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Occupational groups at risk of voice disorders: a review of the literature

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Background	Occupational voice health is becoming more important as more people rely on their voices for their work. A number of studies have identified certain occupational groups at increased risk of developing occupational voice disorders, namely teachers, singers and aerobics instructors.
Aim	The paper aims to review the literature on occupational groups at risk of voice disorders and identify areas for future research.
Method	A literature review of key databases using key words such as 'occupational', 'voice health', 'voice loss', 'dysphonia' and 'work related' was undertaken.
Results	The review identified case reports, studies of attendees at hospital voice clinics and a few cross-sectional studies of occupational groups in the workplace. There were no longitudinal studies found or intervention studies looking at reduction of risk.
Conclusion	Further research on occupational voice disorders needs to be based in the workplace, and to look at the risk factors for the development of voice problems and for the efficacy of controls.
Key words	Occupational groups; occupational voice disorder; risk; singers; teachers.
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Introduction

Excessive use or abuse of the voice at work can lead to symptoms of soreness, hoarseness, weak voice, sore throat and aphonia. It has been suggested that some groups such as teachers and singers are more at risk of developing vocal disorders than others. This paper reviews the literature which has identified the occupational groups most at risk of voice disorders and also examines some of the factors which may affect presentation in hospital clinics for voice malfunction.

Method

The literature review utilized the following databases:

- MEDLINE
- NIOSHTIC
- CISDOC
- HSELINE
- MEZZ
- EMZZ
- PsycINFO
- ERGONOMIC ABSTRACTS ONLINE
- COCHRANE CONTROLLED TRIALS REGISTER

Data were from the years 1966–2000. The key words used to search the databases, either in combination or singly, were:

- occupational
- voice health
- voice loss
- dysphonia
- work related

Occupational populations at risk

American studies estimate that ~25% of the American working population consider voice use a critical aspect of their job, and so for a large section of the working population the prevention of occupational voice disorders

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is essential [1]. Unfortunately, there are no comparable figures available in the literature for the UK.

Within the general population of America, 3–9% of people report a voice abnormality at any one time [2]. Work on background prevalence in the general population has suggested rates varying between 0.65% [3] and 15% [4]. However, these two studies are not reflective of the general working population as they are of selected groups. In the study by Morely [3], the participants were students and so the low prevalence rate could have been due to either the low frequency of the condition or the young age of the respondents. In the Laguaite study [4], the frequency of symptoms varied depending on whether the diagnosis was that of an expert's perception of the problem (7%) or the voice problem was self-reported (15%). As a higher prevalence of voice problems has been reported in the elderly previously [5], the inclusion of elderly subjects in Laguaite's study may also have been a factor in finding higher rates of symptoms.

Groups such as teachers and singers have been extensively studied, and have been reported to have higher frequencies of voice disorders than the general population [6]. For these groups of workers, voice impairment can be employment threatening as voice use is a critical component of their job.

Within the UK, we are currently unable to assess the scale of the problem. The reason for this is that the UK occupational disease recording system—the Occupational Physicians Reporting Activity (OPRA)—has no reported cases of voice disorder in any occupation, preventing calculations of frequency within working populations (OPRA, personal communication). However, throughout the world, a number of surveys have been carried out on working populations to establish the prevalence and incidence of voice disorders for specific occupational groups and to make comparisons between them.

Two large studies, one in Sweden [7] and the other in the USA [8], attempted to establish the relative frequency of various occupations attending voice clinics and compare them to the general population. They made the presumption that a greater representation of a particular occupation in the clinical caseload means a greater risk for the occupation to cause an occupational voice disorder.

In the Swedish study, Fritzell [7] examined 1212 patients of working age, who were attending eight voice clinics across the country over a 6 month period between 1992 and 1993.

In the American study, Titze *et al.* [8] identified 174 adults attending two voice clinics between 1991 and 1993. In both studies, the frequency of symptoms in a particular occupational group was determined and compared with the number of overall workers in the country also following that profession.

Table 1. Pooled results from the US and Swedish studies on occupations at risk of voice disorders

	% in population	% of clinic attendees
Salespersons	13	10
Telesales	0.78	2.3
Factory workers	14.5	5.6
Clerical workers	10.6	8.6
Teachers	4.2	19.6
Counsellors	0.19	1.6
Singers	0.02	11.5

Source: [6].

The results are shown in Table 1.

When the results of the two studies were combined, they suggested that the occupation 'singer' is at greatest risk followed by counsellor/social worker, teacher, lawyer, clergy, telemarketeer, ticket reservation/travel agent and health care worker. Of particular interest is the salespersons' subgroup 'telesales', as it is these who are most likely to be working in call centre environments reading pre-prepared scripts.

Whilst a high frequency of voice disorders in singers is relevant, the most interesting findings from the public health perspective are those occupations which employ large numbers of workers. 'Teacher' was the commonest 'at risk' occupation attending the clinics, and across the two studies was four times more commonly represented clinically than in the population at large.

Teachers

The prevalence of voice problems in teachers depends on whether it is based on objectively diagnosed vocal cord pathology, estimated to have a prevalence rate of 4.4% [9], or subjective self-reported vocal dysfunction, which has been found to be as high as 90% [10].

Considering teachers as a specific occupational group, Smith *et al.* [11] analysed 242 respondents employed as primary and secondary school teachers in America. No response rate was given, but only 5% did not return questionnaires due to their absence on day of collection. They compared the frequency of voice problems with those of individuals in other occupations. They found that teachers were more likely to have a voice problem (15 versus 6%), covering 10 specific voice symptoms and five physical symptoms of discomfort. In particular, 47.5% of teachers complained of hoarseness compared with 21.3% of controls, and teachers averaged almost two symptoms compared with non-teachers. Over 20% of teachers but 0% of non-teachers reported time lost from work because of voice problems. For 4.2% of teaching respondents, the voice problem was significant enough for them to consider a change of occupation. Similar findings were

found in a study by Russell *et al.* [12] of Australian teachers and by Sapir *et al.* [13], who found that more than one-third of teachers with voice problems missed work as a result. The high frequency of lost time from work and decisions regarding change of occupation are a worrying trend from a public health and societal perspective.

One American study, conducted in Iowa by Smith *et al.* [14], looked at 554 teachers (274 males and 280 females) and found that of the 554 respondents, >38% reported that teaching negatively affected their voice and 39% reported having difficulty with teaching lessons because of voice problems. Female teachers reported more frequently than male teachers (38 versus 26%, respectively, $P < 0.05$), both acute ($P < 0.05$) and chronic ($P < 0.05$) voice problems. There were no gender differences in the perception that a voice problem adversely affected their current or future teaching career. Females had a higher probability of reporting voice problems compared with men (odds ratio = 1.7–2.1). Teaching physical education presented the highest risk of voice disorder, independent of gender, hours of teaching per day, numbers of years teaching or age. In contrast, another study by Smith *et al.* [15] of 554 high school teachers and 220 controls found that teachers were more likely than controls to define themselves as having a voice problem (36 versus 1%, $P < 0.05$), having a weak or effortful voice ($P < 0.05$), and having a higher frequency of physical discomfort with speaking ($P < 0.05$). One reason for this finding may be because teaching is such a vocally demanding occupation that even a minor impairment is noted.

Only one study tried to identify environmental and ergonomic risk factors for voice disorders in teachers, that of Preciado *et al.* [16]. This study described the finding of more prevalent symptoms in females rather than males (19.3 versus 15.6%), as in other studies, and identified that teachers in lowest grades were at increased risk. Numbers of teachers complaining of voice problems were highest in nursery and elementary teachers, and lowest in junior schools (36.4 versus 25 versus 20.8%). Other factors associated with an increased frequency of vocal disorders were the physical size of the classroom, larger student numbers, longer classroom hours and higher noise levels.

Despite many authors concluding that the teaching profession is of high risk for occupational voice disorders, Mattiske *et al.* [17] reviewed many of the published papers and expressed the view that the evidence is inconclusive, due to the nature of the studies and lack of statistical control.

Singers

Self-reported voice problems in singers have been described in several studies. Miller and Verdolini [18] assessed the frequency of self-reported voice problems in singing teachers. They looked at a 10% sample of the membership of the National Association of Teachers of Singing in the USA. Participants were randomly selected and stratified in terms of geographical location within the country. Each recipient also received a similar questionnaire for a friend or colleague who was not a singer. In total, 125 singers and 49 controls completed the questionnaires, and the results indicated that 21% of singing teachers and 18% of controls perceived that they currently had a voice problem (a non-significant difference); however, 64% of teachers and only 33% of controls also reported a voice problem in the past. Risk factors for the teachers and controls included a history of past voice problem, which increased the risk of a current voice disorder by a factor of 5, while current use of specific dehydrating medications increased the risk by a factor of 3. Female gender and a younger age (in contrast to older age in the studies of Laguite [4]) also increased the risk. Sapir *et al.* [13] conducted a survey of 79 university voice students, 74 (95%) of whom completed the questionnaire: 13% were symptom free, 26% had few (i.e. one or two) symptoms and 61% had multiple (>3) symptoms. Thirty-five (46%) had sought medical help. Students with multiple symptoms were more likely to be depressed, anxious, frustrated and worried about missing performances, foregoing auditions and speaking in too low in pitch. Perkner *et al.* [19] compared three types of singer—opera, musical theatre and contemporary (not rock) singers—with 'friendship' controls. They found a significant increase in voice disorders (44 versus 21% in controls) and voice disability (69 versus 41% in controls) in the singers, but no difference was found between the different styles of singer.

Perception of voice problems is an important area, as virtually all of the published research relies upon either cross-sectional self-reported symptoms on questionnaires in occupational populations or in attendees at voice clinics. Kitch and Oates [20] reported on a self-reported survey of the effects of vocal fatigue in actors and singers and compared the two groups. Actors, when vocally fatigued, rated the 'power' aspects of their voice as most affected whereas singers rated the 'dynamic' features as most affected. This study was important in highlighting the need to consider the impact of a voice problem in affecting individuals in different ways and potentially causing different degrees of disability depending on the work task involved. Further work on perception of voice problems was undertaken by White and Verdolini [21], who looked at differences in presentation for medical treatment.

Voice clinics in America were used to look at gospel singers. Researchers found that African American singers were more likely than Caucasians to be influenced by

what others thought about attending for medical help. In contrast, Caucasian singers sought help if they thought their own voice was affected. This has implications for research involving medical voice clinic attendees, as clearly there are socio-societal and cultural influences on presentation behaviour that suggest populations attending clinics may show bias compared with the general population.

Aerobics instructors

A number of reports have recently appeared in the literature describing voice problems in aerobics instructors. The demands of the job require verbal instructions to be given to clients at the same time as performing often strenuous exercise. This makes control of breathing and airflow movement more difficult. Many instructors use microphones and particularly radio microphones to reduce the amount of vocal projection necessary in large dance studios, but the acoustics are often such that coordination is still necessary, and there can be significant demands placed on young and inexperienced voices.

Long *et al.* [22] conducted a 35-item personally delivered questionnaire on 54 aerobics instructors in Alabama, USA. The 50 females and four males had a 100% response rate. Their average age was 34.1 years, and the average time of teaching aerobics was 4.9 years. Twenty-four subjects (44%) reported experiencing voice loss and 23 (42.6%) reported partial loss when instructing a class or afterwards. Overall, the results showed a significant number of instructors experienced voice loss and episodes of hoarseness. Sore throats unrelated to illness were also increased in the group, related to following instruction and shouting cues to clients. The study also identified that very few instructors had had any training in vocal hygiene techniques. This study found no effect of microphone use, but the authors commented that the finding may have been due to the availability of and access to such equipment and the pre-established habits of the instructors. Previous research on aerobics instructors by Heidel and Torgerson [23] has shown that aerobics instructors experienced an increase in symptomatology in cold weather, and this earlier work also confirmed the increased risk for this occupational group.

The occupation, however, needs to be looked at holistically. Work in Japan not only confirmed laryngeal discomfort, but also identified leg and calf pain, which was significantly related to the number of dance classes per week [24]. An ergonomic approach looking at all aspects of repetitive behaviours is thus needed to prevent occupational injury in this group.

Cheerleaders

The vocal behaviour of cheerleaders has also been reported as putting them at risk of voice cord pathology [25]. Investigations on cheerleaders have indicated that they have a number of characteristics similar to aerobics instructors. These are: vocalization whilst exercising, pyknic or athletic body type, display of 'hyperkinetic movements of phonation' and a tendency to develop vocal nodules. Cheerleaders have also been found to suffer from excessive and more frequent hoarseness [26].

Some researchers, such as Campbell *et al.* [27], have argued that it is possible to set up a protocol based on history and clinical symptoms to screen potential cheerleaders for those likely to develop problems; however, this does not seem to have been taken up, as the implementation of such a system has not been reported in the literature.

Conclusion

Overall, the quality of studies identified is highly variable and even the best are often not controlled and lack statistical rigour. This means that caution is needed in attributing voice disorders definitively to occupation. The literature does identify several occupational groups potentially at risk of voice disorders. Teachers, singers, actors, cheerleaders and aerobics instructors figure prominently, but the studies are almost always cross-sectional rather than prospective, and many are without controls. Other case reports of occupational hoarseness, e.g. in obstetricians [28], have been published, but the literature contains no general data that can provide a background prevalence of hoarseness, sore throat, etc. in working and non-working populations, and so any estimation of increased prevalence in any one occupational group is not conclusive. The literature did, however, identify important potential biases in studies involving clinic attendees, whose presentation for treatment also depends on their perception of a voice problem. It is likely that the existence of a voice problem, of whatever cause, and its impact on their ability to do their job are also factors in determining presentation for diagnosis and treatment. Such findings mean that caution is needed in interpreting studies that seek to suggest that, because a particular occupational group makes up a large proportion of attendees at a clinic, the condition is found frequently among that occupational group. It may also reflect several factors, including the difficulties those individuals have in performing their usual job.

Another feature of the literature is the tendency to use generic job titles. Only two studies tried to differentiate between individuals within the title 'teachers' and 'singers'. The former found a higher reporting frequency of problems in physical education teachers and the latter commented on there being no difference in reported symptoms when three types of singer (opera, musical theatre and contemporary) were compared.

Future research needs to accurately describe the work undertaken and ways of measuring 'dose' or voice usage. Prospective and well-controlled studies are also needed to accurately define the relationship between work tasks and voice disorders.

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