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From dysphonia to dysphoria: Mokken scaling shows a strong, reliable hierarchy of voice symptoms in the Voice Symptom Scale questionnaire☆

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Abstract

Symptoms of hoarseness (dysphonia) are common and often associated with psychological distress. The Voice Symptom Scale (VoiSS) is a 30-item self-completed questionnaire concerning voice and throat symptoms. Psychometric and clinical studies on the VoiSS show that it has good reliability and validity, and a clear factorial structure. The present article presents a further advance in voice measurement from the patient's point of view. To date, there has been no examination of whether voice-related symptoms form a hierarchy; that is, whether people who suffer voice problems progress through a reliable set of problems from mild to severe. To address this question, the technique of Mokken scaling was applied to the VoiSS in 480 patients with dysphonia. A strong and reliable Mokken scale—a symptom hierarchy—was found, which included 17 of the 30 items. This new information on dysphonia shows that voice symptoms progress from voice-oriented difficulties, through practical problems, to disturbances of social relationships and mood (dysphoria). The results add information about the structured phenomenology of voice problems, further establish the relationship between voice impairment and psychosocial impairment, and suggest practical applications in the assessment of dysphonic voices.

Keywords: Dysphonia; Dysphoria; Mokken scaling; Voice Symptom Scale

Introduction

High vocal demand occupations, noisy social environments, and continued use and abuse of tobacco and alcohol all contribute to the high prevalence of adult voice disorders in Western cultures [1]. The precise number of annual voice referrals to specialists in the UK is not known. Given, however, the fact that a clear majority of voice disorders is managed conservatively by speech and language therapists [2] and that over 20,600 laryngeal examinations and operations are carried out in the UK per annum (http://www.hesonline.nhs.uk), well over 50,000 adults are estimated annually to have voice disorders requiring specialist attention [3]. It is hard to define accurately the worldwide epidemiology of voice disorders—but they are known to comprise, for example, the commonest occupational disorder in Poland [4] and to affect, in later years, between one in five and one in three elderly people [5,6]. The impact of voice disorder is severe and wide ranging. Voice problems affect people's ability to perform in the workplace, both for professionals whose work primarily involves vocal communication and for those simply voicing for activities of daily living. They may be associated with pain, fatigue, altered self image, and distorted relationships. They may intensify with increasing age, where the concomitant reduction in

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hearing acuity of listeners compounds an already very frustrating state of affairs. The gold standard assessment of the severity of a voice disorder is thus typically multidimensional, incorporating evidence from an expert rater, and/or a computerized sound analysis system. The use of a patient-reported outcome measure has two main advantages. First, it offers the opportunity to inform quantitatively on the wider psychosocial implications of the problem, which cannot be judged by mere rating of voice quality. Second, it offers a reflection on the sustained impact over a longer timescale than the 'single snapshot' impression of the clinic visit observations.

The VoiSS—a patient-reported outcome measure—was designed to be applicable across the range of heterogeneous voice symptoms. It was developed in the UK after rigorous psychometric evaluation of its content validity, internal consistency, sensitivity to change, and psychometric structure on a series of large samples of voice patients [7–9]. It has three subscales: impairment (15 items), emotional response (eight items), and physical symptoms (seven items).

In the present study, the statistical technique of Mokken scaling is applied to the VoiSS for the first time, to offer new insights into the relationship between the individual items within the scale. Many readers of the journal are likely to be unfamiliar with the Mokken scaling procedure. Therefore, before discussing the rationale for the current application, we outline the method for the nonexpert. Mokken scaling was developed by Molenaar and Sijtsma [10]. The MSP program, which searches polychotomous item banks for reliable, hierarchical scales, enables the identification of monotone homogeneity and double monotonicity among those items [11]. Monotone homogeneity is the degree to which an item's score value reflects the underlying trait value, i.e., as the underlying trait value increases, the item score increases. Double monotonicity is the situation where an item's level of difficulty differs from another item and the slopes describing their monotone homogeneity do not intersect. For a good Mokken scale both monotone homogeneity and double monotonicity of items should be achieved. Initially, scales are identified on the basis of the scalability of sets of items using Loevinger's coefficient of scalability (H) which should exceed 0.3 for a potential Mokken scale to be present; $H \geq 0.4$ indicates a medium scale [10]. Loevinger's coefficient reflects how closely items' difficulty rates conform relative to one other. MSP also generates a diagnostic value 'Crit' which calculates a single value from the combined H coefficients of the items retained in the analysis. Crit values of 0 are considered to indicate perfectly nonintersecting items, and values of Crit <40 are considered to be the result of sampling error, whereas values of Crit >80 are considered to indicate violations of monotone homogeneity and double monotonicity. Therefore, it is considered acceptable to include items with Crit values ≥0 or <40 [10]. A further diagnostic, the $P(++)$ matrix, shows the probability of obtaining items at certain points in the scale and can be visually inspected. For an acceptable Mokken scale, the $P(++)$ matrix should increase from right to left and from top to bottom [12]. A statistical procedure measuring reliability, analogous to Cronbach's alpha [13] in that it is used to test reliability of the scales obtained by the MSP, generates a value—Rho—which should be ≥0.7 for a reliable scale. A Bonferroni-type method of correction [10] is used within the MSP to estimate the probability of obtaining any scale generated by accounting for the multiple steps involved in this iterative program. Summary scale statistics can also be generated (mean, skewness, and kurtosis) to show how closely scores obtained using the final scale are normally distributed.

To date, the VoiSS has been developed using principal components analysis which, while useful for extracting unidimensional scales from multivariate datasets, merely provides factors that are composed of sets of items that correlate highly with one another [14]. Mokken scales have the additional feature in that a Mokken scale orders items systematically [14]. In addition, Mokken scales demonstrate, for the measurement of a latent trait, how the performance of an item, in terms of its score, varies with changes in the latent trait being measured by the overall scale [15]. Therefore, when item scores in a Mokken scale are summed, this is a measure of the order of the latent trait being investigated [13]. It is increasingly recognized that Mokken scaling adds complementary information to self-report scales which are already in wide use and whose psychometric characteristics, hitherto, have been investigated using only factor analytic-type approaches [11,16].

The general aims of the present study were to advance the measurement of voice pathology, particularly with respect to the patient's perspective on voice difficulties, and to further establish the relation between voice impairment and psychosocial impairment. Specifically, we apply the Mokken scaling procedure to the VoiSS questionnaire responses to discover whether there is a consistent natural hierarchy of voice symptoms among people with dysphonia. One specific aim is to find out whether there is a place on a reliable continuum of voice-related complaints where reports of dysphoric phenomena appear.

Method

Participants

Data were obtained from an initial sample of 496 hospital-referred, dysphonic participants (353 women, 143 men) who completed the VoiSS questionnaire and whose data contributed to two previous reports on its factor structure [7,8]. The mean (S.D., range) age for the 492 subjects who provided age data was 52.0 years (17.0, 16 to 88 years). Of these subjects, 480 provided responses to all of the 30 items of the VoiSS questionnaire and their data are analyzed here. Many dysphonia diagnoses were included, with the commonest primary diagnostic labels being (in order of