



Occupational voice is a work in progress: active risk management, habilitation and rehabilitation

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Purpose of review

The current article reviews recent literature examining occupational voice use and occupational voice disorders (January 2018–July 2019).

Recent findings

Our understanding of the prevalence of voice disorders and work-related vocal use, vocal load and vocal ergonomics (environmental and person influences) across different occupations is continuing to build. There is encouraging evidence for the value of intervention programs for occupational voice users, particularly of late with performers, teachers and telemarketers. Education and prevention programs are emerging for other ‘at risk’ occupations.

Summary

Occupational health and workforce legislation does not adequately acknowledge and guide educational, preventive and intervention approaches to occupational voice disorders. Voice disorders are prevalent in certain occupations and there is an urgent need for research to support occupational voice health and safety risk measurement, prevention and intervention. Large population-based studies are required with a focus on the health and economic burden of occupational voice disorders.

Keywords

dysphonia, economics, occupational health, occupational voice users, voice

INTRODUCTION

Occupational voice disorder literature is expanding with a call for improved occupational health and safety standards and legislation to protect voice [1,2]. Many occupations have been identified as at-risk for the development of voice disorders as a consequence of their inherent work conditions [3,4^{***}]. While such studies are valuable in identifying ‘who’ is at-risk and in the exploration of possible influences, there is a lack of recent epidemiological information for occupational voice disorders in the general nontreatment-seeking population and what we do have is potentially outdated [5,6,7^{*}].

Despite the high prevalence of occupational voice disorders, the WHO neglects to itemize voice disorders as a potential occupationally related disease or condition [8]. It is also difficult to determine where voice disorders fit within the existing criteria for work-related disease (communicable and non-communicable) and injuries (intentional and unintentional). This may in part be due to the multidimensional nature of voice disorders as well as the inherent difficulty in measurement and in establishing an operational definition of vocal injury.

Definitions of work-related voice disorders or vocal injuries may vary across geographical location according to relevant legislation, terminology and context. Yet, any speech pathologist understands the enormity of the occupational voice-user population whereby voice is a critical occupational tool and no voice equals no work today – singers, stage performers, sports coaches, sales assistants, teachers, lecturers, lawyers, telephone operators, call centre workers, receptionists, priests and health professionals. Speech pathologists witness first-hand the extreme financial repercussions of voice disorders

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KEY POINTS

- Occupational voice users exhibit increased risk of dysphonia and suffer economic and psychosocial consequences.
- Increasing understanding of environmental and personal profiles of specific occupational groups is developing.
- Risk measurement is critical to evaluating and monitoring voice disorders in the work place.
- Risk management approaches including group therapy and community-based education program are gathering support across occupational groups.
- Researchers need to consider longevity of voice use with specific attention to pediatric professional voice users and their future as well as maintenance of occupational voice use in the aging workforce.

as well as the impact on social and professional identity.

There is a longstanding assumption of a causal relationship between heavy voice-use and the development of voice problems. More recent research however, suggests that the relationship is more complex. There are people working in heavy voice-use occupations who do *not* experience vocal difficulties. Many other environmental and contextual factors (coined voice ergonomics) have been proposed to exert an effect [9¹¹]. There has been a shift toward the exploration of these occupation-specific environmental factors as well as person factors, such as vocal fitness, as determinants of vocal survival in the workplace especially for those with sustained heavy load [10].

The new American Academy of Otolaryngology-Head & Neck Surgery Clinical Practice Guideline: Hoarseness (Dysphonia), estimates the direct *health costs* of dysphonia in the US up to US\$13.5 billion [11]. Overall economic costs from lost work days, however, is in addition and requires more attention. Described 20 years ago within the Australian context, Pemberton *et al.* [12] estimated teachers' lost work days due to voice problems averaged 1.3 days/year. This absenteeism was estimated conservatively to cost the Victorian State Government approximately \$17 million per annum. More recently, Pemberton [13¹²] presented to the Australian Government on the impressive outcomes from a large-scale 'voice care for teachers' program spanning over 5 years ($n \geq 1500$ teachers). In purely economic terms for the employer, a saving of \$500 000 (AUD) was estimated due to reduced voice-related sick leave.

This current opinion provides an overview of the articles that have published in the last 18 months (January 2018–July 2019) on the topic of occupational voice. We cover 'at-risk' workforce groups, work-related influences on vocal health, risk measurement and intervention, as well as considerations for the future.

OCCUPATIONAL RISK

Risks of vocal harm in those using their voice directly in performance of work duties needs to be understood to provide preventive strategies and early interventions aimed at minimizing development of vocal pathology.

Occupational voice users

Over the last few years, there has been a plethora of articles exploring voice use and voice disorders in specific occupational groups worldwide. Teachers, frequent visitors to the voice clinic, continue to feature heavily in the research [14–33]. International research is now also appearing across a wider range of occupations: radio broadcasters [34], wind instrumentalists [35], fitness instructors [36³⁷], cycling instructors [38³⁹], university professors [39–41], telemarketers [42], tour guides [43], street vendors [44], Islamic officials [45], scientists exposed to chemical irritants [46] and sports coaches [47]. Teachers with music in their job description are receiving more attention including music theory teachers [48], elementary school music teachers [25,48] and music therapists [49,50]. Joseph *et al.* [51] wrote an article titled 'Do young speech pathologists practice what they preach?'. They found speech pathologists did not follow the vocal health principles that they provide to others.

Although most articles describe voice disorder prevalence or list vocal symptoms, there is a recent focus on work-related communication and environmental profiles in specific occupations [34,38³⁹]. A novel and carefully designed observation of indoor cycle instructors found reduced perceived phonatory effort with the addition of amplification but continuing high vocal dose. They hypothesize the loud ambient noise in the indoor cycling arena might cause a Lombard Effect leading to involuntary louder speaking irrespective of amplification [38³⁹]. These types of studies may lead to useful insights for preventive and rehabilitation programs for specific populations.

Professional voice users

Chitguppi *et al.* [52] propose a nomenclature for people who rely on their voice for their occupation and suggest such voice users should be split into

speaking and nonspeaking voice professionals. This may prove useful for determining relative prevalence figures for work-related voice disorders among each group as current information is confounded by differences in voice use characteristics and work-contexts between singers and nonsinger professionals. Certain studies have used this binary classification to report differences between professional voice users [52–54].

As an alternative construct, *professional voice users* are distinguished from *occupational voice users* in a new textbook *Voice Ergonomics: Occupational and Professional Voice Care*: an excellent resource for voice teams [9^{***}]. The authors define *professional voice users* as those who have a need for a skillful voice as distinct from *occupational voice-users* ‘who need a lot of voice and often must use a loud voice’ (such as the teachers and sports coaches described in the previous section). They further separate this group from *active* voice users who use their voice during a working day but without regularly raised intensity (e.g. telemarketers and health workers) [9^{***}]. This proposed classification system is novel and provides interesting criteria for delineating the different vocal loads, work characteristics and phonatory needs.

The professional vocalist or working vocal artist is perhaps historically one of the most recognized ‘at risk’ professional voice user for the development of phonotraumatic lesions. However, employment-related prevalence figures for singers and actors are confounded by huge heterogeneity across and among these voice users in environmental and person variables such as type of voice use, performance environment, music genre, repertoire, context, vocal expectations and voice training. Other difficulties are the reliance on treatment-seeking populations, the inclusion of amateur performers and that many studies do not specify whether performance is the primary occupation.

Despite the dearth of epidemiologic studies, further valuable insights have been provided over the past 18 months regarding vocal health, voice demands, laryngology findings and treatment options among specific performer groups such as elite award-winning performers [55[■]], Broadway singers [56[■]], opera singers [57], theater singers [58[■]], theater actors [59], and singers of specific cultural music styles such as Carnatic [60], Korean classical [61] and Fado singers [62]. Weekly *et al.* [63^{***}] conducted a global survey of an impressive number of amateur and professional voice-users ($n = 1195$) on their vocal health practices and included both speaking and nonspeaking voice users. They found a third of respondents did not access medical care due to insurance or financial constraints. This suggests treatment-seeking populations may be an under-

representation of the number of working vocalists with voice disorders.

RISK MEASUREMENT AND VOICE ERGONOMICS

Sustained heavy vocal load in the workplace has been long identified as the primary threat to employees’ vocal health [4[■],64]. Some studies have now challenged this notion showing, for some voice users, heavy vocal load can have a positive effect on immediate vocal function postloading [10,58[■],59] and may even help build voice strength and endurance [65,66]. Our understanding of ergonomic and person-related influences in the work context is expanding. Further described risks include nonconductive speaking environments and background noise impact [25,26,37,67–69,70[■],71], workload [19], stress and anxiety [28,29,72], posture [22], reduced respiratory [73] or cardiopulmonary function [74[■]] and shyness [75]. Table 1 displays ergonomic and person-factor influences on vocal health.

A previously unreported proactive Australian voice care program, conducted for performers in a large-scale production known as *Santa’s Kingdom 2004*, showed performance vocal load can be less important than other work-related factors (Phyland, unpublished). Performers ($n = 210$) involved in this interactive exhibition worked intensively for the 4 weeks prior to Christmas in loud performance/activity stations around a large exhibition space. All underwent vocal screening baselines, vocal health education and end-of-production voice assessments. Significant short-term deterioration in vocal function was found for 151 (72%) of the performers on self-report surveys and perceptual and acoustic evaluation, although there were no ongoing concerns after the production conclusion. Of great interest was the finding that even those with no or little speaking or singing performance (e.g. polar bear characters who were mute and fully suited) still demonstrated significant acute vocal change. Vocal fatigue was attributed by many performers to an intensive work timetable and highly social ‘extra-curricular’ culture, rather than inherent occupational vocal demands.

Although the identification and measurement of ‘at risk’ behaviors and influences has advanced, the measurement of direct positive and negative impact of these factors on the vocal health of workers is not straightforward. Proving causation of work-related voice disorders is perhaps easier for acute injuries (such as vocal hemorrhage) than chronic voice disorders. Undertaking baseline vocal assessments and regular screening are important for tracking potential voice changes and as points for comparison [49,68,71,76–80]. It is important to

Table 1. Ergonomic and person-factor influences on vocal health

| Influence | Examples of potential influences (+ve and -ve) |
|-------------------------------------|--|
| Work environment & vocal demands | |
| Place of most voicing | Mixed, indoor, outdoor, car, retail shop, performance tent |
| Vocal dose | Intensity, frequency and duration of voicing time |
| Manner of voicing for work | Singing (type), speaking, character voice, degree of effort |
| Voicing schedule | Number of hours per day voicing, number of consecutive days, periods of voice rest, shows per week, double shows, weeks on/off |
| Room acoustics | High ceilings, reverberation, background noise, open plan classroom, car noise |
| Use of acoustic support/strategies | Foldback, portable microphone, amplifier, megaphone, bell, clap |
| Posture while voicing | Standing, leaning, habitual chin out, in a harness, dancing, exercising, head tilted (on phone) |
| Air conditions | Humidity, quality, temperature, consistency, dust, pollens, heating, odors, air conditioning and proximity to vents |
| Work stressors | Difficult classroom behavior, production week, high workload, employment status (contract versus permanent) |
| Voice efficiency | Breathy quality, poor phrasing, speaking on residual air, habitual use of hard glottal attacks |
| Routine of work practices for voice | Casual relief teaching, extra fitness classes, parent interviews |
| Manner of voicing for work | Habitual intensity required, use of character voice/s, degree of effort |
| Person factors | |
| General | Age, sex, personality, physical fitness, health, lifestyle, quality of life, job satisfaction and communication style |
| Voice training | Type and relevance to work (singing, speaking), quantity, consistency and recency |
| Vocal fitness | Voice stability, endurance and recovery thresholds, recent vocal activity (e.g. rehearsals, previous show, back from maternity leave) |
| Vocal load outside of work | Involved in choir, part-time bartender, karaoke singing |
| Value attached to voice | Previous elite singer, regularly complimented on husky voice, voice identity incongruent with current voice, and high voice expectations |

understand normal fluctuations in vocal function across the working hours and days, and what symptoms (including fatigue), durations and severities constitute critical threshold points for development of voice disorders [41,46,69,80–82]. Assessing vocal dose and calculations of occupational vocal load have received much recent research attention and include tools such as visual analogue scales, dosimetry accumulators, fatigue inventories and the Vocal Fatigue Index [14,38,46,48,51,66,67,71,76,78,83,84]. A newly validated self-report scale called the Evaluation of the Ability to Voice Easily may hold promise for tracking fluctuations in speaking voice function as perceived by the voice user and for identifying risk thresholds or cut-off points (Phylant, 2019, in press). Some studies have also explored the impact of a voice disorder on work performance in addition to other dimensions of voice-related quality of life [18,70,85].

RISK MANAGEMENT, HABILITATION AND REHABILITATION

Despite performers being identified as a high-risk group [86], employer management, within the

entertainment industry in particular, of work-related vocal injuries (such as phonotraumatic lesions) is frequently suboptimal [56]. The economic, logistic and psychological ramifications of a vocal injury can be dire for both employee and employer with cancelled shows, loss of audience support, and an inappropriate assumption of poor vocal technique leading to a stigma and reduced future employment prospects for the injured performer. Fortunately, with increased understanding of the etiological factors in vocal injuries focus is changing to a commitment to provide prevention and risk management programs across many different voice-user groups [10,87,88,89,90–92].

There is emergence of proactive occupational health practices. It is difficult to get direct evidence of the efficacy of industry-funded programs due to sensitivity of data and methodological limitations in the program designs, as most do not have research as the primary objective. However, voice habilitation and rehabilitation programs, particularly in teachers and performers, feature in the recent international literature, with a favouring of the term vocal health over hygiene to better represent the philosophical underpinnings. Programs include

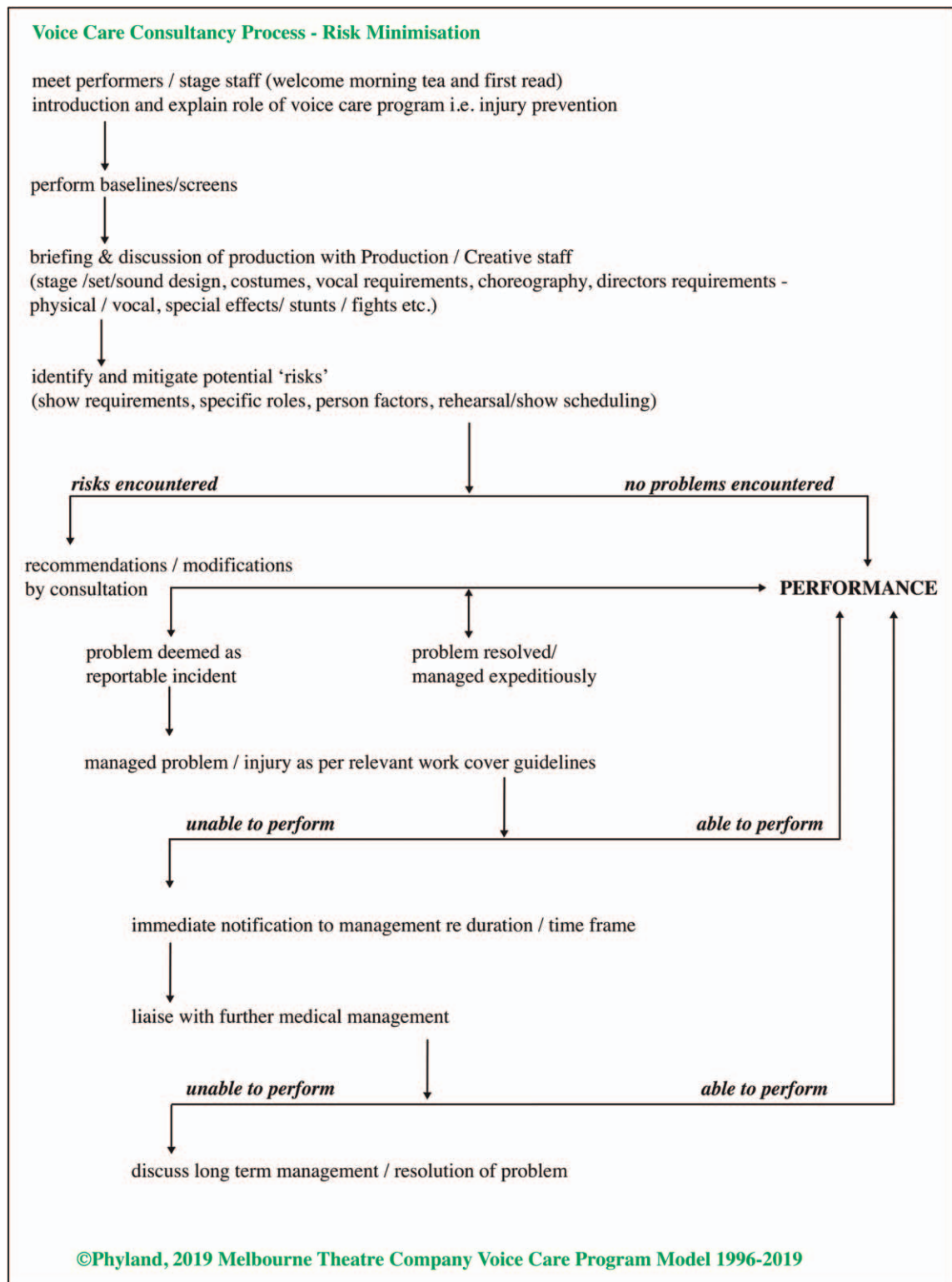


FIGURE 1. Voice care consultancy process – risk minimization (Voice Medicine Australia).

education, vocal screens and audits and specific habilitation approaches, for example, the use of saline nebulizers and amplifiers [30,84^a,86^{aa},89^a,90,91]. Promising improvements have been demonstrated in self-perceived vocal scores, reduction in

vocal attrition, and diagnosed or reportable incidents of voice disorders [30,84^a,86^{aa},89^a,90,91]. Melbourne Theatre Company introduced a voice care program which has been in place for 25 years and this model of prevention is presented in Fig. 1.

Research into risk management of work-related vocal ‘injuries’ is thwarted by privacy protection and sensitivity of information related to both the employer and employee. Occupationally induced voice disorders are strongly represented in laryngology clinics and require comprehensive assessment (with stroboscopy as a standard of care) and expert understanding of the occupational context and its’ potential relationship to the development, maintenance and recovery of voice disorders [52,55⁹,93⁹]. Frequently these occupational voice users will require voice therapy, surgery and expeditious return to work programs [23,52,54,55⁹,56⁹,64,84⁹,86⁹,94,95]. There is a need to further evaluate intervention outcomes, improve understanding of rehabilitation and to develop evidence-based criteria to determine performance fitness in relation to ability to meet vocal requirements (e.g. voice quality, strength, stamina, ease and reliability), across all work-contexts.

CONSIDERATIONS FOR THE FUTURE

Aging workforce

With our understanding of workforce vocal challenges across occupations accumulating, there is a

need to also consider other contributions to voice. Allen and Miles [96] provided a comprehensive summary of age-related changes to the voice and current evidence-based interventions as part of a Special Issue on Ageing in Speech, Language and Hearing. Our international trends of an aging workforce imply there will be a need to address the combination of presbyphonia and occupational voice use more frequently in the future. Research into aging and continued occupational voice use is critical for future-proofing our workforce [96,97].

Early onset professional voice use

It is not only adult vocalists that use their voice professionally – child performers also work with their voices especially within the entertainment industry (television, film and the music theater). Many of the shows introduced this century such as *Billy Elliot The Musical*, *Matilda The Musical* and *School of Rock The Musical* feature children as central to the plot and can even involve a greater number of children than adults in the cast (Fig. 2). The associated occupational voice demands can be heavy and there is an urgent need for research investigating the impact of this load on the development of the child performers’ vocal folds and vocal function [98,99].



FIGURE 2. Matilda The Musical original Australian company. Photo: James D. Morgan.

Unpublished data from Phyland's lab on the outcomes of a voice care program demonstrated child performers ($n=194$) working in professional musical theatre productions experienced no negative change in vocal function. Children can be highly resilient in managing heavy vocal load over lengthy production seasons with appropriate and expert vocal care but long term impact needs to be monitored and speech pathologists and laryngologists still need to advocate for optimal conditions for these children still undergoing laryngeal anatomical development.

CONCLUSION

Voice disorders are prevalent in specific occupational groups and there is an urgent need for research to support occupational voice health and risk measurement, prevention and intervention. Our understanding of vocal use, vocal load and vocal ergonomics (environmental and person influences) across different occupational groups is building. There is encouraging evidence supporting intervention programs for occupational voice users with a primary focus on teachers and increasingly including performers. Education and prevention programs are emerging. Large population-based studies are required with a focus on health and economic burden of occupational voice disorders. International occupational health and workforce legislation does not currently adequately acknowledge, prioritise or guide educational and preventive interventions. There is an urgent need to formally identify combined risk factor bundles or environments; quantify the potential threat that voice disorders pose to a safe and healthy workplace; reduce the expression of voice disorders and its concomitant occupational burden; and develop prevention, management and health promotion targeted toward optimal occupational vocal function.

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Conflicts of interest

There are no conflicts of interest.

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- of special interest
- of outstanding interest

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