

# Prevalence and Voice Characteristics in an Indian Treatment-seeking Population for Voice Disorders

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## ABSTRACT

**Objective:** The purpose of this study was to describe the characteristics of a treatment-seeking population visiting the voice clinic of the Speech and Hearing department in a tertiary care hospital.

**Study design:** Retrospective study.

**Methods:** The study included patient's data who visited the voice clinic from January 2015 to January 2020. The retrospective data related to laryngeal pathology, age, gender, occupation, overall grade (G score of GRBAS), maximum phonation duration, S/Z ratio, and acoustic parameters (F0, jitter, shimmer, noise-to-harmonic ratio) were tabulated and analyzed.

**Results:** The study results were analyzed and reported from 524 patient records. The frequency of organic/structural vocal pathology was observed to be higher ( $n = 468$ ; 89.3%) than functional/nonstructural pathologies ( $n = 38$ ; 7.3%). Vocal nodules (28.1%), vocal fold paralysis/paresis (15.5%), vocal fold edema (13.7%), sulcus vocalis (7.3%), and vocal polyps (6.1%) were the most common (those occurred in more than 5% of the patients) diagnosis observed for the overall sample. Male dysphonic patients ( $n = 283$ ; 54%) outnumbered the females ( $n = 241$ ; 46%). The majority of patients consulting the voice clinic for dysphonia were between 25 and 64 years. The most common occupations seeking help for voice problems were homemaker, student, teacher, business, farmer, retired, singer, and laborer. The overall perceived hoarseness was significantly higher in males compared to females.

**Conclusion:** The present study results allowed a better understanding of characteristics of treatment-seeking population for voice disorders visiting voice clinic. Identification of characteristics and diagnosis of individuals seeking treatment for voice disorders help the speech language pathologists to increase the awareness among the general population about preventive voice care strategies.

**Keywords:** Epidemiology, Laryngeal pathology, Prevalence, Voice disorder.

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## INTRODUCTION

Voice is an essential medium for humans for communication. The general population uses voice to share their thoughts and ideas while others like singers and actors require it more to fulfil their professional needs. Dysphonia is a significant problem that occurs when the quality of voice, pitch, and loudness of voice differ or are inappropriate for the individual based on their age, gender, cultural background, or location. A wide range of etiologies can be associated with voice disorders. They can be organic causes which can be structural (vocal nodules, polyps, etc.) or neurogenic (spasmodic dysphonia, vocal fold paralysis) in nature; or the voice disorder can be due to functional causes, due to improper or inefficient use of vocal mechanism (vocal fatigue, muscle tension dysphonia, etc.). The voice quality can also be affected due to psychological stressors that lead to dysphonia, referred to as psychogenic voice disorders.<sup>1</sup> Voice disorder negatively impacts an individual's life, affecting their communication, physical, social, psychological, and work-related aspects of life. It leads to a medical consult when the voice differs from what the individual and their surrounding expect it to be and is accompanied by complaints like laryngeal pain, pharyngeal reflux, vocal fatigue, etc.

Prospective or retrospective epidemiological studies have been conducted in the literature to investigate the prevalence/incidence of voice disorders in a general or specific group of population. Some studies have attempted to describe the prevalence/incidence of voice disorders in general/specific group of population by describing the characteristics of the individuals

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who seek treatment for their voice problem during a specified time period (retrospective or prospective). Most of the studies which estimated the prevalence of voice disorder among treatment-seeking populations have described the characteristics such as age, gender, occupation and vocal pathology. The purpose of such studies is to identify the population at risk and to understand the causes and the impact of voice disorders. In terms of gender, most of the studies reported a higher representation of females (range from 56 to 71%) in treatment-seeking population for voice problems than males (28–43%).<sup>2–10</sup> Dissimilarity in laryngeal anatomy between the genders, anatomical and resulting physiological differences

(posterior glottic closures, molecular composition of vocal fold tissues, shorter vocal folds, less hyaluronic acid in superficial layer), hormonal factors, higher F0 implying higher vocal load were the most common reasons pointed out for this disparity.<sup>3-7,11,12</sup>

Further, studies have reported that individuals between the ages of 3–18 years (6.6–6.9%)<sup>7,9</sup> and >60 years (14.5–42%)<sup>7-9,13</sup> were less frequently seeking treatment for voice problems when compared to individuals in the age range of 19–59 years (ranging from 51 to 68%).<sup>7-9</sup> The higher prevalence of voice problems in the adult population (19–59 years) was attributed to the increased stress associated with the beginning of a relational, educational, or professional career and higher vocal loading associated with the profession.<sup>4,8</sup> Whereas most of the studies reported that both parents and pediatricians do not consider dysphonia as an active problem in younger children and they seek treatment only when there is severe impairment, which could be the probable reason for lesser prevalence.<sup>5</sup> Some studies reported a lesser percentage of the elderly population (>60 years) seeking help for their voice related problems and they reported that elderly individuals do not pay attention to voice problems and consider it as a normal aging phenomenon.<sup>5,11</sup> Contrary to this, some studies reported a higher representation of the elderly population in the treatment-seeking group for voice problems suggesting laryngeal changes that occur during aging affects the quality of voice<sup>2</sup> and leads to vocal fatigue<sup>7</sup> makes them seek help.

In terms of occupation, some of the recent studies reported the active working adult population (53.5–56.3%), retirees (19.9%), students (15.4%), unemployed (7–11.2%)<sup>5,6</sup> comprised the largest treatment-seeking group. Further, in the working group, professional voice users (41–71%) were mostly affected than nonprofessional voice users (52%).<sup>5,6</sup> Among professional voice users, teachers represented as the largest group seeking help for voice problems (20–56%).<sup>8,13</sup>

Further, the reporting of laryngeal/vocal pathology varied widely across the studies conducted in treatment-seeking population. Nonspecific dysphonia (18.5–31.2%);<sup>7,9,14</sup> vocal fold nodules (11.3–23%);<sup>4-6,8</sup> acute laryngitis (33–42.1%);<sup>11,15</sup> chronic laryngitis (9.7–15.9%);<sup>11,15</sup> unilateral vocal fold paralysis (10–24%);<sup>9,14</sup> muscle tension dysphonia (7–17.6%);<sup>5,9</sup> functional dysphonia (10.1–20%);<sup>4,6</sup> vocal fold paralysis (12–24.2%);<sup>3-5</sup> vocal fold edema (8.3–12.9%);<sup>5,6</sup> mild membranous lesion (15.4–18.5%);<sup>7,9</sup> vocal fold immobility (14.5%);<sup>7</sup> atrophy (3.1%);<sup>6</sup> unilateral; paresis (3.7%);<sup>9</sup> polyps (6.6%);<sup>6</sup> LPR (5.4%);<sup>6</sup> cysts (4.7%);<sup>6</sup> Reinke's edema (4.4%);<sup>6</sup> sulcus vocalis (3.3%);<sup>6</sup> presbyphonia (2.3%);<sup>6</sup> pseudocysts (1.3%);<sup>6</sup> others (19–25.3%)<sup>7,9</sup> were found to be some of the most common vocal pathologies reported by different studies.

Overall, studies conducted on treatment-seeking population give a broader picture of the population at risk for voice disorders, causes, and impact of voice problems in the general population. However, it was observed that the characteristics of people seeking treatment for voice disorders varied from one geographical area to the other, signifying the need for such studies in different locations.<sup>11</sup> Hence, the present study attempted to describe the characteristics of the population visiting voice clinic for the assessment/treatment of dysphonia in a tertiary care hospital of South India with the following objectives: (1) to profile the characteristics of voice disordered individuals (age, gender, occupation, vocal pathology, objective and subjective voice parameters); (2) to find an association between sociodemographic data and the vocal pathology; and

(3) to describe the acoustic, auditory perceptual, and aerodynamic characteristics of treatment-seeking population.

## METHOD

### Participants and Data Collection

This retrospective study included the data basis of dysphonic patients from one tertiary care hospital. The data of patients referred to the voice clinic of the Department of Speech and Hearing for the voice assessment or voice therapy between January 1, 2015, and January 31, 2020 (5 years) were included in the study. A total of 750 patients who visited the voice clinic for the first time with a history of dysphonia were identified from the clinical case registers. Each case was included only once in the study. Patients who visited the hospital for other health issues and were referred for speech and language evaluation (voice problem was not a primary concern) were excluded from the study. Out of 750 patient records, 524 eligible patient data were included in the study for the analysis based on the inclusion and exclusion criteria. The remaining 226 were excluded from the study (153 medical files discarded in the medical records section, 32 diagnosed with voice problems secondary to dysarthria, 16 diagnosed with voice problems secondary to dysphagia, 25 incomplete reports). The present retrospective study was approved by the Institutional Research Committee and the Institutional Ethical Committee.

### Procedure

The following data were collected retrospectively as reported in the patients' medical records; demographic data (age, gender, and occupation), laryngeal pathology, degree of hoarseness during the spontaneous speech (GRBAS scale), aerodynamic measures (maximum phonation duration and s/z ratio), and acoustic voice parameters (fundamental frequency, jitter, shimmer, and NHR). The laryngeal pathology was diagnosed by an experienced Otolaryngologist either using videostroboscopy or histopathological analysis. The voice samples (auditory perceptual, acoustic and aerodynamic measures) were analyzed and reported by experienced SLP having good knowledge about the voice assessment procedures. The ratings for the G score (overall score of hoarseness) of GRBAS (grade, roughness, breathiness, asthenic, strain) scale were considered to measure the degree of hoarseness during spontaneous speech. Maximum phonation duration was obtained from maximum sustained phonation duration of vowels /a/, /i/, /u/, and s/z ratio was obtained from sustained phonation duration of fricative sounds /s/ and /z/ at a comfortable pitch and loudness. The acoustic parameters such as F0, jitter, shimmer, and NHR measured using the Multidimensional Voice Program (MDVP; model 5105, Kay Elemetrics Corp); the samples being collected in a sound treated room and captured using Shure SM58 dynamic microphone.

The obtained data were entered into an Excel spreadsheet and categorized for analysis based on age, gender, occupational details, laryngeal pathology, type of voice disorders, and voice parameters (acoustic, perceptual, aerodynamic). For the data analysis, the patients were classified into five age-groups; 2–14 years, 15–24 years, 25–44 years, 45–64 years, and >65 years based on an earlier study.<sup>16</sup>

### Statistical Analysis

Descriptive statistics (percentage) were used to describe the occurrence of different types of dysphonia to the total sample collected. Frequency and percentage were used to summarize

categorical variables; mean and SD, minimum and maximum were used to summarize continuous variables. The Chi-square test was used to find the association between vocal pathology and different variables in the study. Mann–Whiney *U* test was used to compare the different acoustic, aerodynamic and G score of GRBAS between genders. SPSS statistical software (IBM SPSS Statistics 20) was used for all analyses.

**RESULTS**

The purpose of the present retrospective study was to understand the characteristics of dysphonic subjects who visited to one tertiary care hospital for voice assessment/therapy between January 2015 and January 2020. The data were analyzed and discussed based on 524 eligible patient records.

**Prevalence of Vocal Pathology**

The dysphonic patients were diagnosed to have 22 types of vocal pathologies. The frequency of each type of dysphonia for the entire sample shown in Table 1. Vocal nodules (28.1%), vocal fold paralysis/paresis (15.5%), vocal fold edema (13.7%), sulcus vocalis (7.3%), and vocal polyps (6.1%) were the most common (those occurred in more than 5% of the patients) diagnosis observed for the overall sample. When the vocal pathologies grouped as organic/structural (vocal pathologies which had structural changes in the vocal fold; vocal nodule, vocal polyps, vocal cysts, sulcus vocalis, contact ulcers, granulomas, vocal fold scarring, laryngitis, hyperkeratosis/leukoplakia, glottis carcinoma, vocal fold paresis/paralysis, spasmodic dysphonia, vocal fold edema, presbyphonia, laryngeal web) and functional/nonstructural (vocal pathologies did not have structural changes in the vocal fold; vocal fatigue,

aphonia, muscle tension dysphonia, dysphonia plica ventricularis, puberphonia, psychogenic dysphonia, tremors) and other (GERD/LPR) pathologies, the frequency of organic pathology was observed to be higher ( $n = 468$ ; 89.3%) than functional pathologies ( $n = 38$ ; 7.3%) and other ( $n = 18$ ; 3.4%).

Figure 1 shows the distribution of the G score for most frequently occurring voice pathologies (vocal nodules, vocal fold edema, vocal fold paralysis/paresis, vocal polyp, and sulcus vocalis). The degree of dysphonia severity was higher (G3) in the vocal fold paralysis/paresis group and lower for vocal fold edema.

**Gender and Vocal Pathology**

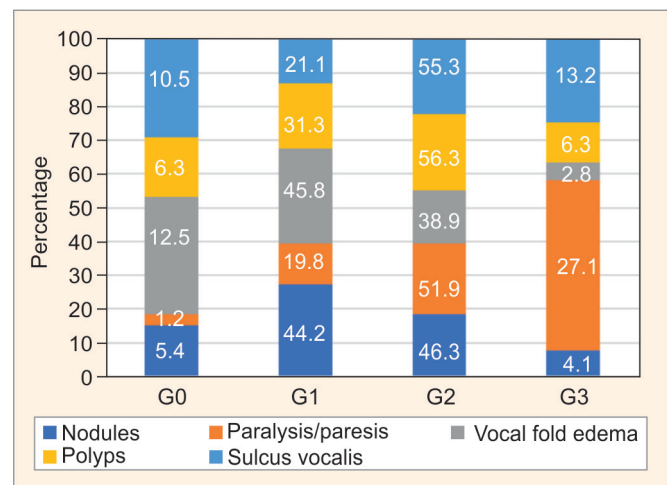
Further when the samples were analyzed in terms of gender, male dysphonic patients ( $n = 283$ ; 54%) outnumbered the females ( $n = 241$ ; 46%). The frequency of organic vocal pathology was observed to be higher in both genders which was 88% ( $n = 249$ ) and 90.9% ( $n = 219$ ), respectively, for men and women. Vocal nodules ( $n = 99$ ; 41.1%), vocal fold paresis/paralysis ( $n = 41$ ; 17%), vocal fold edema ( $n = 30$ ; 12.4%), vocal polyp ( $n = 32$ ; 6.1%), and sulcus vocalis ( $n = 16$ ; 6.6%) were the most frequently diagnosed vocal pathologies in women, whereas vocal nodule ( $n = 48$ ; 17%), vocal polyps ( $n = 23$ ; 8%), vocal fold paresis/paralysis ( $n = 40$ ; 14%), vocal fold edema ( $n = 42$ ; 14.8%), sulcus vocalis ( $n = 22$ ; 7.8%), and vocal fold scarring ( $n = 15$ ; 5.3%) were the most commonly diagnosed vocal pathologies among men (Table 2).

Fisher’s exact test revealed that the frequency of occurrence of vocal nodules was significantly higher among females ( $p \leq 0.001$ ) than males (Table 2), whereas the occurrence of vocal polyps ( $p = 0.013$ ) and contact ulcers ( $p = 0.021$ ) was significantly higher among males than females. Certain vocal pathologies like puberphonia ( $n = 10$ ; 3.5%), glottis carcinoma ( $n = 12$ ; 4.2%), hyperkeratosis/leukoplakia ( $n = 8$ ; 2.8%), contact ulcers/granulomas ( $n = 10$ ; 3.5%), and presbyphonia ( $n = 2$ ; 0.7%) were reported only in male population, whereas the diagnosis of psychogenic voice problems was found only in the female population ( $n = 4$ ; 1.7%).

The acoustic and aerodynamic parameters obtained for both genders shown in Table 3. Mann–Whitney *U* test did not show any significant difference between genders for acoustic and aerodynamic parameters except fundamental frequency and G

**Table 1:** Frequency and percentage of occurrence of different voice disorders ( $n = 524$ )

Vocal pathology	Frequency ( $n = 524$ )	Percentage
Vocal nodules	147	28.1
Vocal fold paralysis/paresis	81	15.5
Vocal fold edema	72	13.7
Sulcus vocalis	38	7.3
Vocal polyps	32	6.1
Vocal fold scarring	24	4.6
GERD/LPR	18	3.4
Laryngitis	17	3.2
Vocal cysts	16	3.1
Contact ulcers/granulomas	12	2.3
Glottic carcinoma	12	2.3
Puberphonia	10	1.9
Hyperkeratosis/leukoplakia	8	1.5
Muscle tension dysphonia	7	1.3
Dysphonia plica ventricularis	7	1.3
Spasmodic dysphonia	6	1.1
Aphonia	5	1.0
Vocal fatigue	4	0.8
Psychogenic dysphonia	4	0.8
Presbyphonia	2	0.4
Laryngeal web	1	0.2
Tremors	1	0.2



**Fig. 1:** Distribution of G scores across most common vocal according to dysphonia severity (G). G0, normal; G1, mild; G2, moderate; and G3, severe



**Table 2:** Distribution of vocal pathologies across genders

Vocal pathology	Gender		Statistics	
	Female (N = 241)	Male (N = 283)	$\chi^2$	p value
Vocal nodules	99 (41.1)	48 (16.9)	17.694	≤0.001
Vocal fold paralysis/paresis	41 (17)	40 (14.1)	0.012	0.912
Vocal fold edema	30 (12.4)	42 (14.8)	2	0.157
Sulcus vocalis	16 (6.6)	22 (7.7)	0.947	0.33
Vocal polyps	9 (3.7)	23 (8.1)	6.125	0.013
Vocal fold scarring	9 (3.7)	15 (5.3)	1.5	0.221
Laryngitis	6 (2.4)	11 (3.8)	1.471	0.225
Vocal cysts	6 (2.4)	10 (3.5)	1	0.317
GERD/LPR	6 (2.4)	12 (4.2)	2	0.16
Contact ulcers/granulomas	2 (0.8)	10 (3.5)	5.33	0.021
Aphonia	4 (1.6)	1 (0.3)	1.8	0.18
Vocal fatigue	3 (1.2)	1 (0.3)	1	0.317
Muscle tension dysphonia	3 (1.2)	4 (1.4)	0.143	0.705
Spasmodic dysphonia	1 (0.4)	5 (1.7)	2.667	0.102
Dysphonia plica ventricularis	1 (0.4)	6 (2.1)	3.571	0.059
Psychogenic dysphonia	4 (1.6)	0 (0.0)	—	—
Glottic carcinoma	0 (0.0)	12 (4.2)	—	—
Puberphonia	0 (0.0)	10 (3.5)	—	—
Hyperkeratosis/leukoplakia	0 (0.0)	8 (2.8)	—	—
Presbyphonia	0 (0.0)	2 (0.7)	—	—
Laryngeal web	0 (0.0)	1 (0.3)	—	—
Tremors	1 (0.4)	0 (0.0)	—	—

df = 1 for all Chi-square analysis and Fisher exact test. Statistically significant difference ( $p < 0.05$ )

**Table 3:** Acoustic and aerodynamic parameters between genders

Vocal parameters	Female	Male	Z value	p value
Acoustic voice parameters				
F0 (Hz)	213.06	152.41	-11.820	<0.001
Jitter %	2.6735	3.064	-0.991	0.322
Shimmer %	5.3115	5.6	-1.225	0.221
NHR	0.158	0.16	-0.068	0.946
Aerodynamic voice parameters				
MPD /a/ (second)	8	9	-1.619	0.105
MPD /i/ (second)	9	9	-0.941	0.347
MPD /u/ (second)	8	9	-0.591	0.555
s/z ratio	1.2	1.2	-0.507	0.612
Overall Grade score of GRBAS				
Grade (G)	1.54	1.69	-1.225	0.024

Statistically significant difference ( $p < 0.05$ ); MPD, maximum phonation duration

score. The perceived degree of dysphonia/hoarseness (G) of GRBAS (grade, roughness, breathiness, asthenia, strain) was found to be significantly higher in men compared to women.

### Age and Vocal Pathology

The age of the study population varied widely, ranging from 3 to 89 years, with a mean age of 41.6 (SD = 16.8) years. The subjects were classified into five age categories; 2–14 years, 15–24 years, 25–44 years, 45–64 years, and >65 years. The percentage of

patients distributed across different age range are as follows: 7.2% ( $n = 38$ ) in 2–14, 8.9% ( $n = 47$ ) in 15–24 years, 39.3% ( $n = 206$ ) in 25–44 years, 35.6% ( $n = 187$ ) in 45–64 years, and 8.8% ( $n = 46$ ) above 65 years. The majority of patients presenting vocal pathology were in the middle adulthood 25–44 years ( $n = 206$ ; 39.3%), followed by patients in late adulthood 45–64 years ( $n = 187$ ; 35.6%) (Table 4). Further analysis revealed the percentage of female patient's was higher in the age range of 25–44 years ( $n = 126$ ; 24%) compared to male patients ( $n = 80$ ; 15.2%), whereas percentage of male patient's was higher ( $n = 114$ ; 21.7%) than females ( $n = 73$ ; 13.9%) between 45 and 64 years. Vocal nodules were the most common vocal pathology in females from 2 to 64 years, vocal fold paralysis and vocal fold edema between 25 and 64 years. Among male patients, vocal nodules remained common vocal pathology between 2 and 64 years, polyps between 25 and 64 years, vocal fold paralysis between 25 and 64 years, vocal fold edema between 25 and 64 years and glottic carcinoma between 45 and 64 and over 65 years. GERD/LPR is diagnosed at a higher rate in males (12/18) compared to females (6/18) between 25 and 64 years.

### Occupation and Vocal Pathology

The total sample included 54 different occupations. The most common occupations seeking help for voice problems were; homemaker, student, teacher, business, farmer, retired, singer, and laborer. Table 5 displays the number of occupations and the number of people in each occupation who visited the voice clinic for voice problems.

**Table 4:** Occurrence of vocal pathology by different age-groups

Vocal pathology	2-14 years		15-24 years		25-44 years		45-64 years		>65 years		Total	
	M	F	M	F	M	F	M	F	M	F	M	F
Vocal nodules	15	11	3	10	11	57	16	20	3	1	48	99
Vocal fold paralysis/paresis	0	0	3	2	10	14	19	22	8	3	40	41
Vocal fold edema	3	1	5	1	14	17	16	11	4	0	42	30
Sulcus vocalis	1	0	4	4	5	7	6	4	6	1	22	16
Vocal polyps	0	0	1	0	11	4	9	4	2	1	23	9
Vocal fold scarring	1	1	0	0	7	6	7	2	0	0	15	9
Laryngitis	2	0	2	1	1	4	5	1	1	0	11	6
Vocal cysts	2	0	0	0	4	4	3	2	1	0	10	6
GERD/LPR	0	0	0	3	4	0	7	3	1	0	12	6
Contact ulcers/granulomas	0	0	0	1	3	1	6	0	1	0	10	2
Aphonia	0	0	0	0	1	3	0	1	0	0	1	4
Vocal fatigue	0	0	1	0	0	3	0	0	0	0	1	3
Muscle tension dysphonia	0	0	0	0	1	3	3	0	0	0	4	3
Spasmodic dysphonia	0	0	0	0	0	0	3	1	2	0	5	1
Dysphonia plica ventricularis	0	0	0	0	0	0	5	1	1	0	6	1
Presbyphonia	0	0	0	0	0	0	0	0	2	0	2	0
Glottic carcinoma	0	0	0	0	0	0	6	0	6	0	12	0
Puberphonia	1	0	6	0	3	0	0	0	0	0	10	0
Hyperkeratosis/leukoplakia	0	0	0	0	4	0	0	0	1	0	8	0
Psychogenic dysphonia	0	0	0	0	0	0	0	1	0	0	0	4
Laryngeal web	0	0	0	0	1	0	0	0	0	0	1	0
Tremors	0	0	0	0	0	0	0	0	0	1	0	1

**Table 5:** Distribution of data based on occupation

Occupation	Frequency	Percentage
Homemaker	107	20.4
Student	80	15.3
Teacher	77	14.7
Business	37	7.1
Farmer	32	6.1
Retired	29	5.5
Singer	13	2.5
Laborer	13	2.4
Unemployed	10	1.9
Tailor	10	1.9
Shopkeeper	9	1.7
Priest	8	1.5
Driver	8	1.5
Factory worker	8	1.5
Fisherman	6	1.1
Engineer	5	1.0
Vendor	5	1.0
Clerk	4	0.8
Cashier	4	0.8
Bus conductor	4	0.8
Contractor	4	0.8
Salesman	3	0.6
Police	3	0.6

(Contd...)

**Table 5:** (Contd...)

Occupation	Frequency	Percentage
Construction worker	3	0.6
Mechanic	3	0.6
Caterer	3	0.6
Waiter	3	0.6
Cook	2	0.4
Electrician	2	0.4
Politician	2	0.4
Nurse	2	0.4
Carpenter	2	0.4
Medical representative	1	0.2
Marketing manager	1	0.2
Prosecutor	1	0.2
Bank employee	1	0.2
Health inspector	1	0.2
Pharmacist	1	0.2
Curator	1	0.2
Doctor	1	0.2
Municipality worker	1	0.2
Counsellor	1	0.2
Fitness instructor	1	0.2
Anganwadi worker	1	0.2
Agriculture officer	1	0.2
Computer operator	1	0.2
Loco pilot	1	0.2



Photographer	1	0.2
Lineman	1	0.2
Painter	1	0.2
Beutician	1	0.2
Lab technician	1	0.2
Press worker	1	0.2
Hotel manager	1	0.2
Accountant	1	0.2

Further, the data distribution were analyzed for the most frequently appearing vocal pathologies (>5% of the total sample) and the occupations associated with them (Table 6).

As shown in Table 6, vocal nodule and edema were more evident in teachers, students, and homemakers. Vocal fold paralysis more evident in homemaker, retired, and farmers. Sulcus vocalis was evident among students and homemakers whereas vocal polyps were evident among homemakers and business people.

## DISCUSSION

The present study conducted retrospective analysis (5 years data) of the dysphonic population who visited the voice clinic of the Department of Speech and Hearing for voice assessment/therapy in a tertiary care hospital. The study identified 22 different types of dysphonia, which were further analyzed based on the population's age, gender, and occupational status. The data collection were restricted for the past 5 years as most patient records were discarded beyond 2015.

### Prevalence of Vocal Pathology

Out of 22 different vocal pathologies, structural vocal pathologies (89%) were found to be more common than the nonstructural vocal pathologies (7%) in consonance with the findings of De Bodt et al.,<sup>4</sup> which could be attributed to a lack of awareness about early signs of vocal dysfunctions and their treatments. Few studies have reported that despite the adverse impact of dysphonia, only a minimal percentage of people seek evaluation and treatment in the early stages. Structural vocal pathologies increase the degree of dysphonia and psychosocial impact.<sup>11,17-20</sup> These factors could be the possible reason for the higher percentage of structural pathology identified in the present study.

Vocal nodules (28.1%), vocal fold paralysis/paresis (15.5%), vocal fold edema (13.7%), sulcus vocalis (7.3%), and vocal polyps (6.1%) were the most common (those occurred in more than 5% of the patients) diagnosis observed for the overall samples which are consistent with previous studies in the literature.<sup>3,4,11,16</sup> The prevalence of vocal nodules (28.1%) identified in the present study is higher than other studies reported in the literature,<sup>3,8,16</sup> which could be attributed to the higher representation of homemakers, teachers, and students in the current study, who are reported to be more vulnerable to have vocal nodules.<sup>6,8,16</sup> Further, the prevalence of vocal fold paralysis/paresis was 15.5%, which is similar to findings reported by (14.4%) De Bodt et al.<sup>4</sup> As shown in Figure 1, a significant number of patients with vocal fold paralysis rated having severe dysphonia (G3), which would have had a significant impact on their quality of life which could be the possible reason for a higher number of populations with vocal fold paralysis

**Table 6:** Most common vocal pathologies and associated occupations (N >5)

Occupation	Vocal nodule	Vocal fold		Sulcus vocalis	Vocal polyp
		paresis/paralysis	edema		
Student	36	0	11	7	0
Teacher	34	0	18	0	0
Homemaker	31	31	11	6	6
Factory worker	7	0	0	0	0
Businessman	6	7	6	0	6
Singer	5	0	0	0	0
Retired	0	9	0	0	0
Farmer	0	8	7	0	0

seeking the treatment. Vocal fold edema (13.7%) is another most common diagnosis that appeared in the present study, which is at par with the findings of (14.1%) Herrington-Hall et al.<sup>16</sup> and (14%) De Bodt et al.<sup>4</sup> Several reasons for vocal fold edema are quoted in the literature, such as vocal abuse, excessive voice use, smoking, alcohol consumption, laryngopharyngeal reflux, dehydration, etc. In the present study, vocal fold edema was prevalent among teachers (n = 18), homemakers (n = 11), and students (n = 11). Even though the present study did not collect information on potential causative factors, literature reports vocal edema is common vocal pathology in teachers, homemakers, and students due to vocal abuse or excessive voice use. It can be assumed that vocal fold edema leads to throat irritation, frequent throat clearing, and change in voice quality (rough/hoarse), all these factors would have facilitated them to seek treatment. Similarly, seeking treatment for vocal polyps and sulcus vocalis was found to be higher in the present study, which may be attributed perception of severe hoarseness/diplophonia secondary to glottis insufficiency and absence of mucosal wave, in consonance with the literature.<sup>21</sup>

### Gender and Vocal Pathology

The majority of the studies in the past have identified that females outnumber males in treatment-seeking population.<sup>3,4,8,16,22</sup> However, in the present study, male (n = 283; 54%) outnumbered females (n = 241; 46%) in seeking treatment for voice problems, contradicting the findings in the literature.<sup>3,4,8,16,22</sup> Analysis of the diagnosis of vocal pathology between two genders (Table 2) shows that men experienced certain vocal pathologies like sulcus vocalis, vocal polyps, vocal fold scarring, laryngitis, vocal cysts, GERD/LPR, glottis carcinoma, hyperkeratosis/leukoplakia at a higher rate than women and these vocal pathologies said to have a severe impact on quality of voice. To supplement this notion, the present study found a significantly higher "G" score (overall degree of hoarseness) on the GRBAS scale in male than females. Thus, it could be postulated that a severe degree of hoarseness is one reason for a higher number of males seeking voice evaluation and treatment; however, the exact reason for this trend is unknown. Thus, there is a need to investigate further the self-perception about voice problem and attitudes towards seeking medical help for voice problems between the genders.

Further, our study confirms the reports of previous research that women are more vulnerable to vocal nodules than men and men are more vulnerable to vocal polyps and contact ulcers than women.<sup>3,4,8</sup> Higher frequency of vocal fold vibration<sup>23</sup> and lesser concentration

of hyaluronic acid<sup>24–26</sup> in females have been attributed to the higher prevalence of vocal nodules. Hirano<sup>27</sup> explained that lower pitch phonation exacerbates more stress on the deeper portion of the lamina propria and ruptures the blood vessels, leading to hemorrhage. This could be the possible reason for the occurrence of vocal polyps at a higher rate in men than women. In addition, contact ulcers/granuloma appeared higher in males in the current study. Due to collision trauma, contact ulcers/granuloma appear on the vocal process of the arytenoid cartilage, where the vocal process of arytenoid cartilage reported to be larger in men than women. Hence, the lower pitch phonation in men leads to a greater approximation of the vocal fold and vocal process, increasing the potential risk to develop contact ulcers/granuloma.<sup>3,28–30</sup> Apart from this, contact ulcers/granuloma may also occur secondary to GERD/LPR,<sup>31,32</sup> which is found to be higher in males than females in the current study. The occurrence of certain vocal pathologies like glottic carcinoma (4.2%), hyperkeratosis/leukoplakia (2.8%), and presbyphonia (0.7%) was found only in men, which is consistent with past studies.<sup>4,22</sup> Hyperkeratosis/leukoplakia and glottis cancer are associated with smoking,<sup>33</sup> which could be the probable reason for finding these vocal pathologies only in men. Diagnosis of presbyphonia was higher in males in the present study, consistent with the literature.<sup>3,4</sup> However, the reason for this is less apparent. Further, in the present study, diagnosis of psychogenic dysphonia was found only in women. Studies have shown that psychogenic dysphonia is usually associated with emotional conflicts, anxiety, and depression, and women are reported to be vulnerable to emotional conflicts as they need to maintain a balance between their domestic and professional lives.<sup>8,16,22,34</sup>

### Age and Vocal Pathology

The age range of the population in the present study was between 3 and 89 years, with a mean age of 41.6 years. Population seeking treatment for dysphonia was prominent between 25 and 64 years compared to 2–24 years and >65 years, consistent with other study reports.<sup>3,4,8,20,35,36</sup> The elderly population is less likely to seek treatment for voice problems, and the reasons quoted are that elderly people are unaware of the treatment options, and they view dysphonia as a normal aspect of aging.<sup>37</sup> In the current study, vocal nodules were highly prevalent between 2 and 14 years (Table 4) of age in both genders, attributed to phonotraumatic behaviors, consistent with findings in the literature.<sup>4,8,16,22</sup> In the current study, diagnosis of vocal fold paralysis was highest in the middle (4.5%) and late (7.8%) adulthood (25–64 years) than older adults, >65 years (2%). The reason for this finding is less clear and not consistent with previously reported studies where the diagnosis of vocal fold paralysis increased with an increase in age.<sup>4,8,16,22</sup> However, Cantarella et al.<sup>38</sup> reported that vocal fold paralysis secondary to thyroidectomy is more common in the middle and late adulthood populations. Hence, future studies should gather information on risk factors for vocal cord paralysis.

### Occupation and Vocal Pathology

In the present study, homemakers (20.4%) appeared as the most common occupation seeking help for voice problem, followed by students (15.3%), teachers (14.7%), businessman (7.1%), farmer (6.1%), and retired people (5.5%). Homemakers are more prone to phonotraumatic behaviors and emotional conflicts that are presumed to underlie psychogenic vocal pathology between 20

and 50 years.<sup>16,22</sup> Out of 99 vocal nodule cases, 31% of the cases were homemakers, which may be attributed to child-rearing and psychogenic factors.<sup>16</sup>

Certain vocal behaviors such as vocal overuse and loud talking/screaming are commonly reported in teachers and student communities, which contribute to the development of vocal nodule or polyp.<sup>22</sup> In the present study, 70% of the vocal nodules were diagnosed among teachers (36%) and students (34%). This could be the possible reason for the student community to appear as the second and teachers as the third most common occupation seeking help for voice problems in the present study. Business people appeared as the fourth most common occupation in the treatment-seeking population. Individuals in this occupation need to communicate with customers in high background noise, increasing vocal intensity, causing vocal trauma, leading to vocal fold edema, vocal nodules, etc. The farmers emerged as one of the top five occupations seeking help for voice-related problems in the present study, which is not considered a high-risk occupation for voice problems in other studies. In the current study, out of 32 farmers, 8 had vocal fold paralysis, and 7 had vocal fold edema as major vocal pathologies. Farmers may be more prone to allergic reactions as they are exposed to dust or pesticides, leading to dry cough and vocal fold edema and voice problems.

Similar to the findings of other studies,<sup>4,16</sup> retired people appeared as one of the most common occupation seeking medical help for voice problems in the present study. Most of them experienced age-related vocal pathologies such as vocal fold paralysis ( $n = 9$ ), glottis carcinoma ( $n = 5$ ), sulcus vocalis ( $n = 3$ ), and spasmodic dysphonia ( $n = 3$ ), which could be the reason for seeking treatment more frequently.

### CONCLUSION

The outcome of the present retrospective study analyzed the most common vocal pathologies, age of occurrence, and most common occupations seeking treatment for voice problems. Prevalence of voice problems observed higher in men as compared to women, and structural pathologies were more prevalent than the non-structural pathologies. Vocal nodule, vocal fold paralysis, vocal fold edema, sulcus vocalis, and vocal polyp occurred more frequently (>5% of the total sample) in treatment-seeking population. Vocal nodules were the common diagnosis in the pediatric population, vocal fold nodule, and psychogenic voice problems were more prevalent among women and vocal polyp, glottic carcinoma, hyperkeratosis/leukoplakia, contact ulcers/granuloma, presbyphonia, and puberphonia were more prevalent in men. Men had a significantly higher degree of perceived hoarseness ("G" score of GRBAS) than women. Most of the vocal pathologies were more prevalent above 15 years of age. Homemakers, students, teachers, businessman, farmer, and retired people were the most common occupations seeking treatment for voice problems.

Future studies are needed to determine causes, voice characteristics and impact of voice problems to design effective treatment strategies. Large-scale studies in multiple centers can be conducted for every decade to understand the developments in the diagnostic methods and the relative shift in the prevalence of vocal pathology with respect to gender, age, and occupation, which in turn will help the professionals to develop appropriate vocal hygiene and other forms of preventive strategies.

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