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Validation of the Japanese Version of the Singing Voice Handicap Index
(邦題：日本語版 Singing Voice Handicap Index の信頼性と妥当性の検証)

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Validation of the Japanese Version of the Singing Voice Handicap Index

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Abstract: Purpose. The aim of the present study was to translate the Singing Voice Handicap Index (SVHI) into Japanese and validate the Japanese version of the SVHI.

Methods. The SVHI was translated into Japanese from the validated original version, and the questionnaire was administered to 102 singers with voice problems and 88 healthy singers. Internal consistency and test-retest methods were implemented to evaluate the reliability of this index. The internal consistency method assessed validity via Cronbach's α, and test-retest reliability was analyzed by the intraclass correlation coefficient (ICC) and limits of agreement (LoA) according to the Bland Altman method. Construct validity was verified by confirming correlations between SVHI scores and visual analog scale (VAS) scores for disability in singing using Spearman correlation. Discriminant validity was evaluated by comparing SVHI scores between singers with voice problems and healthy singers using *t* tests. Using the Tukey's honestly significant difference (HSD) test, we also compared the Voice Handicap Index (VHI) and SVHI scores among three groups: healthy singers, singers with voice problems solely during singing, and singers with voice problems during both speaking and singing.

Results. The Japanese version of the SVHI showed excellent internal consistency (Cronbach's α = 0.981) and test-retest reliability (ICC: 0.93). The 95 percent LoA was calculated to be between -20.8 and 33.9. Construct validity was verified through correlated SVHI and VAS scores (r = 0.736, $P < 0.001$). Discriminant validity was verified as the SVHI scores of singers with voice problems were higher than those of healthy singers (77.8±37.5 vs. 30.0±26.5, $P < 0.001$). There were no statistically significant differences in VHI scores between singers with voice problems solely during singing and healthy singers; however, the SVHI scores of singers with voice problems solely during singing were significantly higher than those of healthy singers (63.4±36.8 vs. 30.0±26.5, $P < 0.001$).

Conclusion. We confirmed that the Japanese version of the SVHI is a valid and reliable self-rated questionnaire for measuring the patient-perceived impact of singing voice problems among Japanese singers.

Key Words: Singing voice handicap index—Singing—Voice handicap index—Voice problems—Singers.

Abbreviations: HSD, Honestly significant difference−ICC, Intraclass correlation coefficient−LoA, Limits of agreement−PRO, Patient-Reported Outcomes−SVHI, Singing Voice Handicap Index−VAS, Visual analog scale −VHI, Voice Handicap Index.

INTRODUCTION[1]

The evaluation of voice disorders, including the diagnosis and quantification of disorders, has historically been performed based on reliable examinations such as strobolaryngoscopy, aerodynamic examination, and acoustic analysis. However, even with a similar degree of voice impairment upon objective examination, the degree of functional handicap and disability varies greatly depending on the individual's gender, age, occupation, and living environment. For appropriate and comprehensive treatment and management of voice impairment, clinicians must consider the degree of impact of voice impairment on the individual's quality of life.

In 1997, the Voice Handicap Index (VHI) was developed to assess patients' perception of the severity of their voice disorder.[1] The VHI consists of 30 questions and evaluates impacts on three realms: physical, emotional, and functional. In recent years, translated versions of the VHI have been validated in many languages, and the VHI is one of the major subjective examinations used in clinical practice for evaluating voice disorders (along with classical objective examinations).[2-6] Although the VHI has been performed on patients from a wide range of backgrounds, singers experience differential impacts on voice impairment compared with non-singers, that may not be fully reflected in the VHI.[7] Attempts have been made to adapt the VHI in order to reflect the quality of life with impairments among singers, but the sensitivity of these adapted scales is insufficient.[8]

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[1]SVHI: Singing Voice Handicap Index; VAS: Visual Analog Scale; VHI: Voice Handicap Index

Singers are a high-risk group for voice disorders and are sensitive to subtle changes in their singing voice.[9] Minor voice changes can have a substantial impact on the life and quality of life of singers, who are therefore more likely to seek laryngologist consultations compared with non-singers. In addition to typical symptoms such as hoarseness, singers also frequently complain of vocal fatigue, a choking sensation, changes in pitch, and a strained voice.[9] Therefore, it is important to assess how much singers themselves feel the influence of minor changes in their voice. Morsomme et al created a self-assessment questionnaire for singing disorders designed for classical singers, but this scale was not sufficiently versatile due to the limited genre.[10] In 2007, Cohen et al created and verified the Singing Voice Handicap Index (SVHI) as a self-assessment tool for voice disorders among all types of singers.[11] This is a 36-question questionnaire, that evaluates the physical, emotional, social, and economic impacts of singing problems. The SVHI has been translated into many languages, including German, Italian, Spanish, and Persian, and its reliability and validity have been verified.[12-15] Studies have reported the influence of participant characteristics on SVHI scores as well as the responsiveness of the SVHI to treatment-related changes in patients' singing.[16,17]

In the process of translation and adaptation for patient-reported outcome measures such as the SVHI, the translated version of questionnaires is produced through several steps: forward translation, reconciliation, back translation, back translation review (permission from original author), cognitive debriefing, and review, among others.[18] The reliability and validity of the translated version of the questionnaire then needs to be verified for the target group, as the quality of the translated rating scale depends on its reliability and validity. Reliability evaluation includes the parallel test method, test-retest method, split-half method, and Cronbach's α coefficient.[19] The parallel test and test-retest methods evaluate the stability. In the parallel test method, two sets of tests having the same true value and error variance are created, and the reliability is obtained using each measured value. In the test-retest method, the same test is measured twice with a time interval. The split-half method and Cronbach α coefficient evaluate internal consistency, which is an assessment of whether each question item measures the same concept as a whole. In the split-half method, the items included in a set of tests are divided into two and evaluated from the correlation coefficient of both groups. The Cronbach α coefficient is the average of the confidence coefficients obtained by enforcing all split-half methods. Validity evaluation includes construct, discriminant, content, and criterion-related validity. Construct validity evaluates whether the hypothesis derived from a certain theory correlates with the score of a rating scale, and whether there is any contradiction. Discriminant validity determines the extent to which two groups divided by clear criteria can be distinguished from the score of the rating scale. Content validity implies that the question item comprehensively covers all aspects of the external criteria that may be relevant. Criterion-related validity assesses how the score of a rating scale is related to external criteria. In general, reliability and validity are verified by combining evaluations of these methods.

The purpose of this study was to translate the original English SVHI into Japanese, and to verify the reliability and validity of the Japanese version to use it as a self-assessment tool for evaluating singing voice disorders in Japanese singers.

MATERIALS AND METHODS

This study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the institutional ethics committee (IRB number:18-Im-007). All participants provided their written informed consent.

Development of the Japanese version of the SVHI

The original validated SVHI[11] was translated from English to Japanese by a professional translator. The first translated version was discussed by three laryngologists, two speech therapists, and a professional singer in order to revise the words and expressions of the questions (to make them easier for the singer to understand). The second revised Japanese version was tested by 5 singers, after which incomprehensible expressions and words were corrected. The final Japanese version was re-translated from Japanese to English by a different professional translator. The re-translated Japanese version of the SVHI was sent to the original author, and permission was obtained to verify the reliability and validity of this Japanese version. The Japanese version of the SVHI is presented in Appendix 1.

Participants

Participants were singers, who visited the Tokyo Voice Center for the first time due to voice disturbances during a period of 1 year and 5 months (starting in October 2019), and who agreed to participate in the study. Patients were confirmed to have lesions or other adverse findings in their vocal cords on videolaryngostroboscopy. Patients participated in this study following a doctor's explanation of their diagnosis, after undergoing an objective examination. Healthy singers with no voice problems participated as control group volunteers. We recruited research volunteers for singers who attended the Tokyo Voice Center for evaluation of their voice health, teachers and students of music colleges, and vocalists. Volunteers underwent videolaryngostroboscopy at the Tokyo Voice Center as far as possible; they included healthy singers who did not undergo videolaryngostroboscopy, as their voice was not subjectively morbid. These also included singers whose larynx had been visualized during voice health checks at the otolaryngology department of another clinic. The final study enrolled 102 singers with voice problems and 88 healthy (control) singers.

Based on the diagnosis, participants were classified into three groups: an inflammation group (laryngitis and

hemorrhage), a benign vocal fold mass group (vocal fold polyps and nodules), and a functional disorder group (muscle tension dysphonia).

Administration of the Japanese version of the SVHI

At their first visit to the Tokyo Voice Center (for consultation), singers who complained of voice disabilities were administered the translated SVHI without assistance. Singers with voice problems also responded to the VHI and a questionnaire regarding gender, age, socioeconomic status, genre, income, duration of voice symptomology, and awareness of their disability (in conversation and/or singing). Healthy singers were administered the SVHI, the VHI, and a questionnaire regarding gender, age, socioeconomic status, genre, and income. Both groups were evaluated with respect to the time required to respond to the SVHI. All singers self-reported the severity of their singing problems on a 10 cm Visual Analog Scale (VAS; 0: "no problem," through 10: "serious problem." All participants were provided a copy of the SVHI and were instructed to complete the second SVHI at home and mail the survey to the study center within 7-10 days of the first SVHI.

Statistical analysis

Reliability was verified through the internal consistency and test-retest methods. The internal consistency reliability of the Japanese version of the SVHI was evaluated using Cronbach's alpha coefficient; the item-total correlations were calculated. The test-retest reliability of the SVHI was calculated using the intraclass correlation coefficient (ICC) by 2.1-two-way random effect model single measures.[20] Measurement error was assessed by limit of agreement (LoA), which was calculated according to the Bland-Altman method.[21]

Validity was verified as discriminant validity and construct validity. Discriminant validity was evaluated by comparing SVHI total scores between singers with voice problems and healthy singers through *t* tests. Construct validity was assessed as the correlation between a VAS assessing singing disabilities and SVHI total scores via Spearman's correlation.

To confirm the responsiveness of the Japanese version of the SVHI in clinical practice, a Tukey's honestly significant difference (HSD) test was used to compare diagnoses groups and those complaining of voice impairment based on VHI and SVHI scores.

Statistical analyses were performed using SPSS software (version 27; IBM Corp., Armonk, NY). P values <0.05 were considered statistically significant.

RESULTS

A total of 190 singers were administered the SVHI, including 38 male and 64 female singers with voice problems (mean age ± standard deviation: 37.1±15.2 years) and 30 male and 58 female healthy singers (mean age: 38.1±15.2 years). There were no statistically significant differences in gender or age between singers with voice problems and healthy singers ($P = 0.847$ and $P = 0.717$, respectively). The characteristics of the singer cohort are presented in Table 1. Diagnoses of singers with vocal problems are shown in Table 2; 30.9% of patients complained of voice impairment during singing and 69.1% of patients complained of voice impairment during singing and speaking.

All singers completed the SVHI without assistance. The mean time required for participants to complete the SVHI was 179.3±80.5 seconds (range: 51-550 seconds).

TABLE 1.
Characteristics of all Singers in the Cohort

		N	Percent
Income	Singing: primary source	84	44.2
	Singing: secondary source	53	27.9
	Singing: not a source	53	27.9
Singing style	Classical	74	38.9
	Pop	45	23.7
	Musical	29	15.3
	Choral	14	7.4
	Rock	10	5.3
	Other	18	9.5
Singing status	Professional	120	63.2
	Singing teacher	15	7.9
	Student	23	12.1
	Amateur	32	16.8

Reliability

The retest was completed by 67.7% of participants, and the mean duration from the first response to the second response was 9.0±2.6 days. Internal consistency reliability was assessed using Cronbach's α, with a reported α of 0.981, and the item-total correlations ranged from r = 0.438 to r = 0.876. The first mean SVHI score was 49.1±40.6 and the second mean SVHI score was 42.6± 38.4, leading to a mean difference of 6.54±14.0 (95% confidence interval, 4.10 to 8.98). The ICC was 0.93

TABLE 2.
Diagnoses in the Patient Cohort

Diagnosis	N	Percent
Laryngitis	31	30.4
Vocal fold nodule	24	23.5
Vocal fold polyp	22	21.6
Muscle tension dysphonia	9	8.8
Vocal fold hemorrhage	4	3.9
Other	12	11.8

Other: vocal fold atrophy, sulcus, edema.

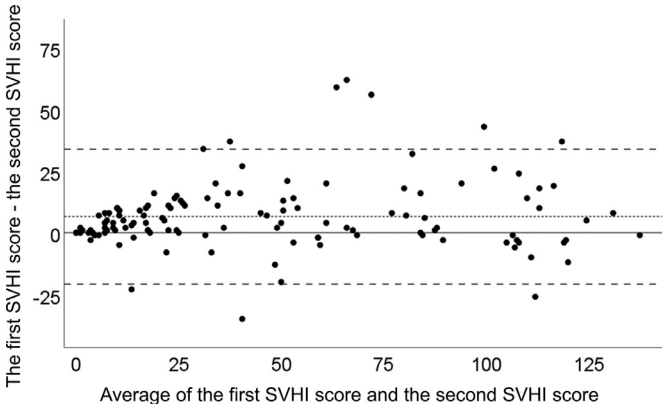


FIGURE 1. The bland Altman plot. The difference in scores between the first and second SVHI plotted against the average scores on both test occasions. The middle dotted line represents mean difference (6.54), and the top and bottom dotted lines represent the 95% limits of agreement (-20.8, 33.9); 9 of 128 (7.0%) cases were outside the limits of agreement. SVHI, Singing Voice Handicap Index.

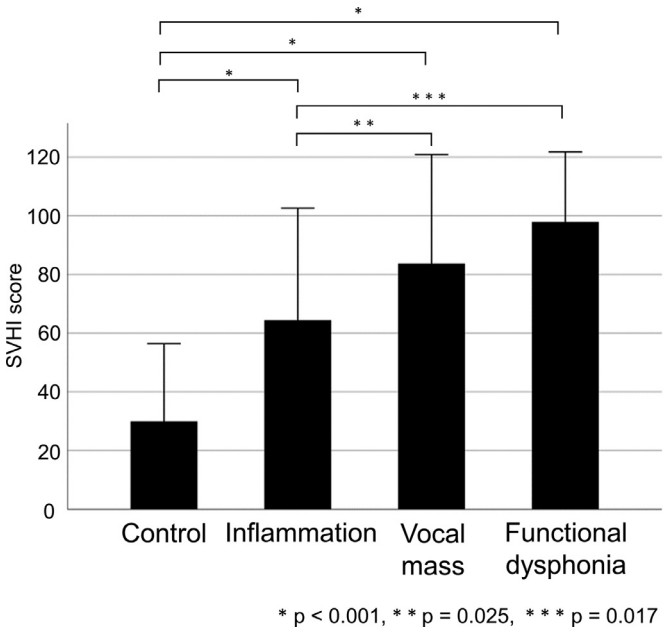
(95% confidence interval, 0.86 to 0.96), and the LoA was calculated to be between -20.8 and 33.9; 9 of 128 (7.0%) cases were outside the LoA (Figure 1).

Validity

Construct validity was assessed through the correlation between self-rated severity of singing problems on VAS and SVHI scores. The correlation between VAS and SVHI scores in this study was 0.736 ($P < 0.001$). We likewise compared SVHI scores of singers with voice problems and healthy singers to assess discriminant validity. The mean SVHI score of singers with voice problems was 77.8±37.5, compared with a score of 30.0±26.5 for healthy singers ($P < 0.001$).

SVHI scores and diagnoses

SVHI scores were compared among three groups: an inflammation group, a benign vocal fold mass group, and a functional disorder group. A comparison of the SVHI in these three diagnostic groups is shown in Figure 2. The inflammation group presented with lower SVHI scores (64.4±38.2) compared with the benign vocal fold mass (83.8±37.1, $P = 0.025$) and functional groups (97.9±23.9, $P = 0.017$). In the benign vocal fold mass group, we found no statistically significant difference in SVHI between patients with polyps and nodules (89.1±36.7 vs. 79.1±38.4, $P = 0.377$). The SVHI scores of all three groups were statistically significantly higher than those of the healthy control group (benign mass group vs. control group, $P < 0.001$; inflammation group vs. control group, $P < 0.001$; functional group vs. control group, $P < 0.001$).



* p < 0.001, * * p = 0.025, * * * p = 0.017

FIGURE 2. Singing Voice Handicap Index (SVHI) scores for each diagnosis group.
The inflammation group had significantly lower SVHI scores than the vocal mass group and the functional dysphonia group.

VHI and SVHI

The VHI score was 32.2±24.7 for singers with voice problems and 6.1±11.4 for the control group ($P < 0.001$). A correlation was found between VHI and SVHI scores (r = 0.777, $P < 0.001$).

Singers were compared between three groups: a control group, a voice problem solely during singing group, and voice problem during both speaking and singing group; the respective VHI and SVHI scores are shown in Figure 3. We found statistically significant differences in SVHI scores when comparing the three groups (control vs. a voice problem solely during singing; 30.0±26.5 vs. 63.4±36.8, $P < 0.001$; control vs. voice problem during both speaking and singing; 30.0±26.5 vs. 84.2±36.3, $P < 0.001$; and voice problem solely during singing vs. voice problem during both speaking and singing; $P = 0.029$). We did not find statistically significant differences between the control group and voice problem solely during singing group with respect to the VHI scores (6.1±11.4 vs. 15.0±15.7, $P = 0.160$), although there were statistically significant differences between the control vs. voice problem during both speaking and singing group (6.1±11.4 vs. 39.5±24.3, $P < 0.001$), and voice problem solely during singing vs. voice problem during both speaking and singing ($P < 0.001$).

DISCUSSION

Singers are a population requiring specialized medical assessment and treatment for specific voice problems. Laryngologists involved in voice assessment and management of this special population should be trained not only in

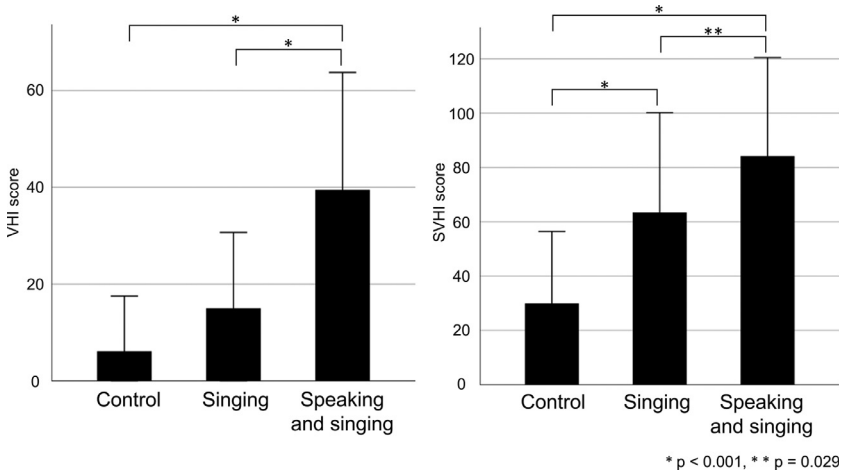


FIGURE 3. Voice Handicap Index (VHI) and Singing Voice Handicap Index (SVHI) scores among singers complaining of voice impairment. There were no statistically significant differences in VHI scores between healthy singers (controls) and singers with voice problems. However, we found statistically significant differences between healthy singers (controls) and singers with voice problems in terms of SVHI scores.

objective examinations, but also in evaluating how seriously the patient's condition has influenced their singing (which is at the center of their social activity). However, as the singer's larynx is continuously stimulated through daily practice and performance, any pathology seen on videostrobolaryngoscopy does not necessarily affect singing; studies reported a lack of correlation between the extent of pathology seen on videostrobolaryngoscopy and SVHI scores.[22] This demonstrates the usefulness of incorporating the SVHI into objective examinations to inform a more accurate understanding of the singer's voice status and a better response to the singer's needs. To date, there has been no validated Japanese-language self-assessment instrument to evaluate the impact of voice impairments in singing, and singers could therefore not be administered self-assessment tools in their native language. In this study, the Japanese version of the SVHI was successfully adapted and validated for reliability and validity.

Test-retest and internal consistency reliability were assessed to evaluate the reliability of this instrument; 67.7% of participants completed the second SVHI, and the second response rate in our study was higher therefore than that reported in other studies.[11,13] Participants were instructed to respond to the second SVHI 7-10 days after the first. The period until the second survey response was selected in consideration of both, the timeframe in which it was unlikely that the voice condition of the participants would change and the timeframe in which previous answers would not be remembered. The average response period for participants was 9.0 days; in general, the second SVHI was completed within the expected response period. In previous studies, the test-retest reliability of the SVHI was calculated with Pearson's correlation, but we calculated with the use of ICC.[11-14] The ICC was as high as 0.93, and stability was confirmed. In the Bland-Altman method, there was no systematic error, and only random error was observed. In addition, the Cronbach's α coefficient was 0.981, which was a high value near 1; this was similar to the coefficient for the original scale (0.97) as well as the coefficients for other language versions (0.78-0.975).[11-15] Evaluation showed that each question item of the Japanese version of SVHI measures the same concept as a whole. We therefore believe that SVHI has high reliability.

Construct validity and discriminant validity tests were performed to evaluate validity. Construct validity indicates how well the evaluation method reflects the characteristics of what is being measured. By evaluating the correlation between SVHI and VAS, we confirmed whether the severity of voice impairment affecting singing was reflected in the SVHI values. The reported correlation coefficient was 0.76 (similar to the original scale coefficient of 0.63), and the SVHI score reflected the severity of singing voice impairment.[11] In terms of discriminant validity, we confirmed whether the SVHI score could discriminate between singers with and without voice problems. The SVHI scores of healthy singers were statistically significantly lower than those of singers with voice problems, and we verified that the SVHI effectively distinguishes between these groups. The validity of the Japanese version of SVHI was confirmed based on these results.

We examined the effects of patient diagnoses on SVHI scores (Figure 2). The SVHI scores of the three diagnosis groups were significantly higher than those of healthy singers, confirming that SVHI can distinguish singers with voice problems from healthy singers. The SVHI scores in the inflammation group were significantly lower than those of the vocal fold mass and functional disorder groups. Similar results have been reported in other studies,[13] which indicate that the short duration of disabilities such as laryngitis, bleeding, and vocal cord edema may be associated with low SVHI scores. Some researchers have reported that the duration of voice disorders positively correlated with SVHI

scores,[16] while others have reported the tendency of inverse correlations between patients' duration of voice disability and SVHI scores.[23] Hence, it is difficult to interpret the effect on severity based only on the aspect of voice disorder duration. Phyland et al reported that 70% of singers in their cohort experienced one or more voice disorders within 12 months of being administered the survey, and 43.7% of singers were diagnosed with some kind of voice disorder within 12 months; 43% of the diagnosed singers had laryngitis, and singers who participated in the study had to stop performances an average of 1-8 times in a year due to voice impairment.[9] For singers, laryngitis (caused by upper respiratory tract inflammation and vocal cord abuse) is frequently a daily or near-daily illness; having experienced the healing process after receiving treatment in the past may help inform a more accurate understanding of the prognosis among singers; this may have lowered the mean SVHI score of singers in the inflammation group.

In this study, the VHI scores of singers who recognized vocal impairment solely during singing were not significantly different from the scores of healthy singers. Singers are more sensitive to changes in voice, and are more worried about the impact of subtle voice impairments on singing; thus, they are more likely to meet a laryngologist than non-singers.[9] As was the case with 30.4% of the patients participating in this study, singers tend to go to the voice clinic for consultation regarding changes in their voice, that are not noticeable in the speaking voice. However, because the VHI focuses on speaking voice disorders, this scale may not be sufficiently reflective for singers with voice problems that affect singing (vs. singing and speaking). Rosen et al reported that the VHI scores of singers who complained of voice impairment were significantly lower than those of non-singers, and that even if the singer's VHI score was low, a serious handicap may be hidden. They likewise reported that a low VHI score should not be ignored when considering the overall seriousness of the singer's voice problems based on total symptomology and quality of life impairments.[7]

Conversely, the SVHI scores of singers who complained of voice impairment solely during singing were significantly higher than those of healthy singers. The SVHI, which assesses the effects of singing voice disorders, can reflect the severity of voice disabilities on singing (even when the singer's voice disorder or symptomology is underrated by the VHI). It has been shown to be a highly sensitive and useful tool in the assessment of singing voice impairments. In addition, in singers with voice disabilities, the SVHI scores in speaking and singing were significantly higher than those of singers with disabilities solely during singing. As noted in the results, SVHI scores correlated with VHI scores; it may therefore be possible to use the VHI to infer the effect of voice impairment on singing to some extent. However, this study revealed that the SVHI was able to accurately assess the impact of singing disability (even small changes in the voice that would not be noticed when speaking), which is important to voice-sensitive singers.

The limitations of this study included an insufficient number of disease types examined, and an insufficient sample size for optimally subdividing participant groups and comprehensively evaluating disease. In addition, we did not validate the SVHI using objective examinations, such as aerodynamic examination and acoustic analysis. Previous reports have evaluated associations between self-evaluation tests such as the VHI and objective examinations.[24] Future studies should validate the SVHI through objective examinations and should consider effect modification by singer characteristics. The SVHI may thus help us improve the evidence base informing management, and treatment of voice complaints from singers.

CONCLUSIONS

This version of the SVHI translated into Japanese demonstrated high validity and reliability for measuring patient-perceived impact of singing voice problems within the studied cohort. We found that the Japanese version of this questionnaire could discriminate between singers with voice problems and healthy singers. The SVHI was highly sensitive to the impact of voice impairment in singing voices in particular, and it was found to be effective in evaluating subtle early changes in voice that do not affect the speaking voice.

DATA AVAILABILITY

Although the data used in this manuscript is not publicly available, they will be made available to other researchers upon reasonable request.

DECLARATIONS OF INTEREST

None.

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at doi:10.1016/j.jvoice.2021.08.023.

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