

Polish cross-cultural adaptation of a disease-specific quality-of-life instrument: The Penn Acoustic Neuroma Quality-of-Life Scale

Katarzyna Bieńkowska^{1,A–D,F}, Barbara Kostecka^{1,A–D,F}, Mirosław Ząbek^{2,3,4,A–C,E,F}, Andrzej Kokoszka^{1,A–D,F}, Sebastian Dzierżęcki^{4,A–C,E,F}, Ewelina Cichon^{4,5,6,A–C,E,F}, Grzegorz Turek^{3,A–C,E,F}

¹ Second Department of Psychiatry, Medical University of Warsaw, Poland

² Department of Neurosurgery, Postgraduate Medical Centre, Warsaw, Poland

³ Department of Neurosurgery, Bródno Masovian Hospital, Warsaw, Poland

⁴ Gamma Knife Centre, Warsaw, Poland

⁵ Department of Psychology, Faculty of Applied Studies, Psychology Research Unit for Public Health, University of Lower Silesia DSW, Wrocław, Poland

⁶ Faculty of Health Sciences, Wrocław Medical University, Poland

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation; D – writing the article; E – critical revision of the article; F – final approval of the article

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Address for correspondence

Barbara Kostecka

E-mail: barbara.kostecka@wum.edu.pl

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Abstract

Background. The medical community has shown a growing interest in developing methods for measuring and comparing objective patient outcomes coupled with subjective patient assessments. Questionnaires enable healthcare professionals to obtain the patient's perspective about their experienced vestibular schwannomas (VS) symptoms quickly. To date, in Poland, a cross-cultural adapted version of a disease-specific questionnaire for the measurement of quality of life (QoL) in patients with VS has not been produced.

Objectives. This study aimed to adapt the questionnaire evaluating disease-specific QoL in patients with VS (Penn Acoustic Neuroma Quality-of-Life Scale; PANQOL) to Polish and evaluate its psychometric properties.

Materials and methods. One-hundred twenty-four patients aged between 24 and 85 years (mean (M) = 60.17 ± standard deviation (SD) = 13.27) diagnosed with VS and treated with Gamma Knife were included in the study. We used a questionnaire translated from English into Polish by a bilingual professional, verified through a back-translation. The final version consisted of 26 items. The internal consistency of the Polish version of the PANQOL scale domains was measured using the Cronbach's alpha (α). To verify the validity of PANQOL subscales, a correlation analysis was conducted between the domains of PANQOL and other questionnaires, including the Assessment of Quality of Life (AQoL-8D), the Glasgow Benefit Inventory (GBI), the 5 Well-Being Index (WHO-5), the Skarzynski Tinnitus Scale (STS) for the presence of dizziness, and the Gardner–Robertson classes.

Results. The majority of PANQOL domains showed excellent or good internal consistency (for a PANQOL total of 0.934; for subscales in the range of 0.916–0.424). Our analysis showed strong correlations between the total PANQOL score and AQoL-8D utility score, as well as between the subscales. We observed weak to moderately significant relationships between GBI and PANQOL domains ($r = 0.18–0.43$), the WHO-5 ($r = 0.18–0.56$) and the STS scale ($r = -0.40–-0.19$).

Conclusions. The results demonstrated that the POL-PANQOL is a reliable and valid questionnaire for measuring QoL.

Key words: quality of life, adaptation, psychometrics, vestibular schwannomas, Penn Acoustic Neuroma Quality-of-Life scale

Background

Over the last decade, the medical community has shown a growing interest in developing methods for measuring and comparing objective patient outcomes coupled with subjective patient assessments.¹ The World Health Organization (WHO) indicates that currently the measure of success for medicine is not only treatment but also the improvement in health-related quality of life (QoL) in psychological and social areas. Using health-related QoL questionnaires, it is possible to assess the impact of disease and treatment on the patient's daily life not only in terms of physical health but also in psychological and social areas.² Two types of standardized questionnaires can be used for QoL assessments – generic or disease-specific. A generic questionnaire may be less sensitive in the assessment of changes related to a disease or treatment. Therefore, disease-specific questionnaires are dedicated to patients diagnosed with a particular entity, and the tools are designed to consider symptoms or various health aspects that may be affected by the disease.

Vestibular schwannomas (VS) are slow-growing benign intracranial tumors arising from the Schwann cells of the vestibular part of cranial nerve VIII.^{3,4} The most common symptoms include unilateral or asymmetric hearing loss (94%), tinnitus (83%), dizziness or vertigo, and facial paralysis. The availability of high-resolution magnetic resonance imaging (MRI) has contributed to an increase in the detection rate of VS (completely asymptomatic or with only minor clinical symptoms). If the patient presents with only minor symptoms, the assessment of QoL is an important factor in medical decision-making and helps understand the patient's perspective.⁵

To date, most studies that assessed QoL in patients with VS were performed using generic questionnaires, which may be inadequately sensitive to changes in clinical status and insufficient to provide meaningful data for a specific patient population. Only a few retrospective studies in patients with VS evaluated QoL using disease-specific questionnaires,^{1,6,7} especially the Penn Acoustic Neuroma Quality-of-Life scale (PANQOL). What is more, another methodology for QoL measurement in patients with VS after treatment, proposed by the European Association of Neuro-Oncology, does not indicate which treatment options have the greatest impact on QoL improvements.⁸ Thus, there is a need for the adaptation and validation of a disease-specific questionnaire. So far, in Poland, a cross-cultural adapted version of a disease-specific questionnaire for the measurement of QoL in patients with VS has not been produced.

Objectives

This study aimed to adapt the PANQOL, designed and validated by Shaffer et al.,⁵ to Polish context and evaluate its psychometric properties.

Materials and methods

Study design

From June 2021 to August 2022, patients diagnosed with VS were recruited. They received a package with 2 copies of the informed consent form, 5 questionnaires including the PANQOL-POL, Glasgow Benefit Inventory (GBI), Assessment of Quality of Life 8-Dimension (AQoL-8D), Skarzynski Tinnitus Scale (STS), and WHO-5 Well-being Index, and a demographic survey.

Ethics approval and consent to participate

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki, and the study protocol was approved by the institutional review board at the Centre of Postgraduate Medical Education, Warsaw, Poland (approval No. 37/2021 issued on May 12, 2021). Every patient enrolled in the study signed an informed consent form after receiving the necessary information from an investigator prior to their participation in the study.

Cross-cultural adaptation of the PANQOL

The PANQOL is a questionnaire established by Shaffer et al.⁵ to evaluate disease-specific QoL in patients with VS. The authors based it on the system that classifies outcomes in terms of body dysfunction, activity restriction and effects on participation in society. They created the first questionnaire for patients with VS that not only involves reporting symptoms but reflects QoL impairment at all 3 levels mentioned above and includes issues specifically identified by patients.⁵

The questionnaire consists of 26 items grouped into 7 domains: Hearing (4), Balance (6), Facial Function (3), Pain (1), Anxiety (4), Energy (6), and General Health (2). The responses are provided with a rating scale from 1 (strongly disagree) to 5 (strongly agree). The total score was obtained by calculating the average number of points from the 7 domain scores. Higher scores are interpreted as a better health-related QoL. The values of test-retest reliability and internal consistency were high.^{1,5} Domain scores were obtained by calculating the average number of points from responses to items assigned to a particular domain. So far, the PANQOL has been adapted and translated into Dutch,⁹ Spanish,¹⁰ French,¹¹ Japanese,¹² and Hindi.¹³

The PANQOL-POL adaptation was based on guidelines by Beaton et al.¹⁴ The first step of the adaptation process was to obtain permission from the authors. The translation process was conducted in accordance with Guidelines for the Cross-Cultural Adaptation Process by Beaton et al.¹⁴

Translation method

Stage 1: Translation of the PANQOL into Polish was conducted by a clinical psychologist (Polish-English native

speaker, not directly engaged in the study) and by a translation agency (bilingual translator, English native-speaker from Cracow, Poland). The translation agency was not informed about the aim of the study, and the translators had different backgrounds.

Stage 2: Synthesis of the translation was performed by a translator and 2 observers from the study team. The result of this stage was to produce 1 translated version.

Stage 3: The 3rd stage was to conduct a back-translation. Two bilingual professionals (from the translation agency) translated the questionnaire back into the original language, and we received 2 back translations.

Stage 4: The Expert Committee of 5 specialists in the fields of neurosurgery, psychiatry and clinical psychology assessed the translation. Polish and English versions were compared with each other, and after some corrections, the best version was finally chosen.

Questionnaires

The AQoL-8D developed by Hawthorne¹⁵ consists of 35 items covering 8 dimensions: Independent Living, Pain, Senses, Mental Health, Happiness, Coping, Relationships, and Self-Worth, as well as Super dimensions: Physical and Psycho-Social. The Polish version of this questionnaire, adapted by Obrycka et al.,¹⁶ has good psychometric properties and is a valid and reliable measure of QoL. The total score of the AQoL-8D and subscales were used to check the validity of the Polish version of the PANQOL.

The GBI was designed by Robinson et al.¹⁷ and intended for single-use post-intervention as a measure of change related to a specific medical procedure, especially for otolaryngological interventions. The tool consists of 18 items. The questions are related to aspects of general, social and physical health. The scores range from –100 to +100 (max benefit). The Physical Health subscale was used to check the validity of the Polish version of the PANQOL for the General Health subscale.

The STS was established by Skarzynski et al.¹⁸ to evaluate tinnitus complaints, either with normal or impaired hearing. The scale consists of 15 items grouped into 3 subscales: psychological distress, functioning and coping. Scores are expressed on a scale from 0 to 100, where 0 means no difficulties. The total score of STS was used to check the validity of the Polish version of the PANQOL for the Hearing subscale.

The WHO-5 was established by Hajos et al.¹⁹ and adapted by Cichoń et al.²⁰ This is an unidimensional 5-item tool used to measure general emotional wellbeing. The scores are summed with higher scores indicating better emotional wellbeing. The total score of the WHO-5 was used to check the validity of the PANQOL-POL for the subscales of Energy and Anxiety.

A demographic survey included questions about sex, age, residence, education, employment, economic status, marital status, and comorbidities.

Statistical and psychometric analyses

Data analysis was performed using IBM SPSS v. 28.0 for Windows (IBM Corp., Armonk, USA). The level of significance was calculated with a 95% confidence interval (95% CI) ($p < 0.05$).

The basic descriptive statistical data for age with sociodemographic and categorical variables were reported as frequencies and percentages (Supplementary Table 1). A descriptive statistical analysis was performed for all questionnaire measurements (GBI, WHO-5, STS, PANQOL, and AQoL-8D). The means (M), medians (Me), quartiles (Q1; Q3), standard deviations (SD), as well as minimum and maximum values are presented in Supplementary Table 2. We verified data distribution for skewness and kurtosis considering standard errors and the results of the Kolmogorov–Smirnov test.

In the next step, the internal consistency of the Polish version of the PANQOL scale domains was measured using Cronbach's alpha (α). The value of alpha describes the extent to which the items on a scale measure the same concept or construct.²¹ The commonly accepted interpretation of Cronbach's alpha was as follows: ≥ 0.91 (if alpha is too high (about > 0.95), it may suggest that some items are redundant, as they are testing the same question but in a different manner²²) – excellent; < 0.80 – 0.90 – good; < 0.70 – 0.80 – acceptable; < 0.60 – 0.70 – questionable; 0.50 – 0.60 – poor; and ≤ 0.50 – unacceptable.

To verify the validity of the PANQOL subscales, a correlation analysis was conducted, where the Pearson's correlation coefficients (for quantitative variables) using the bootstrap method were estimated between the domains of PANQOL and GBI, WHO-5, STS, and AQoL-8D subscales. The assumption of Pearson's correlation analysis about the linearity was checked using scatter plots. The validation was based on correlations with questionnaires measuring the same or similar construct, correlating with the relevance of the QoL variable. The bias-corrected and accelerated (BCa) bootstrap method using 1000 resamples was used as the recommended technique for calculating confidence intervals in the cases where statistics did not address data normality.^{23–25}

We also compared the results of the PANQOL dimensions between patients with and without dizziness after Gamma Knife surgery (GKS).

Results

Sociodemographic data

The study sample included 124 patients diagnosed with VS and treated with GKS. The mean age of patients was 60.17 years (SD = 13.27). Most patients were women ($n = 77$; 62.10%). In total, 106 (86.18%) patients had secondary or higher education, and the majority assessed their economic status as medium (73.98%). A total of 51

(41.46%) and 64 (52.03%) patients were employed or retired, respectively. Gardner–Robertson (GR) classes I and II after surgery were seen in 25.64% and 24.36% of patients, respectively. Most patients (30.77%) after surgery were assigned to class III according to the GR classification (details presented in Supplementary Table 1), while 10.26% of participants were classified as level V in GR scale which is interpreted as „Deaf”. Descriptive statistical data based on the results obtained from questionnaires are presented in Supplementary Table 2. Most participants had grade 1 according to the House–Brackmann (HB) scoring system, interpreted as a normal function, and facial paralysis was not reported.

PANQOL-POL domain internal consistency

The internal consistency of the PANQOL-POL scale domains is presented in Table 1. Our analysis showed that most PANQOL domains showed excellent or good internal consistencies. The Facial Function and Hearing subscales reached acceptable internal consistencies ($\alpha > 0.7$). The General Health domain showed an unacceptable internal consistency ($\alpha < 0.5$). The low value of alpha may be due to the number of questions in that set (only 2 items).

Table 1. Internal consistencies (Cronbach's alpha) of the Polish version of the PANQOL

PANQOL dimension	M	SD	Cronbach's alpha	Number of items
Anxiety	63.60	24.67	0.897	4
Facial	74.65	21.85	0.730	3
General Health	47.61	18.25	0.424	2
Balance	62.19	25.07	0.916	6
Hearing	54.23	21.30	0.748	4
Energy	57.81	24.05	0.879	6
Pain	58.87	30.61	— ^a	1
Total	59.76	16.75	0.934	26

PANQOL – Penn Acoustic Neuroma Quality-of-Life Scale; M – mean; SD – standard deviation; ^a the Pain subscale consists of only 1 item and thus Cronbach's alpha is not applicable.

Measurement with questionnaires: Correlations with PANQOL-POL scores

Pearson's product–moment correlation coefficients (r) were calculated to examine the interdimensional correlations between the PANQOL domains and the AqoL-8D dimensions. These are presented in Table 2.

The PANQOL Facial Function subscale was weakly but significantly correlated with all AqoL-8D domains ($r = 0.2$ – 0.4). The PANQOL Facial Function subscale had the strongest correlation with the Relationships ($r = 0.39$; Boot95% BCa CI: 0.229–0.530) and Independent Living ($r = 0.38$; Boot95% BCa CI: 0.223–0.527) values.

The PANQOL Anxiety domain was also significantly correlated with all AqoL-8D domains (from a $r = 0.25$ for the Senses value (Boot95% BCa CI: 0.047–0.444) to a $r = 0.61$ for the Utility score (Boot95% BCa CI: 0.430–0.741).

The PANQOL General Health domain showed moderately significant correlations with the Independent Living, Happiness, Coping, Relationships, Self-Worth, Pain, Senses, and Mental Health dimensions. The strongest correlations were observed between the PANQOL General Health domain and the Utility score ($r = 0.65$; Boot95% BCa CI: 0.537–0.738) as well as the Physical super dimension ($r = 0.65$; Boot95% BCa CI: 0.512–0.751).

The PANQOL Balance and Hearing subscales were weakly or moderately correlated with all AqoL-8D domains ($r = 0.28$ – 0.55). The strongest correlations were observed between the PANQOL Balance domain and the Psycho-social super dimension value ($r = 0.53$; Boot95% BCa CI: 0.394 – 0.647), while the PANQOL Hearing subscale had the strongest relationship with the Senses value ($r = 0.55$; Boot95% BCa CI: 0.431–0.664).

The PANQOL Energy dimension was moderately or strongly correlated with all AqoL-8D domains ($r = 0.40$ – 0.66). The strongest correlation was observed between the PANQOL Energy subscale and Utility score ($r = 0.66$; Boot95% BCa CI: 0.528–0.760).

Similarly, the PANQOL total score was moderately or strongly correlated with all AqoL-8D domains ($r = 0.52$ – 0.71). The strongest correlation was observed between the PANQOL total score and Utility score ($r = 0.71$; Boot95% BCa CI: 0.598–0.807).

The PANQOL Balance and Hearing subscales were weakly or moderately correlated with all AqoL-8D domains ($r = 0.28$ – 0.55). The strongest correlations were observed between the PANQOL Balance domain and Psycho-social super dimension ($r = 0.53$; Boot95% BCa CI: 0.394 – 0.647), while the PANQOL Hearing subscale had the strongest relationships with the Senses value ($r = 0.55$; Boot95% BCa CI: 0.431–0.664).

The weakest relationships were observed between the PANQOL Pain dimension and all AqoL-8D domains ($r = 0.18$ – 0.51). There was no significant correlation between this PANQOL subscale and Mental Health, whereas the strongest correlations were observed for the PANQOL Pain subscale and Pain value ($r = 0.51$; Boot95% BCa CI: 0.360–0.629). The strongest significant interdimensional correlations are presented in Supplementary Table 3.

Next, Pearson's product–moment correlation coefficients (r) with the 95% BCa confidence intervals from 1000 bootstrap replications were estimated to test the correlations between the PANQOL domains and WHO-5 scores (Supplementary Table 4). All PANQOL domains were significantly weakly or moderately correlated with WHO-5 scores ($r = 0.18$ – 0.56). The strongest correlation was observed between the PANQOL General Health domain and WHO-5 results ($r = 0.56$; Boot95% BCa CI: 0.429–0.671).

Table 2. The results of Pearson's correlations (r) for PANQOL and AQoL-8D subscales; the bootstrap^a method was used

AQoL-8D												
Statistics		Utility score	Independent living value	Happiness value	Mental health value	Coping value	Relationships value	Self-worth value	Pain value	Senses value	Psychosocial super dimension	Physical super dimension
PANQOL Facial												
r		0.372	0.384	0.275	0.256	0.232	0.388	0.321	0.230	0.333	0.346	0.311
p-value		<0.001	<0.001	0.002	0.004	0.010	<0.001	<0.001	0.010	<0.001	<0.001	<0.001
Bootstrap 95% BCa	LL	0.203	0.223	0.118	0.083	0.039	0.229	0.124	0.052	0.139	0.190	0.138
	UL	0.518	0.527	0.419	0.393	0.389	0.530	0.483	0.397	0.498	0.495	0.454
PANQOL Anxiety												
r		0.607	0.338	0.539	0.570	0.580	0.489	0.546	0.415	0.252	0.416	0.570
p-value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.001	<0.001
Bootstrap 95% BCa	LL	0.430	0.136	0.409	0.412	0.416	0.322	0.379	0.258	0.047	0.244	0.413
	UL	0.741	0.540	0.650	0.694	0.705	0.631	0.676	0.562	0.444	0.579	0.701
PANQOL General												
r		0.648	0.480	0.522	0.609	0.513	0.554	0.457	0.512	0.398	0.578	0.648
p-value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bootstrap 95% BCa	LL	0.537	0.340	0.365	0.494	0.358	0.398	0.312	0.380	0.278	0.472	0.512
	UL	0.738	0.607	0.656	0.704	0.656	0.682	0.573	0.625	0.519	0.671	0.751
PANQOL Balance												
r		0.467	0.491	0.286	0.354	0.335	0.398	0.314	0.430	0.384	0.527	0.366
p-value		<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bootstrap 95% BCa	LL	0.321	0.358	0.123	0.205	0.177	0.250	0.144	0.274	0.263	0.394	0.207
	UL	0.602	0.617	0.442	0.488	0.490	0.540	0.470	0.579	0.506	0.647	0.523
PANQOL Hearing												
r		0.482	0.325	0.297	0.320	0.363	0.449	0.417	0.312	0.554	0.449	0.371
p-value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bootstrap 95% BCa	LL	0.315	0.170	0.111	0.134	0.180	0.270	0.245	0.132	0.431	0.293	0.176
	UL	0.628	0.482	0.454	0.489	0.516	0.599	0.563	0.478	0.664	0.592	0.555
PANQOL Energy												
r		0.662	0.459	0.514	0.584	0.561	0.617	0.554	0.402	0.451	0.517	0.655
p-value		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bootstrap 95% BCa	LL	0.528	0.308	0.382	0.465	0.405	0.492	0.410	0.246	0.279	0.379	0.539
	UL	0.760	0.600	0.632	0.683	0.687	0.724	0.665	0.530	0.584	0.636	0.754
PANQOL Pain												
r		0.344	0.311	0.189	0.118	0.268	0.265	0.276	0.508	0.233	0.452	0.183
p-value		<0.001	<0.001	0.037	0.195	0.003	0.003	0.002	<0.001	0.009	<0.001	0.042
Bootstrap 95% BCa	LL	0.152	0.127	-0.014	-0.105	0.064	0.080	0.090	0.360	0.056	0.298	-0.045
	UL	0.502	0.454	0.358	0.317	0.432	0.421	0.434	0.629	0.394	0.575	0.376
PANQOL Total												
r		0.712	0.558	0.517	0.547	0.570	0.624	0.577	0.574	0.515	0.661	0.608
p		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bootstrap 95% BCa	LL	0.598	0.419	0.378	0.372	0.439	0.498	0.420	0.442	0.358	0.554	0.468
	UL	0.807	0.676	0.629	0.689	0.689	0.727	0.708	0.694	0.642	0.757	0.741

PANQOL – Penn Acoustic Neuroma Quality-of-Life Scale; AQoL-8D – Assessment of Quality of Life 8-Dimension; Bootstrap 95% BCa – the bias-corrected and accelerated (BCa) 95% bootstrap confidence interval; LL and UL – lower and upper limit of 95% confidence interval. Values in bold are significant at 95% confidence limit; ^a bootstrap 1000 samples.

In the next step, Pearson's product–moment correlation coefficients (r) with the 95% BCa confidence intervals from 1000 bootstrap replications were also estimated to test the correlations between PANQOL domains and GBI dimensions (Supplementary Table 5).

Only the GBI Support subscale was not significantly correlated with PANQOL domains. The observed significant relationships between the GBI and PANQOL domains were weak ($r = 0.18$ – 0.43). The strongest correlation was observed between the PANQOL General Health domain and GBI total results ($r = 0.43$; Boot95% BCa CI: 0.268 – 0.567) as well as between the PANQOL General Health domain and GBI General subscale ($r = 0.42$; Boot95% BCa CI: 0.255 – 0.567).

We also estimated Pearson's product–moment correlation coefficients (r) with the 95% BCa CIs from 1000 bootstrap replications to test the correlations between the PANQOL domains and the STS scale (Supplementary Table 6).

The STS scale was negatively and weakly correlated with 4 PANQOL domains: General Health ($r = -0.19$; Boot95% BCa CI: -0.347 – -0.022), Hearing ($r = -0.40$; Boot95% BCa CI: -0.544 – -0.249), Energy ($r = -0.22$; Boot95% BCa CI: -0.391 – -0.050), and total PANQOL scores ($r = -0.26$; Boot95% BCa CI: -0.428 – -0.093). Thus, the more tinnitus complaints (STS score), the lower the scores in the General Health, Hearing and Energy domains and the aggregate results of PANQOL.

Dizziness after surgery and PANQOL results

Further, we compared the PANQOL Balance subscale results between patients with and without dizziness after surgery (Supplementary Table 7). Patients without dizziness obtained higher PANQOL scores ($M = 78.43$; $SD = 20.25$) than those with dizziness after surgery ($M = 48.14$; $SD = 19.74$); $t(121) = 8.39$; 95% BCa CI: 23.28 – 37.34 . The effect size was large (Cohen's $d = 1.52$).

Discussion

The purpose of this study was to conduct the first adaptation of the disease-specific questionnaire for patients with VS to Polish conditions and to evaluate its psychometric properties based on data obtained from 124 patients, the largest group in which adaptations have been performed so far. The results of the study demonstrate that the PANQOL-POL is a valid and reliable instrument to measure disease-specific QoL in patients with VS. Our analysis showed that most PANQOL domains had excellent or good internal consistency measured with Cronbach's alpha; similar values were reported in the original version of this tool presented by Shaffer et al.⁵ Only the General Health domain showed unacceptable internal consistency ($\alpha < 0.5$), as in the Japanese adaptation.^{9,12} The low value

of alpha may be due to the small number of questions in that set (only 2 items). Nishiyama et al.¹² emphasized that clinicians need to be careful in interpreting the General Health domain score. As in previous adaptations conducted by van Leeuwen et al.⁹ (PANQOL-Dutch), Nishiyama et al.¹² (PANQOL-Japanese) and Pattankar et al.¹³ (PANQOL-Hindi), we did not determine the internal consistency for the Pain domain because it included only a single item.

To verify the validity of the PANQOL subscales, a correlation analysis was conducted between the domains of PANQOL and the following questionnaires: AQoL-8D, GBI, WHO-5 and STS, as well as the presence of dizziness and GR classes. In the previous non-Polish adaptations (such as Japanese, Dutch and Hindi), the PANQOL total score was correlated with the 36-Item Short Form Health Survey (SF-36). In the Polish adaptation, we decided to use the AQoL-8D questionnaire as we focused on patients with hearing loss and this tool is frequently used in this group of patients. Our analysis showed a strong correlation between the PANQOL total score and the AQoL-8D Utility score. Strong correlations were found between subscales AQoL-8D Pain and PANQOL Pain, AQoL-8D Physical super dimension and PANQOL General Health, AQoL-8D Utility and PANQOL Energy, and AQoL-8D Senses and PANQOL Hearing. Furthermore, the PANQOL Hearing subscale was correlated with GR classes, and the results showed that the higher the GR class (greater degree of hearing impairment), the lower the scores on the PANQOL, which is interpreted as a worse QoL. Moreover, the analysis showed a relationship between lower anxiety according to the PANQOL and better coping in daily life. All PANQOL domains were significantly weakly or moderately correlated with WHO-5 scores. The strongest correlation was observed between the PANQOL General Health domain and WHO-5 results, which could be interpreted that patients who assessed their general health as better also reported better mental health functioning. We observed a correlation between the PANQOL General Health domain and GBI total results. Patients who reported better general health also reported higher benefits after GKS treatment.

The PANQOL Facial Function domain had the strongest correlation with the Relationships value. It needs to be highlighted that most participants had grade 1 according to the HB scoring system, which is interpreted as a normal function, and facial paralysis was not reported. Patients achieved high scores ($M = 74.65$; $S = 21.85$) in the PANQOL Facial Function domain, which is consistent with our medical data (patients did not have facial nerve dysfunction). In the Hindi adaptation of the PANQOL conducted by Pattankar et al.,¹³ the PANQOL Facial Function domain had poor correlation with SF-36 dimensions. We also compared the results of the PANQOL Balance subscale between patients with and without dizziness after surgery. The results showed that patients who did not report dizziness obtained better scores in the PANQOL Balance. Moreover, the more tinnitus complaints (STS

score), the lower scores in General Health, Hearing and Energy domains and the total results of the PANQOL.

The PANQOL is a disease-specific questionnaire including questions about symptoms. The results of our study indicate a strong correlation between the general and specific questionnaires. Therefore, we propose that the PANQOL be used to assess quality of life in patients with VS.

Limitations

The General Health domain showed unacceptable internal consistency ($\alpha < 0.5$) for the Polish version of the scale. The low value of alpha may be due to the number of questions in that set (only 2 items). Clinicians need to be careful in interpreting the General Health domain scores, and to assess it, additional questionnaires should be applied. Quality of life is a subjective construct and multiple factors may have an impact on the health-related QoL of patients. According to the Central Brain Tumor Registry in the USA, the incidence increases between the 65–74-year-old age group without a sex difference.²⁶ In our study, the study group could be more representative in terms of gender distribution. Vestibular schwannoma occurs with the same frequency in both sexes.

Conclusions

The present report is the first adaptation of a disease-specific questionnaire for patients with VS to Polish conditions. The results demonstrated that the Polish version of PANQOL is a reliable and valid questionnaire.

Supplementary data

The Supplementary materials are available at <https://doi.org/10.5281/zenodo.10933235>. The package includes the following files:

Supplementary Table 1. Demographic and medical characteristics of the patients (n = 124)

Supplementary Table 2. Descriptive statistics of questionnaires used in the study.

Supplementary Table 3. The strongest correlations between AQoL-8D and PANQOL subscales (n = 123).

Supplementary Table 4. Pearson's correlations (r) for PANQOL subscales and WHO-5_ the bootstrap method was used.

Supplementary Table 5. Pearson's correlations (r) for PANQOL subscales and GBI_ the bootstrap method was used.

Supplementary Table 6. Pearson's correlations (r) for PANQOL subscales and STS_ the bootstrap method was used.

Supplementary Table 7. Comparison of patients with and without dizziness after Gamma Knife surgery based on the PANQOL Balance subscale scores.

Data availability


The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.


Consent for publication


Every patient was informed and gave their consent to the statistical processing and anonymous publication of their answers before participating in this study.

ORCID iDs


Katarzyna Bienkowska  <https://orcid.org/0000-0002-3390-3244>


Barbara Kostecka  <https://orcid.org/0000-0002-0531-3642>

Grzegorz Turek  <https://orcid.org/0000-0002-0609-5819>

Mirosław Zabek  <https://orcid.org/0000-0001-6847-2424>

Andrzej Kokoszka  <https://orcid.org/0000-0003-4518-5494>

Sebastian Dzierżęcki  <https://orcid.org/0000-0002-8262-1999>

Ewelina Cichoń  <https://orcid.org/0000-0001-5728-3003>

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