voice	Yes	23(12)	8(1)	58.116	**<0.001**
	No	165 (88)	736 (99)		
Sore/dry throat	Yes	63 (34)	81(11)	58.800	**<0.001**
	No	125 (66)	663 (89)		
Shortness of breath	Yes	35 (11)	44 (6)	31.217	**<0.001**
	No	153 (89)	700 (94)		
Neck muscle	Yes	35 (19)	44 (6)	31.217	**<0.001**
	No	153 (81)	700 (94)		

Tired voice	Yes	97 (52)	160 (22)	68.040	<**0.001**
	No	91(48)	584 (79)		
Excessive coughing	Yes	24 (13)	18 (2)	37.334	<**0.001**
	No	164 (87)	726 (98)		
Difficulty	Yes	20 (11)	50 (7)	3.316	0.069
	No	168 (89)	694 (93)		
Strain in voice	Yes	54 (29)	43 (6)	84.727	<**0.001**
	No	134 (71)	701(94)		
Throat clearing	Yes	20 (11)	16 (2)	29.115	<**0.001**
	No	168 (89)	728 (98)		
Husky/ hoarse	Yes	21 (11)	4 (1)	64.994	<**0.001**
	No	167 (89)	740 (99)		
Unsteady voice	Yes	5 (3)	7 (1)	3.488	0.062
	No	183 (97)	737 (99)		
Projecting	Yes	26 (14)	16 (2)	47.570	<**0.001**
	No	162 (86)	728 (98)		
Monotone voice	Yes	15 (8)	12 (2)	21.619	<**0.001**
	No	173 (92)	732 (98)		
Increased effort	Yes	18 (10)	1.2 9 (1)	37.329	<**0.001**
	No	170 (90)	735 (99)		
Wobbly/s haky	Yes	20 (11)	14 (2)	32.739	<**0.001**
	No	168 (89)	730 (98)		
Swallowing	Yes	9 (5)	8 (1)	11.547	**0.001**
	No	179 (95)	736 (99)		

Note: Data are number (percentage) of teachers with voice problems unless otherwise specified. Percentages were calculated with the number of respondents in each group. P values were derived from the Chi-square test. Boldface values indicate statistical significance (p< 0.05).

Teachers were asked to identify if they are experiencing any symptoms of vocal attrition listed in the questionnaire. Out of 16 symptoms, tired voice after lengthy talk was the most frequent symptom (51.6%), followed by sore/dry throat (33.5%), strain in voice (28.7%), neck muscle tension (18.6%) and difficulty projecting voice (13.8%). All the symptoms were significantly higher (p<0.05) for the teachers who reported voice problem (VP) when compared with teachers who did not report the presence of voice problem (NVP).

Awareness about the voice disorder and Physician/ SLP Consultation

Teachers were asked to indicate whether they are aware of the voice disorder, and whether they have consulted physician for the same.

Table 5. Awareness of the voice disorder and physician and SLP consultation by two groups of teachers (VP & NVP)

Symptoms		**VP(N =188)**	**NVP(N=744)**	χ^2	***P* value**
Awareness of voice disorder	Yes	78 (41)	118 (16)	59.35	**<0.001**
	No	110 (59)	626 (84)		
Consulted physician	Yes	56 (28)	12 (2)	1.76	**<0.001**
	No	132 (78)	732 (98)		
Consulted SLP	Yes	47 (25)	16 (2)	1.24	**<0.001**
	No	141 (75)	728 (98)		

Note: Data are number (percentage) of teachers with voice problems unless otherwise specified. Percentages were calculated with the number of respondents in each group. P values were derived from the Chi-square test. Boldface values indicate statistical significance (p< 0.05).

As shown in the Table 5, awareness to voice disorder was found to be poor in both VP and NVP group of teachers. However, significantly more teachers in the VP group than NVP group reported they were aware of voice disorder and consulted physician and SLP than NVP group of teachers. Out of 47 teachers from VP group and 16 teachers from NVP group who consulted SLPs for their voice problem 35 (74%) of teachers from VP group and 13(81%)

teachers from NVP group reported their voice improved after their consultation with SLP. Very less number of teachers reported they received any voice care programs (7(1%) from NVP group and 10(7%) from VP group).

Effect of voice problem on job performance

Functional impairment and missing of work

The functional impairment (difficulty in performing their job) experienced by teachers due to voice problem is shown in Table 6. As can be seen a total of 108 (57%) teachers from the voice disordered group reported functional impairment due to voice problem. Among them 71 (38%) teachers reported they experienced functional impairment for less than 7 days. Remaining 80 (43%) teachers did not report much of functional impairment due to voice problem. Further, among the teachers who reported voice problem, 66% of them did not report missing work and 34% of them reported they missed work due to voice problem. Among them, most of the teachers (27%) indicated they missed work for less than a week and only 7% of them reported they missed work for more than a week.

Table 6. Functional impairment and missing of work due to voice problem

Effects		**VD (N=188)**
Functionally impaired days	<7 days	71 (38%)
	8-15 days	21 (11%)
	16-30 days	3 (2%)
	>30 days	13 (7%)
Missed work days	Not missing work	124 (66)
	< 7 days	50 (27)
	8-15 days	9 (5)
	16-30 days	1 (.5)
	>30 days	4 (2)

Note: Data are number (percentage) of teachers with voice problems unless otherwise specified. Percentages were calculated with the number of respondents in this group.

Personal lifestyle

Teachers were asked to give information on their personal lifestyle such as smoking, use of caffeinated beverages, physical activities, water intake and sleeping pattern and shown in Table 7.

Table 7. Comparison of living habits between VP and NVP group of teachers

Factors		**VP(188)**	**NVP(744)**	χ^2	***p***
Smoking	Yes	3 (2)	5 (1)	1.421	.491
	No	185 (98)	738 (99)		
Alcohol	Yes	5 (3)	8 (1)	2.739	.098
	No	183 (97)	736 (99)		
Caffeinated Drinks	<3 times	122 (65)	430 (58)	3.513	.173
	>3 times	9 (5)	34 (5)		
	No consumption	57 (30)	280 (38)		
Physical activities	<30 mins	62 (33)	266 (36)	.524	.770
	>30 mins	27 (14)	105 (14)		
	Not applicable	99 (53)	373 (50)		
Water intake	<4 litres	154 (82)	562 (76)	3.428	.064
	>4 litres	34 (18)	182 (25)		
Sleep within 2 hrs	Yes	110 (59)	445 (60)	.105	.745
	No	78 (41)	299 (40)		
Taking medicine	Yes	18 (10)	13 (2)	39.50	**<0.001**
	No	170 (90)	731 (98)		

Note: Data are number (percentage) of teachers with voice problems unless otherwise specified. Percentages were calculated with the number of respondents in each group. P values were derived from the Chi-square test. Boldface values indicate statistical significance ($p < 0.05$).

As shown in Table 7, no significant difference was observed with respect to living habits of teachers in two groups except that significantly higher number of teachers in the VP group is taking medicine. Negligible number of teachers reported smoking or intake of alcohol.

Health related conditions

Here teachers were asked to report whether they are suffering from any of the health related conditions.

Table 8.Health related conditions of VP and NVP group of teachers

	VP(188)	**NVP (744)**	χ^2	**P value**
No health problem	108 (58)	613 (82)	59.88	<0.001
Respiratory system related problem	43 (23)	68 (9)		
Thyroid problem	13 (7)	18 (2)		
GERD	12 (7)	12 (2)		
Respiratory allergy	10(5)	4(0.5)		
Neurological disease	3 (2)	6 (1)		
Diabetes/arthritis	5 (3)	17 (2)		

Note: Data are number (percentage) of teachers with voice problems unless otherwise specified. Percentages were calculated with the number of respondents in each group.

As evident from the above table 8, significantly higher numbers of teachers (p<0.05) in VP group have reported experiencing respiratory system related problems, thyroid problems and GERD.

Risk factors associated with the presence of voice problems

Table 9: Factors having significant association with voice problems

		Unadjusted Odds Ratio (95% CI)	p value	Adjusted Odds Ratio* (95% CI)	p value
Teaching experience	< 10 years	1.00		1.00	
	10 – 20 years	1.411 (0.395 – 2.924)	0.020	0.827 (0.542 – 1.262)	0.378
	>20years	2.338 (0.841 – 3.875)	0.012	1.739 (1.062 – 2.848)	**0.028**
Noise level in the classroom	Low	1.00		1.00	
	Medium	1.523 (0.432 – 7.542)	0.191	1.299 (0.898 – 1.879)	0.164
	High	4.302 (2.506 – 10.582)	0.002	4.488 (1.559 – 12.924)	**0.005**
Stressed while teaching		3.965 (2.833 – 5.550)	<0.001	3.125 (2.152 – 4.538)	**< 0.001**
Holding breath while speaking in the classroom		3.667 (2.409 – 5.582)	< 0.001	2.268 (1.438 – 4.432)	**0.001**
Clenching jaw/teeth while speaking		4.201 (2.605 – 6.776)	<0.001	2.524 (1.438 – 4.432)	**0.001**
Medical conditions	Upper respiratory tract infections (Cold, Laryngitis, Pharyngitis etc.)	1.927 (1.216 – 3.658)	0.004	2.287 (1.377 – 3.798)	**0.001**
	Thyroid problems	1.974 (1.739 – 6.254)	0.026	3.734 (1.667 – 8.364)	**0.001**
	Respiratory allergy	2.062 (0.721 – 18.368)	0.051	1.261 (0.329 – 4.837)	0.735
	Acid reflux	3.520 (1.947 – 12.210)	0.041	4.897 (1.892 – 12.676)	**0.001**
	Neurological disease	2.400 (0.295 – 6.276)	0.694	1.532 (0.324 – 7.254)	0.591
	Other medical	0.371	0.542	0.736	0.613

	conditions (Diabetes, arthritis, hypertension etc.)	(0.308 – 9.374)		(0.224 – 2.419)	

Boldface values indicate statistical significance ($p < 0.05$).

The association between voice problem and influencing variables were assessed using adjusted (using Wald forward selection criteria) and unadjusted odds ratio with 95% confidence interval. The variables having significant association with voice problems experienced by the teachers are shown in Table 8. Unadjusted odds ratio showed, the risk of reporting voice problems increases as the teaching experience increases by 1.4 times with 10 – 20 years of teaching experience and 2.3 times with more than 20 years of experience. However, multiple logistic regression analysis revealed teachers who have more than 20 years experience were at significantly higher risk (1.7 times) than teachers with lesser than 20 years of experience. Overall the study results showed that, teaching experience having significant association with reporting of voice problem. The adjusted and unadjusted odds ratio both showed high level of noise level in the classroom, being stressed while taking classes, improper breath management (holding breath while speaking), and poor focus of the tone (clenching jaw/teeth while speaking) as significant risk factors for the voice problems in teachers. In the present study we found teachers who are stressed while taking classes were at 3.1 times higher risk, teachers reporting high level of noise in the classroom were at 4.4 times higher risk, teachers who reported they hold breath while talking were at 2.2 times higher risk and teachers clenching jaw while talking were at 2.5 times greater risk than teachers who did not report these behaviours. Other than these work related variables, certain medical conditions were also found to have significant association with reporting of voice problems. As shown in Table 8. teachers reporting upper respiratory tract infections, thyroid problems

and experiencing acid reflux were at 2.2 times, 3.7 time and 4.8 times higher risk for developing voice problems than teachers did not report these conditions. Less than 5% of the teachers reported other medical conditions such as respiratory allergy, neurological diseases and other conditions (such as diabetes, hypertension, arthritis) and did not have significant association with voice problems experienced by teachers.

Discussion

Main objective of the present study was to investigate the prevalence of voice problems in primary school teachers. For this purpose, teachers from both government and private schools were included considering their similar working environment factors in the classroom, number of working hours/week, as well as number of students in the classroom. Thus, these teachers are considered homogenous and representative. Generally, reports in the literature suggest that there are more female teachers in primary schools compared to secondary school (Smith et al., 1998; de Jong et al., 2006; Kooijman et al., 2006). Similar trend was observed in the present study, as there were 781 (83%) of female teachers and 151 (17%) of male teachers in the total sample of 1082 teachers. For the present study, the voice problem was defined as 'whether teachers experienced any voice problems during their career since they began to work which prevented them from doing their job'. Results indicated that 17% of the teachers experienced voice problems in their career which prevented them doing their work. In the literature, there is a large range in prevalence of voice problems reported by different studies and varies between 15% to 80% in preschool, elementary, and high school teachers (Smith et al., 1998; Rusell et al., 1998; Roy et al., 2004; Thibeault et al., 2004; de Jong et al, 2006; Van Houtte, Claeys, Wuyts, Van lierde,2011). Majority of the studies reported prevalence closer to 50%. This diversity in values can be attributed to the definitions of voice problems and investigation methods used in different studies. Hence, it is difficult to compare the findings of different studies. In the present study we obtained a prevalence rate of 17%. This could be attributed to the fact that, in India, teachers are not made aware of vocal symptoms associated with their profession during their training period or after they join for their profession. Hence, teachers who experience symptoms of vocal fatigue may not consider it as voice problem and teachers may have higher threshold to consider themselves suffering from voice problem.

The results of the present study were discussed based on the responses of teachers with voice problem (VP) and teachers without voice problems (NVP). The responses of these two groups of teachers were compared for demographic characteristics, vocational information, living habits, health related conditions, vocal behaviours exhibited during classroom teaching, vocal symptoms, awareness about voice disorders, and consulting physician or SLP. In order to maintain a ratio of 1:4 between teachers with voice problem and without voice problem, 744 teachers without voice problems were selected randomly from a sample of 894 subjects. Further, the study results were analyzed by comparing the different variables between teachers with voice problems and teachers without voice problems by maintaining a ratio of 1:4.

Demographic, teaching and environmental characteristics

There was no significant effect of age and gender between the teachers reporting voice problem and teachers with no voice problem. Similar findings are reported by Sapir, Keidar, and Van Velzen (1993). However, in most of the studies self-reporting of voice problems was significantly higher in female teachers than male teachers and reporting of voice problems higher in teachers above 50 years of age (Smith et al., 1998; Russell et al., 1998; Roy et al., 2004). They attributed it to the hormonal effects and age related changes in vocal folds. In the present study sample size (male teachers) in each age group was very small and hence difficult to arrive at conclusion with respect to gender and age. By taking adequate samples, study of voice problems in teachers in different age groups and gender may reveal more facts. However, teaching experience was found to have positive relationship with reporting of voice problems. Significantly higher number of teachers with voice problems had more than 20 years of teaching experience. This finding is in consonance with findings of Smith et al. (1997); Smith et al. (1998); Kooijman et al. (2006); and Thibeault et al. (2004). They

attributed it to the cumulative voice use by teachers over a period of time which increases the risk of developing voice disorders. However, this result disagreed with Russell et al., (1998) and Chen et al., (2010) investigations who did not find any relationship between teaching experiences and voice problems.

A significant relationship was observed between teachers reporting voice problem and the noise levels in the classroom. Teachers with voice problems reported they experienced high back ground noise, especially the students' noise, in the classroom. It is universally accepted fact that teachers need to compete with the high background noise levels which force them to increase the loudness while teaching, as teachers' voice cannot be perceived by the students due to unsatisfactory signal-to-noise ratio. The noise level in the classroom may be more either because of outside environmental factors or because of within classroom noise created by students. According to Eysel-Gosepath, Dault, Pinger, Lehmacher, and Erren (2012), for teachers the students' noise within the classroom is a disturbing factor than the external noise (traffic or construction work). This was found true in the present study as teachers with voice problems reported that they experienced high back ground noise especially the students' noise. Noise levels in the work place where speech communication is important should not exceed 62 dB (A) (Webster, 1979). According to Berg (1993) noise levels in the classroom should be below 35-40 dB (A) for good communication. However, survey conducted by different investigators reveal very few primary schools meeting these requirements (McCroskey & Devens, 1975; Crandell & Smaldino's, 1994). According to them, noise levels in the classroom is at least 10-15 dB higher than recommended standards. Exact noise levels in the classroom were not measured in the present study, however, teachers reported there is medium to high levels of noise in the classroom.

Teachers with voice problems reported experiencing stress while teaching in the classroom at significantly higher rate than teachers who did not report any voice problems. This finding is

in accordance with reports of several studies in the literature (Boone, 1991; Raven, 1993; Kitch & Oates, 1994; Sataloff, 2001) who reported the amount and nature of stress in the work place will have a great influence on the professional voice. In teachers, the teaching demands, curriculum revision, inappropriate behaviours of students and noise levels in the classroom could be the possible influencing factors for the increased stress levels while teaching in the classroom (Simberg et al., 2005). Apart from teaching, reporting of voice problem was significantly higher in teachers who were involved in singing. Along with class room teaching if teachers are involved in singing they place high demands on their vocal mechanism and this may adversely affect their vocal apparatus (Vilkman, 2001). Teachers with voice problem in the present study were more likely ($p< 0.001$) to yell and shout in the classroom, had inappropriate breath management (holding breath) and clenching their jaw than teachers not reporting voice problems. This finding suggests that teachers in VP group were involved in straining their voice by inappropriate speaking style and vocal abusive behaviours. All these vocal behaviours are considered to have negative influence on VFs leading to vocal fatigue. According to Sapir et al. (1993), when teachers experience vocal fatigue their voice tires easily and they experience difficulty in talking or singing. Teachers in the VP group in the present study reported they stop speaking when their voice gets tired than teachers in the NVP group. This indicates that the teachers with voice problem experience vocal fatigue at significantly higher rate which prevents them continuing their speech. No significant difference between two groups of teachers (VP and NVP) was observed with respect to medium of instruction, number of classes/day, duration of each class, average student strength, and vocal loudness while teaching suggesting that these factors probably have less influence on the teachers' voice problems.

Voice symptoms

Out of 14 symptoms listed in the questionnaire, the most frequently reported vocal symptoms were vocal fatigue (52%), sore or dry throat (34%), vocal strain (29%), neck muscle tension (19%) and difficulty in projecting the voice (14%). This finding suggests that, voice problem in teachers will manifest as several symptoms. The vocal symptoms mentioned above were identified as most commonly occurring symptoms in teachers in the literature (Russell et al., 1998; Sapir et al, 1993; Gotaas & Starr, 1993, Pekkarinen et al., 1992; Smith et al., 1997). According to Tavares et al. (2007) symptoms like vocal fatigue, vocal strain, sore or dry throat are signs of vocal abuse or intense voice use in teachers in inappropriate working conditions. Ferreira et al., (2010) and Lime-Silva, Ferreira, Oliveira, Silva, and Ghirardi (2012) found a positive correlation between excessive use of voice, shouting, yelling, inappropriate hydration, jaw opening limitations, sleep disturbances and lack of rest having significant association with reporting of vocal symptoms in teachers. The teachers who experienced these vocal symptoms in the present study were reported to be involved in vocal habits such as yelling, speaking loudly or excessively, speaking in noisy environment, inappropriate speaking styles (clenching jaw while speaking) which generate vocal loading. The teachers also reported they teach a variety of subjects and often use their voice continuously on an average 3 hrs/day. The teachers who reported voice problems also indicated prolonged voice use under medium to high background noise. In teachers, vocal symptoms may begin slowly and sporadically, and over a time they contribute to the development of laryngeal disorders/occupational voice disorders that prevents normal voice production. When this situation is associated with poor hydration, oral breathing while speaking and relatively less air humidity in the environment may lead to the symptoms like dry throat and sore throat (Tavares & Martins, 2007). However, air humidity in the city of Mysore was not measured for the present study and difficult to comment the influence of

humidity on the dry throat. According to Sivasankar (2002), vocal symptoms among Indian school teachers are associated with high student- teacher ratio, extended teaching hours and poor classroom acoustics.

Medical help

In the present study, the teachers with voice problems consulted physicians and SLPs more frequently than teachers in the NVP group. From the VP group of teachers, 28% consulted physicians and 25% consulted SLP related to their voice problems (Table 4). However, it can be noted that, less than half of the teachers who experienced voice problems consulted physician or SLP seeking help. This is in accordance to the findings of Roy et al. (2004) and Russell et al. (1998) who reported that 14.3% and 32.7% of the teachers with voice problems consulted physician or SLP. From these findings it can be assumed that, either the teachers consider voice problems are associated with their profession, or do not give much importance to vocal symptoms unless it severely affects them, or they are reluctant to take time off from the work for medical appointments. Other possibilities could be teachers may not be aware of help available to prevent voice problems (Roy et al., 2004; Russell et al., 1998) or teachers find it difficult to justify their sick leaves associated with voice disorders as voice disorders are not recognized as professional disease. In the present study even though 41% of the teachers from VP group reported they are aware of the voice disorder only 28% of them consulted physician or SLP. Hence, it can be presumed that, teachers do not give much importance to their initial symptoms of vocal attrition and may approach physician or SLP only when it severely affects them.

Effects of voice problem

The present study sought to identify the effects of voice problem in teachers by asking them to report the functional impairment and missing work due to their voice problems. About 57.4% of the teachers reported they experienced functional impairment due to voice problem and 34% of them reported they missed their work due to their voice problems during their career. Among them majority of the teachers reported they experienced functional impairment (38%) and missing work (27%) for less than a week. This outcome was similar to the findings of Russell et al. (1998) and Titze et al. (1997) who reported that 39% of the Australian and 20% of the American teachers missed work for less than week respectively. Further, the above data shows that, all the teachers who reported functional impairment did not miss their work. According to Rice (2010) and Roelen et al. (2010) the relationship between missing work and illness is not straight forward, the individuals with illness may not miss work by the pressure to come for work. This finding was supported study by Chen et al. (2010) who reports no significant association between the presence of voice disorder and absence taken by the teachers. This supports the view that, teachers believe voice problems are a part of their occupation and do not acknowledge the existing restrictions for carrying out the professional and communication activities and do not consider it as an excuse for absence (Dragone, 2011). However, Smith et al. (1997) and Titze et al. (1997) reported significantly higher number of teachers take sick leaves related to voice problems than the general population. Since the teachers are a significant portion of the working population, teachers reporting missing work due to voice problems should be considered more seriously and they should be provided appropriate voice care strategies to prevent voice problem related absenteeism and related economic consequences.

Risk factors

Teaching in the classroom is associated with several risk factors which affects the voice of teachers. The present study found a significant association between self-reported voice problems and work organization (years of working).The prevalence of self-reported voice problems was significantly higher among teachers who reported more than 10 years of teaching experience, increased background noise, experiencing stress while teaching in the classroom, inappropriate breath management, inappropriate jaw opening and health problems such as upper respiratory tract infections, thyroid problems, experiencing acid reflux.

Work and environment related factors

Teachers who had more than 20 years of experience were found to be at 1.7 times greater risk than teachers who had lesser than 20 years experience. It supports the findings of Smith et al. (1997) that vocal fatigue increases with the number of years of teaching. Roy et al. (2004) also identified increase in teaching experience as a factor to history of voice problem. According to Titze (1999), the accumulated injury during continuous voice use (daily basis) in teachers can reach a point where day to day recovery is not possible. This could be the possible reason for the higher prevalence of vocal symptoms in teachers who have more than 20 years of teaching experience. However, teaching experience is not found as risk factor for development of voice problems in teachers universally, and contrasting findings are reported by Russell et al. (1998) and Sapir et al. (1993) where these authors found no significant association with years of teaching and vocal symptoms in teachers.

Similarly, teachers who experienced high back ground noise in the teaching area were found to be at 4.4 times higher risk of developing voice problems than teachers who did not report higher back ground noise. Speaking in high back ground noise increases vocal loading (Vilkman, 2004; Sodersten et al, 2005) as the speaker automatically increases the sound

pressure level and spectral contents of voice signal to improve message transfer. Increase in SPL increases medial compression of the VFs. This leads to higher mechanical load on the VF tissue, and increases the risk of vocal fatigue (Jonsdottir, 2003).

Studies in the literature have shown that stress consistently being associated with voice problems in teachers. (Russell et al.,1998; Gotaas & Starr, 1993; Kooijman et al., 2006). According to Vilkman, (2004) stress adds to the subjective perception of the voice load in teachers. Teachers who experienced stress in the present study were found to be 3.1 times at higher risk than teachers who did not experience stress. This finding is in line with the findings of Sapir et al., (1993), Raven (1993), and Gassull, Casanova, Botey and Amador, (2010), who reported that psychological stress is common among teachers who report voice disorders. This finding supports the views in the literature that, emotions can influence voice production negatively, especially in sensitive persons. Increase in stress subsequently changes the phonation pattern, and increases vocal load (Gotaas & Starr, 1993; Nerriere, Vercambre, Gilbert, & Kovess-Masfety, 2009).

Inappropriate speaking style (holding breath while talking, clenching jaw/teeth) exhibited by the teachers were found to have significant association with reporting of voice problems. Kosyk and Rochet (1998) reported the presence of inefficient co-ordination of respiratory and laryngeal adjustments in teachers who reported voice problems, and contributing to the symptoms of vocal fatigue. Supporting this view, the results of the present study showed that, teachers having inappropriate breath management were at 2.2 times higher risk of developing voice problems than teachers who do not report this. Several studies have identified altered speech breathing behaviour in teachers who exhibited symptoms of vocal fatigue (Sapienza & Stathopolos, 1994; Sulkowski & Kowalska, 2005; Lowell, Barkmeir-Kraemer, Hoit & Story, 2008) which resulted in effortful and strained voice quality (Milstein & Watson, 2004). These results highlight that, there is respiratory and laryngeal system imbalance in teachers who

report voice problems and they begin their utterances 10%-25% above the resting expiratory level and terminate at near resting expiratory level. However, the physiological respiratory characteristics of teachers who reported holding of breathe while speaking and its contribution to the development of laryngeal pathology is not explored in the present study. Clenching of jaw or teeth will inhibit the full opening of vocal tract during production of vowels causing a tight throat instead of an open one. Further, restricted jaw opening causes production of words at the back of the mouth and tightens the throat and laryngeal muscle tension. Inappropriate speaking style by the teachers in the present study by clenching their jaw and teeth was identified as contributing factors for the voice problems (odds ratio 2.5). The association between clenching of jaw and voice problems may be explained by above mentioned factors.

Health related factors

Upper respiratory tract infection (laryngitis, rhinitis/sinusitis, pharyngitis) was found to be a significant risk factor (2.2 times higher) in teachers who experienced voice problems. Other studies in the literature also showed a positive association between dysphonia and respiratory problems in teachers (Smith et al., 1997; Marcal & Peres, 2011; Sebastian et al., 2012). Exposures to dirt and chalk dust in the classroom were reported to increase the likelihood of developing upper respiratory tract (URTI) infections in teachers. According to Boone (1991) upper respiratory tract infections can lead to complete loss of voice or hoarseness of the voice. URTI leads laryngitis, and in turn the superficial layer of the VFs becomes stiffer. Persistent use of the voice with laryngitis leads inflammation of the VFs and impairs voice production. This in turn increases the need to put extra effort to convey the message in the classroom teaching and vocal fatigue (Colton & Casper, 1990; Gotaas & Starr, 1993). Thyroid hormones are also known to cause voice disturbances (Ritter, 1964). In the present study, teachers reporting thyroid problems were at 3.7 times higher risk than teachers who did

not report thyroid problems. Thyroid hormones serve to increase the rate of metabolic functions in the body. Thyroid hormone disorders lead to increased levels of polysaccharides in the vocal folds leading to increased fluid retention and vocal fold thickening. The vocal fold thickening causes a decreased vibratory capacity and results in lower fundamental frequency and a sensation of insufficiency. Hyperthyroidism (high thyroid function) also can cause hoarseness, usually when it is severe (Kadakia, Carison, Sataloff, 2013).

Teachers who reported experiencing acid reflux were found to be 4.8 times greater risk than teachers who did not experience acid reflux. It is well documented fact in the literature that acid reflux is one of the important risk factors for the development of voice problems (Koufman et al, 1996; Pribuisiene, Uloza, Kupcinskas, & Jonaitis, 2006; Sataloff, 2008; Lowden et al, 2009). Reflux can cause laryngitis or tighten the laryngeal muscles due to irritation of vagus nerve (Gill & Morrison, 1997). Studies endorsing the association between LPR and dysphonia have attributed it to the inflammatory process (Reinke's edema) and frequent throat clearing associated with LPR, which in turn alters the mucosa of the vocal folds. This could be the possible reason for the significant association between experiencing symptoms of LPR and vocal symptoms as reported by the teachers.

In the literature it has been reported that, number of classes/day (classroom hours), age, gender and number of students/class are related to the incidence of voice problems in primary school teachers. In the present study, these factors did not show significant odds ratio, which leads to the assumption that, contribution of these factors may be relatively less for the development of the voice problems in primary school teachers compared to other factors which showed significant odds ratio. On the other hand the non-significant association of these factors with voice problems in teachers could be attributed to the study design itself, that is, in cross sectional study designs it is difficult to establish the exact cause and effect relationship (Marcal & Peres, 2011).

Summary

- The results of the present study showed that 17% of the primary school teachers suffer from voice problems during their career.
- Vocal symptoms were reported by both group of teachers (VP & NVP) but significantly more by the VP group. Teachers in the VP group also exhibited vocal behaviors such as yelling and shouting, holding breath, and clenching jaw/teeth significantly higher than teachers with no voice problems which are identified as risk factors for the development of voice problems.
- The results confirm that teachers with voice problems experience functional impairment and miss work due to voice problems. However, treatment seeking behavior was observed to poor among them.
- In this questionnaire study multivariate logistic regression analysis showed certain specific factors (teaching experience more than 20 years, high back ground noise level, stress, holding breath, clenching jaw/teeth, upper respiratory tract infections, thyroid problems, acid reflux) are contributing to the voice problems in teachers. This finding highlights the multifactorial complexity of aspects related to voice complaints in teachers other than just vocal loading.

Conclusion

The results of this study confirm that teaching is a high risk profession for voice problems, and several factors (work organization & environment, psychoemotinal, health) play a role in development of voice problems in teachers. Majority of these factors can be controlled by the teachers and they can maintain good vocal health. It shows that there is great need to educate the teachers about importance of prevention of voice problems. Teachers should be given education regarding how to optimize their voice use depending on the room acoustics and background noise. They should be made aware of different etiological factors and their interplay so that there is a good interaction between teachers' working conditions and their general and vocal health. This action can be brought by conducting workshops about knowledge of voice production and factors influencing it. Further studies are warranted to identify the exact factors that contribute to the voice problems in teachers by considering the individual risk factors and their impact on the vocal mechanism. This will help the SLP to develop effective preventive voice care programs for teachers.

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