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THE INDUSTRIAL INJURIES ADVISORY COUNCIL

POSITION PAPER 16

OCCUPATIONAL VOICE LOSS

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Occupational Voice Loss

SUMMARY

- 1.** This paper is concerned with the risk of voice loss in those employed in occupations requiring high levels of voice use. Requests have been received by the Industrial Injuries Advisory Council (IIAC) to consider the terms of prescription in relation to this outcome in occupational groups which may be at risk.
- 2.** In response to these requests a targeted review of the scientific literature was carried out by the Council's librarian and the literature was examined by members of the Council's scientific sub-committee, the Research Working Group (RWG). The Council also consulted two independent scientific experts in the field of voice loss and other vocal disorders.
- 3.** Vocal problems, including voice loss, have been studied in a number of occupational groups, notably teachers, telemarketing staff and those involved in certain performance arts.
- 4.** It was noted however, that vocal problems may occur as a result of a number of events or disorders and it is not possible to identify a condition with unique clinical features which is specifically associated with prolonged heavy vocal use or which occurs in a particular occupational group or groups.
- 5.** In addition, there is an absence of good quality epidemiological data to indicate a doubling of risk of voice loss or vocal problems as a result of any particular type of work. Although a number of studies have been published these lack a consistent or objectively verifiable definition of the condition or of the exposure.
- 6.** It was concluded, therefore, that current evidence for occupational voice loss is insufficient to meet the requirements for prescription. However, this is a relatively new and developing area of research and the emerging literature will be kept under review.

INTRODUCTION

The Industrial Injuries Disablement Benefit scheme

1. The Industrial Injuries Advisory Council (IIAC) is an independent statutory body established in 1946 to advise the Secretary of State for Social Security on matters relating to the Industrial Injuries Disablement Benefit scheme. The major part of the Council's time is spent considering whether the list of prescribed diseases for which benefit may be paid should be enlarged or amended.
2. The Industrial Injuries Disablement Benefit (IIDB) scheme provides a benefit that can be paid to an employed earner because of an industrial accident or Prescribed Disease (PD).

The legal requirements for prescription

3. The Social Security Contributions and Benefits Act 1992 states that the Secretary of State may prescribe a disease where he is satisfied that the disease:
 - i. ought to be treated, having regard to its causes and incidence and any other relevant considerations, as a risk of the occupation and not as a risk common to all persons; and
 - ii. is such that, in the absence of special circumstances, the attribution of particular cases to the nature of the employment can be established or presumed with reasonable certainty.
4. In other words, a disease may only be prescribed if there is a recognised risk to workers in an occupation, and the link between disease and occupation can be established or reasonably presumed in individual cases.
5. In seeking to address the question of prescription for any particular condition, the Council first looks for a workable definition of the disease. Then it searches for a practical way to demonstrate in the individual case that the disease can be attributed to occupational exposure with reasonable confidence. For this purpose, reasonable confidence is interpreted as being based on the balance of probabilities according to available scientific evidence. If the condition might result from occupational exposure in the absence of an identifiable accident, the Council must consider whether it should be included in the list of diseases that are prescribed for benefit purposes. In these circumstances, it may be possible to ascribe a disease to a particular occupational exposure in two ways – from specific clinical features of the disease or from epidemiological evidence that the risk of disease is at least doubled by the relevant occupational exposure.

Clinical features

6. For some diseases attribution to occupation may be possible from specific clinical features of the individual case. For example, the proof that an individual's dermatitis is caused by his occupation may lie in its improvement when he is on holiday, and regression when he returns to work, and in the demonstration that he is allergic to a specific substance with which he comes into contact only at work. It can be that the disease only occurs as a result of an occupational hazard (e.g. coal workers' pneumoconiosis).

Doubling of risk

7. Other diseases are not uniquely occupational, and when caused by occupation, are indistinguishable from the same disease occurring in someone who has not been exposed to a hazard at work. In these circumstances, attribution to occupation on the balance of probabilities depends on epidemiological evidence that work in the prescribed job, or with the prescribed occupational exposure, increases the risk of developing the disease by a factor of two or more. The requirement for, at least, a doubling of risk is not arbitrary. It follows from the fact that if a hazardous exposure doubles risk, for every 50 cases that would normally occur in an unexposed population, an additional 50 would be expected if the population were exposed to the hazard. Thus, out of every 100 cases that occurred in an exposed population, 50 would do so only as a consequence of their exposure while the other 50 would have been expected to develop the disease, even in the absence of the exposure. Therefore, for any individual case occurring in the exposed population, there would be a 50% chance that the disease resulted from exposure to the hazard, and a 50% chance that it would have occurred even without the exposure. Below the threshold of a doubling of risk only a minority of cases in an exposed population would be caused by the hazard and individual cases therefore could not be attributed to exposure on the balance of probabilities. The epidemiological evidence required should ideally be drawn from several independent studies, and be sufficiently robust that further research at a later date would be unlikely to overturn it.

BACKGROUND TO THE REVIEW

8. Concerns about occupational voice loss were highlighted in an article published in the autumn 2004 edition of the Trades Union Congress (TUC) publication, 'Hazards'. This article drew attention to concerns expressed by members of the Royal College of Speech and Language Therapists who have noted that an increasing number of teachers are seeking help for voice disorders which they attribute to the demands of their work. 'Hazards' also noted that a number of other occupations, involving large numbers of staff, might be at increased risk of these disorders. These occupations include call-centre staff, salespersons of various types, journalists and other communication workers, military drill sergeants, receptionists, advice workers, barristers and preachers.
9. Attention was also drawn in this article to an Appeal Tribunal's decision to award Industrial Injuries Disablement Benefit to an appellant who had developed nodules on her vocal chords, affecting her voice. Although voice loss is not included in the schedule of prescribed occupational diseases, her condition was regarded as having arisen as a result of a series of specific events and thus she was awarded benefit under the accident provisions of the scheme.
10. Following the publication of the article, IIAC received three separate enquiries about occupational voice loss, including a representation from a Member of Parliament following correspondence with a constituent who had been unsuccessful in an application for IIDB in respect of voice loss. The constituent felt that permanent damage to her voice had resulted from vocal strain in her employment occurring over many years. She was informed that her condition did not fall within the category of a prescribed industrial disease and she requested, therefore, that consideration should be given to the inclusion of occupational voice loss in the list of prescribed diseases.
11. This matter was discussed at the meeting of IIAC's RWG in November 2004. It was noted that a preliminary review of the evidence, carried out by IIAC's Medical and Scientific Secretary and Scientific Advisor, indicated that the literature on this subject was unlikely to provide sufficient evidence for prescription. However, it was agreed that a full review of the evidence should be placed on the future agenda of the RWG.

Voice production and voice disorders

12. The vocal system is complex and although the main source of the voice is the larynx, phonation (voice production) occurs as a result of the interaction of a number of body organs and systems. The lungs provide the air that passes between the vocal folds and the diaphragm generates inspiratory force. In voice production, the vocal folds open and close emitting pulses of air. In each phonatory cycle this occurs in a rippling fashion with the lower portion of the vocal folds beginning to open and close before the upper portion. This is accompanied by a rippling displacement of the covering mucosal layer. Hoarseness and other vocal changes occur when this motion is impaired.
13. The sound produced by the air emitted from the vocal folds is a complex tone which contains a fundamental frequency and numerous overtones. This sound is substantially altered as it passes through the supraglottic vocal tract (supraglottic larynx, tongue, lips, palate, pharynx, nasal cavity and sinuses) which acts as a resonator so that some frequencies are enhanced and some attenuated. The particular characteristics of the supraglottic vocal tract are largely responsible for the distinctive sound of a person's voice.

14. The organs involved in voice production may be affected directly by disease or trauma or indirectly by the condition of parts of the musculoskeletal system which influence respiratory function and by neurological factors which mediate fine muscle control. Psychological factors may also influence voice production, for example via autonomic control of mucosal secretions.
15. Symptoms of vocal disorder (dysphonia) include hoarseness, breathiness (characterised by excessive loss of air during vocalisation) fatigue (an inability to phonate for extended periods without a change in vocal quality) and the need for a prolonged warm-up time before speaking, especially on waking. More severely there may be complete loss of the voice, which may often be associated with neck or laryngeal muscle pain and discomfort.
16. Structural abnormalities which may be observed on clinical examination include:
 - i. Vocal nodules: benign fibrotic masses of vocal folds. Treatment may be by vocal therapy or surgery.
 - ii. Vocal polyps: benign solitary lesions on the vocal folds. Treatment may be by vocal therapy or surgery.
 - iii. Vocal fold cysts: submucosal lesions of the vocal folds usually requiring surgical treatment.
 - iv. Reinke's oedema: a characteristic 'floppy' vocal fold producing a low gruff voice. This is almost always associated with smoking.
17. A number of causes of voice disorders or factors which make the voice more vulnerable to damage have been identified and the disorders may be multi-factorial in etiology. In addition to faulty or overuse of the voice mechanism, these include normal ageing which produces predictable changes in various body systems involved in voice production, recurrent acute infection, exposure to irritants, disease and trauma.

Implications for prescription

18. Symptoms of vocal disorders or structural damage to the vocal system can result from a number of events or conditions and such disorders may therefore occur frequently in the general population. Vocal abuse is accepted clinically as one possible cause of vocal disorders; however it is not possible to identify a condition with unique clinical features which is specifically associated with prolonged heavy vocal use. Thus in order for occupational voice loss to fulfil the terms of prescription it will be necessary to demonstrate a doubling of risk of vocal disorders in a particular occupational group or groups who are subject to heavy vocal demands in the course of their work.

Method of investigation

19. A literature review was carried out by the Council in order to evaluate the epidemiological evidence relating to the prevalence of vocal disorders, including voice loss, in occupational and other groups in the population.
20. The literature search identified a total of thirty-seven relevant papers, the majority of which (twenty-three papers) were concerned with the prevalence of voice problems in specific occupational groups. From these articles, fifteen were concerned with teachers, four with professional performers (actors and singers), two with aerobics instructors, one with telemarketing staff and one with cheerleaders. Two papers (one from Sweden and one from the United States) reported on the representation of different occupations in patients attending voice clinics. Other papers discussed individual cases or explored the validity and reliability of certain diagnostic techniques or clinical approaches (nine papers). Three recent review papers were also identified and considered.

Review of the evidence

Populations studied

21. Research has predominantly focussed on teachers, sometimes highlighting specific branches of teaching thought likely to involve greater demands on the voice, notably nursery school teaching and the teaching of physical education, aerobics and the performing arts. Other studies have focussed on professional performers, cheerleaders and telemarketing staff. One investigation concerned with diagnostic indicators used players of wind instruments as its study population.

Prevalence studies

22. Those studies which have attempted to assess the prevalence of voice disorders in certain occupations have either drawn their subjects from clinic populations or have consisted of cross-sectional surveys of occupational samples.
23. Several studies report on the number of patients presenting at voice clinics who belong to a certain occupational group. For example, in an American study, Titze et al., (1997) reported the representation of particular occupational groups among 174 patients attending two voice clinics between 1991 and 1993 and compared this with the number of workers belonging to that occupation in the country as a whole. Results suggested that, of all the populations studied, only teachers appeared to be at increased risk of voice problems, in the sense that teachers represented approximately 4% of the US working population but 19.6% of the clinic population.
24. Similarly a report of 1,212 patients attending phoniatic clinics in eight hospitals in Sweden (Fritzell, 1996) found that more than 16% of patients were from the teaching profession. In Sweden teachers represent 5.9% of the working population. In this study social workers, lawyers and clergymen were also over-represented in the clinic population relative to their overall percentage in the working population, although in the case of clergymen this was based on only five patients.
25. The authors of both the above studies draw attention to the fact that clinic attendees represent a selective sample of the population who might, for example, be more aware of health care issues, be more concerned about the effect of vocal problems on their careers and thus be more liable to seek help. While, therefore, these results are suggestive of a problem requiring investigation, they cannot be regarded as robust evidence of the prevalence of a problem in a particular group.

- 26.** Other studies constitute cross-sectional surveys of samples of occupational groups describing the frequency and type of symptoms reported by participants in the survey. For example, a study carried out in Finland found that 19% of a sample of 226 student teachers reported two or more voice symptoms (Simberg et al., 2000) and a study of 1,168 Australian teachers found a similar percentage reporting voice problems (Russell et al., 1998). A survey of 146 cheerleaders found that 82% reported episodes of dysphonia (Reich et al., 1986) and a smaller investigation of 10 actors and 10 singers found that 40% and 20% respectively reported symptoms of vocal fatigue often or very often, (Kitch and Oates, 1994). These investigations are again suggestive of an increased risk in certain occupational groups (notably teachers and performers), but do not provide control groups against which the prevalence in teachers can be compared.
- 27.** Several studies do include a comparison group and these indicate a doubling of risk for symptoms of voice problems in teachers (Smith et al., 1997, 1998; Sala et al., 2001, 2002; Roy et al., 2004), student teachers, (Simberg et al., 2004), professional singers (Miller and Verdolini, 1995; Sapir et al., 1996; Phyland et al., 1999), telemarketers (Jones et al., 2002) and aerobic instructors (Heidel and Torgerson, 1993).
- 28.** However, the majority of these studies rely exclusively on self-report as the measure of vocal disorder and are inconsistent in their definition of the condition under investigation. Although there is a degree of commonality in the symptoms included, the measures derived from these self-reports vary considerably between studies.
- 29.** Some studies simply enquire about the presence or absence of a voice disorder as reported by the subjects. For example, Roy et al., 2004 reported a significantly increased risk of such a disorder occurring during the lifetime of a teacher as opposed to a member of the general population.
- 30.** Other studies enquire about a range of symptoms and compare the frequency of each symptom in the two groups. In a further study by Roy et al., 2004, teachers, compared to non-teachers, were found to have a doubling of risk of some voice symptoms (e.g. voice tires after short use, difficulty projecting voice) but not others (e.g. throat dryness, frequent throat clearing). Conversely Sala et al., 2001, comparing day care teachers with nurses, also found that certain symptoms were reported significantly more often by the teachers but that their most frequently reported symptom was throat clearing.
- 31.** Several studies report the average number of symptoms of all types and define a voice problem in terms of the occurrence of two or more symptoms over a specified time period. For example, Smith et al., 1997 report a 3.5 excess risk of two or more current symptoms occurring in teachers compared with non-teachers. Results expressed in these different forms and the absence of a consensus on the definition of the disorder present considerable difficulties of interpretation.
- 32.** Some studies have attempted to develop and validate a symptom questionnaire such as the Voice Handicap Index (Rosen and Murray, 2000). Although this may prove useful in the future its development appears to be in its early stages and it does not currently have wide application. In particular, attempts to demonstrate a consistent association between questionnaire and physician diagnosis have proved unsuccessful.

Objective measures

- 33.** A number of semi-objective or objective techniques have been used in the diagnosis of vocal disorders. These have been employed mainly in clinical settings, but occasionally they have been included in studies to investigate the nature of voice problems attributed to occupational factors. These are of three broad types:
- i.** Here diagnosis is based on the evaluation of the recorded speaking voice by trained phoniatrists in terms of specific parameters: normal or disturbed sound; quality of glottal attack; articulation; breathing and posture; muscular tension; vocal abuses such as throat clearing; lip and jaw movements and medium speaking range. However, studies which have used this approach point to a degree of inconsistency between different diagnosticians. For example, in a study of sixty-three wind instrument players, using two phoniatrists, there was disagreement about the presence or absence of a voice disorder in eighteen subjects, (Ocker et al., 1990).
 - ii.** Clinical endoscopic examination of the laryngeal structures to identify conditions such as vocal nodules, polyps or vocal fold cysts. This may include fibre optic endoscopy examination to identify factors such as asymmetrical adduction, redness of the vocal chords, visible blood vessels and mucous stranding and also microstroboscopic examination, in which the principles of stroboscopy (a means of sampling images to create the visual illusion of slowing down the movement) are used to determine the frequency and amplitude of oscillation of the vocal chords during phonation. These methods of examination have primarily been employed in a clinical context. A small number of cross-sectional surveys have included these investigations alongside self-report measures as a means of confirming diagnosis (Simberg et al., 2000), but such techniques have not so far been employed in well-designed epidemiological studies which include appropriate sampling methods and a reference population.
 - iii.** Use of a speech analyser to measure short-term acoustic changes in voice quality, (fundamental frequency, sound pressure level and perturbation), associated with high levels of vocal activity. For example, measures of phonatory stability during the production of sustained vowel sounds are taken before and after periods of teaching or aerobic instruction. Some studies have reported that small changes in these parameters in response to vocal demands occur more often in those reporting voice problems. (Rantala and Viikman, 1999 and Wolfe et al., 2002). These measures appear to be indicators of transitory vocal fatigue and it is not clear at present how they relate to more severe forms of vocal damage.

To date, none of the above techniques have been employed in well-designed epidemiological investigations of occupational vocal disorder.

OVERVIEW

- 34.** The investigation of vocal disorders is a rapidly developing field. A number of potential causes of vocal disorders have been identified. However, those resulting from occupational factors do not exhibit unique clinical features which allow them to be differentiated from those resulting from other causes.
- 35.** In order to fulfil the terms of prescription, therefore, it will be necessary to demonstrate a doubling of risk of vocal disorders in certain occupations or in occupational groups with particular levels of exposure to conditions likely to result in vocal disorders.
- 36.** The current literature on occupational vocal disorders is focussed, in particular, on teachers and to a lesser extent on professional performers and telemarketing staff. A number of studies consist of reports of clinic populations or surveys of occupational samples without reference to a comparison group or a background population level and cannot therefore provide evidence of prevalence in certain groups.
- 37.** Those studies which include a reference group rely almost exclusively on self-report to define the condition and this definition varies between studies in terms of the number or type of symptoms included. Thus there is currently no consensus on the definition of the disorder.
- 38.** Although clinical techniques for identifying structural damage to the vocal system have developed considerably in recent years these have only rarely been included in epidemiological studies, alongside self-report measures, and have not so far provided robust evidence of increases in such damage in particular occupational groups.
- 39.** At the present time, therefore, there is an absence of a workable case definition of occupational voice loss and insufficient epidemiological evidence of good quality to satisfy the requirements for prescription.

CONCLUSION

- 40.** The current evidence relating to an association between voice loss and particular types of work is insufficient to satisfy the requirements for prescription. However, this is a relatively new field of investigation and there is a need for further research which addresses questions of definition and measurement in relation to both the disorder and the exposure. The Council will keep the emerging literature on this subject under review.

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Details of the scientific references referred to in this report are available from the IAC Secretariat on request.

