

Research Article

Construction and Preliminary Validation of the Chinese Assessment Scale for Zoster-associated Pain Based on the Delphi Method

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Abstract

This study aimed to develop and preliminarily validate a Chinese assessment scale for zoster-associated pain (ZAP) based on the Delphi method. A descriptive study was conducted. An initial item pool was developed based on domestic and international guidelines, expert consensus, and professional discussions related to ZAP. The Delphi method was employed in September 2023 to screen and revise the items, forming a preliminary version of the scale. From October 5, 2023, to January 31, 2024, a total of 209 patients with ZAP treated at the Department of Pain Management, The First Affiliated Hospital of Zhejiang University School of Medicine, were surveyed using this scale. Items were excluded using several criteria: standard deviation < 0.7 or coefficient of variation < 0.15 (dispersion trend method), correlation coefficient < 0.2 or non-significant differences ($P > 0.05$) (correlation analysis), non-significant differences ($P > 0.05$) (critical ratio method), and factor loadings < 0.4 or cross-loadings > 0.4 on multiple factors (exploratory factor analysis). Reliability was evaluated using internal consistency (Cronbach's α), and validity was assessed through content and construct validity. Two rounds of Delphi expert consultation were conducted, involving 15 clinical pain specialists. A preliminary 16-item scale was developed based on threshold screening criteria. The response rate for both Delphi rounds was 100%, and the authority coefficients of experts were all > 0.7. Cronbach's α coefficients were 0.847 and 0.909 for the first and second rounds, respectively. Kendall's W coefficients were 0.259 ($\chi^2 = 108.814$, $P < 0.001$) and 0.291 ($\chi^2 = 74.130$, $P < 0.001$) across the two rounds. Following item analysis of the 209 patient responses, 15 items were retained. The content validity of the scale was judged to be satisfactory by pain specialists. After further validity testing, 11 items were finally retained. The Kaiser-Meyer-Olkin (KMO) value was 0.837, and Bartlett's test of sphericity was significant ($P < 0.001$). Exploratory factor analysis extracted three common factors, accounting for a cumulative variance contribution of 64.791%. The final Cronbach's α coefficient was 0.808. The developed Chinese version of the ZAP assessment scale consists of 11 items across three dimensions, demonstrating good reliability, validity, and applicability.

Keywords

Herpes Zoster, Zoster-associated Pain, Delphi Method, Scale Development, Items, Reliability, Validity

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1. Introduction

Zoster-associated pain (ZAP) encompasses both acute pain during the onset of herpes zoster and postherpetic neuralgia (PHN). Acute ZAP refers to pain occurring from the onset of the rash until the healing of skin lesions [1], whereas PHN is defined as pain that persists for one month or more after lesion resolution [2]. ZAP may present as continuous or intermittent pain with diverse characteristics and is often accompanied by emotional disturbances, sleep disorders, and impaired quality of life.

Epidemiological studies estimate the incidence of herpes zoster in the Asia-Pacific region at 3 to 10 per 1,000 person-years, with over 90% of patients experiencing moderate to severe pain. The incidence of PHN following herpes zoster is approximately 25% [3], rising to 29.8% in Chinese populations [4]. The risk increases significantly with age—around 65% of patients over 60 years old and up to 75% of those over 70 develop PHN [3]. Once established, PHN may persist for years or even decades, profoundly affecting both physical and psychological health, reducing quality of life, and leading to insomnia, anxiety, depression, or even suicidal ideation. This condition places a substantial burden on families and society at large [4-8].

Clinically, early intervention throughout the course of herpes zoster is emphasized, with the goal of promptly and effectively managing pain [9-11]. Continuous monitoring of pain intensity is crucial during treatment [12-16]. Pain assessment is a critical component of ZAP management and should follow a multidimensional approach. Current clinical tools recommended for pain intensity include the Visual Analogue Scale (VAS) and the Numerical Rating Scale (NRS); for pain characteristics, instruments such as ID Pain, the Douleur Neuropathique 4 (DN4), and the painDETECT questionnaire are utilized. Quality of life can be evaluated with instruments like the SF-36, the Nottingham Health Profile, or disease-specific indices. However, these tools often focus on a single dimension and lack a comprehensive assessment specific to ZAP.

There remains a clinical need for a simple, multidimensional, and standardized digital tool to comprehensively assess ZAP, allowing clinicians to quantitatively monitor disease progression and therapeutic response, ultimately forming a closed-loop pain management system. The present study aims to develop a clinically practical scale for evaluating the disease status of patients with ZAP and to validate its reliability and validity, thereby providing a more effective tool for clinical practice and scientific research.

2. Participants and Methods

2.1. Development of the Chinese ZAP Assessment Scale Based on the Delphi Method

2.1.1. Construction of the Item Pool

This study compiled authoritative domestic and international guidelines, expert consensus, and normative documents related to zoster-associated pain (ZAP), including the Chinese Expert Consensus on the Diagnosis and Treatment of Postherpetic Neuralgia (2016 Edition), Expert Consensus on the Comprehensive Management of Zoster-Associated Pain (2021 Edition), Chinese Expert Consensus on the Application of Pain Assessment Scales (2020 Edition), and Chinese Guidelines for the Assessment and Management of Neuropathic Pain (2024 Edition). In combination with the epidemiological features and clinical manifestations of ZAP in China and the input of pain medicine specialists, an initial item pool for the assessment scale was constructed.

2.1.2. Expert Selection

The Delphi method [17-23] was used for the preliminary screening of items. Experts in pain management were invited to participate in two rounds of consultation, approximately two weeks apart [24]. Based on the consultation results, the final items were determined. A total of 15 pain specialists from 12 provinces were included, covering all major regions in China (northeast, north, east, south, central, and southwest). The first round was conducted from September 6 to 8, 2023, and the second round from September 25 to 26, 2023. Inclusion criteria for experts were: (1) associate senior professional title or above; (2) working in a pain management department; (3) at least 10 years of professional experience; and (4) willingness to participate in the study.

2.1.3. Preliminary Item Screening

A 5-point Likert scale [18-21] was used to rate the importance of each item, where 5 indicated "very important" and 1 indicated "not important." The scale contained no reverse-scored items. The degree of expert consensus was reflected by the mean score and the full-score rate (full-score rate = number of scores rated 5 / total number of responses). Initial screening was conducted using the threshold method, with the following three criteria:

- (1) $\text{Mean} \geq (\text{mean} - \text{SD})$;
- (2) $\text{Full-score rate} \geq (\text{full-score rate} - \text{SD})$;
- (3) $\text{Coefficient of variation (CV)} \leq (\text{CV} + \text{SD})$.

Items meeting all three criteria were retained. If one or two criteria were unmet, expert opinion determined inclusion; if none were met, the item was excluded.

2.1.4. Quality Control

Expert enthusiasm was assessed by questionnaire response rate. Expert authority was measured by the authority coefficient (Cr), calculated as $Cr = (Ca + Cs)/2$, where Ca is the coefficient of judgment basis and Cs is the coefficient of familiarity [25, 26]. Coordination among experts was evaluated by the coefficient of variation and Kendall's W. The coefficient of variation = $SD / \text{mean} \times 100\%$. A P-value < 0.05 was considered statistically significant.

2.2. Validation of the Preliminary Scale and Formation of the Tentative Version

2.2.1. Study Participants

From October 5, 2023, to January 31, 2024, patients diagnosed with ZAP and treated at the Department of Pain Management, The First Affiliated Hospital of Zhejiang University School of Medicine, were enrolled to assess the reliability and validity of the preliminary scale. The required sample size was 5–10 times the number of items in the scale. With 16 items initially proposed, a total of 209 valid cases were included.

Inclusion criteria: (1) diagnosed with ZAP; (2) first-time consultation for this episode; (3) capable of completing the questionnaire and follow-up, with complete clinical records; (4) informed consent and voluntary participation.

Exclusion criteria: (1) unclear diagnosis or presence of other evident pain-causing diseases; (2) psychiatric disorders affecting judgment.

Table 1. Expert Familiarity Criteria (Cs) Assignment Table.

Familiarity Level	Score
Extremely Familiar	1.00
Familiar	0.75
Somewhat Familiar	0.50
Not Familiar	0.25

Table 2. Expert Judgement Criteria (Ca) Assignment Table.

Judgement Basis	Impact Factor	Large
Practical Experience	0.5	Large
Theoretical Analysis	0.3	Medium
Domestic and International Literature	0.1	Small

2.2.2. Data Collection and Processing

A trained physician explained the purpose and procedures

of the study to patients using standardized instructions. Upon obtaining informed consent, patients completed the survey through an online platform. Questionnaires with incomplete answers, logical inconsistencies, or duplications (based on name and birthdate) were excluded.

All collected data were entered into a database for cleaning, including the removal of invalid entries, identification of missing or abnormal values, and verification of data accuracy.

2.2.3. Screening of Items in the Tentative Scale

Items were screened using the dispersion trend method, correlation coefficient method, critical ratio method, and exploratory factor analysis.

(1) Dispersion Trend Method: This assessed item sensitivity. Items with a standard deviation (SD) < 0.7 or coefficient of variation (CV) < 0.15 were considered insufficiently sensitive and potentially removed.

(2) Correlation Coefficient Method: This assessed item representativeness and homogeneity. The correlation coefficient (r) between each item and the total score was calculated. An $r < 0.2$ or a non-significant correlation ($P > 0.05$) indicated poor homogeneity and was grounds for item exclusion.

(3) Critical Ratio Method: Based on total scores, participants were divided into high-score (top 27%) and low-score (bottom 27%) groups. Independent sample t-tests were used to compare item scores between groups. Items with no statistically significant differences ($P > 0.05$) lacked discriminative power and were removed.

2.2.4. Reliability and Validity Analysis

(1) Validity: Validity refers to the degree to which the instrument measures what it is intended to measure [27, 28]. This study evaluated both content validity and construct validity. Content validity was assessed by expert judgment on the alignment of items with the construct being measured. Construct validity was evaluated using exploratory factor analysis (EFA). The Kaiser-Meyer-Olkin (KMO) value and Bartlett's test of sphericity determined the suitability of EFA. Principal component analysis with varimax rotation was then used to extract common factors and determine item loadings and variance contribution.

(2) Reliability: Reliability reflects the consistency, stability, and internal coherence of the instrument [28, 29]. It was assessed using Cronbach's alpha coefficient, which indicates the average of all possible split-half reliabilities. A Cronbach's $\alpha > 0.8$ indicates high reliability; 0.7–0.8 indicates good reliability; 0.6–0.7 indicates acceptable reliability; and < 0.6 suggests poor reliability. The study process is illustrated in Figure 1.

2.3. Statistical Methods

Data were analyzed using SPSS 26.0 statistical software. Quantitative data that followed a normal distribution are presented as mean $\pm$ standard deviation ($\bar{x} \pm s$), while quantitative

data that did not follow a normal distribution are presented as median (interquartile range) [M (Q1, Q3)]. Categorical variables are presented as frequency (percentage) [n (%)]. Item analysis, validity testing, and reliability testing were performed on the collected

questionnaires. A p-value of less than 0.05 was considered statistically significant.

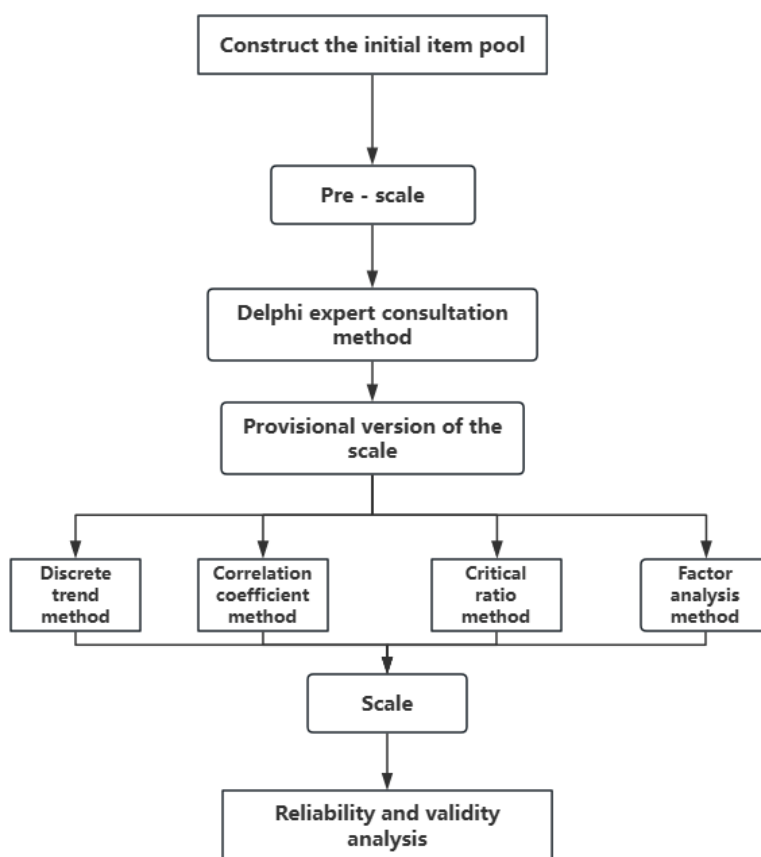


Figure 1. Flowchart of constructing and preliminarily validating the Chinese Scale for Assessment of Herpes Zoster-Related Pain based on the Delphi Method.

3. Results

3.1. Construction of the ZAP Assessment China Scale

3.1.1. Expert Representation

A total of 15 experts were invited to participate in the study, all of whom were pain specialists. These experts were from 12 provinces, covering regions including Northeast, North, East, South, Central, and Southwest China. The experts were selected to ensure a good representation of the field, with a balanced distribution in terms of age, years of work experience, professional titles, and academic qualifications. The basic information of the expert group is shown in Table 3.

Table 3. Basic Information of Expert Consultants in the German Legal Consultation (n=15).

Item	Number (%)
Gender	
Male	9 (60%)
Female	6 (40%)
Age (years)	
40 ~ 50	2 (13.3%)
>50 ~ 60	13 (86.7%)
Position	
Associate Senior	1 (6.7%)

Item	Number (%)
Senior	14 (93.3%)
Education	
Bachelor's Degree	2 (13.3%)
Master's Degree	6 (40.0%)
Doctorate	7 (56.7%)
Years of Work Experience (years)	
10 ~ 15	1 (6.7%)
>15 ~ 20	1 (6.7%)
>20	13 (86.7%)
Region	
Secondary Cities	12 (80.0%)
Tertiary Cities	2 (13.3%)
Cities and Below	(6.7%)

3.1.2. Expert Participation

In the first round, 15 questionnaires were distributed, and all 15 were returned, resulting in a 100% response rate. Three experts provided textual modification suggestions. In the second round, 15 questionnaires were distributed, and all 15 were returned, again achieving a 100% response rate, with three experts offering textual modification suggestions. This indicates a high level of expert participation.

3.1.3. Expert Authority

The analysis of expert authority indicated that, in the first round, the expert judgment coefficient (Ca) was 0.94 ± 0.06 , the expert familiarity coefficient (Cs) was 0.92 ± 0.15 , and the

expert authority coefficient (Cr) was 0.93 ± 0.09 . In the second round, the expert judgment coefficient (Ca) was 0.95 ± 0.06 , the expert familiarity coefficient (Cs) was 0.95 ± 0.10 , and the expert authority coefficient (Cr) was 0.95 ± 0.06 . Both rounds showed expert authority coefficients greater than 0.7, indicating a high level of authority among the experts [30].

3.1.4. Concentration of Expert Opinions

The results from the first round of consultation showed an average indicator score between 3.07 and 4.80, with a maximum score ratio ranging from 0.13 to 0.80, and a coefficient of variation between 0.09 and 0.34. In the second round, the average indicator score ranged from 3.47 to 4.80, the maximum score ratio was between 0.20 and 0.87, and the coefficient of variation ranged from 0.11 to 0.30. The results of expert consultations are shown in Table 4.

The scale used the threshold method to filter items, with the threshold table shown in Table 5. Results indicated that, in the first round, two items did not meet three threshold criteria and were therefore deleted (Items 16 and 20). Four items did not meet two threshold criteria, but after expert discussion, Item 9 was retained, and Items 19, 22, and 27 were deleted. Three items did not meet one threshold criterion, but after expert discussion, Item 3 was retained, and Item 26 was deleted. Items 28 and 29 were deleted to ensure the scale's clinical operability and convenience. After the second round of consultation, one item did not meet three threshold criteria and was deleted (Item 18), one item did not meet two threshold criteria, but after discussion, Item 2 was retained, and Items 3, 5, and 9 were kept. Redundant items, such as Item 8, were deleted after expert discussion. After two rounds of Delphi expert consultations and group discussion adjustments, a provisional scale with 16 items was formed, as detailed in Table 6.

Table 4. Expert Consultation Results in German Legal Consultation (n=15).

No.	Item	Round 1			Round 2		
		Importance Score (M±SD)	Full Score Ratio	CV	Importance Score (M±SD)	Full Score Ratio	CV
1	Pain distribution location	4.67±0.60	0.73	0.13	4.73±0.57	0.80	0.12
2	Area of skin lesions/pigmentation	4.13±0.81	0.40	0.19	3.80±0.75	0.20	0.20
3	Depth of pain location	3.87±1.09	0.33	0.28	4.13±0.96	0.47	0.23
4	Nature of pain	4.53±0.88	0.73	0.20	4.47±0.88	0.67	0.20
5	Pain attack pattern	4.13±0.88	0.40	0.21	4.07±1.00	0.40	0.25
6	Verbal pain intensity rating	4.73±0.44	0.73	0.09	4.67±0.70	0.80	0.15
7	VAS pain intensity rating	4.26±0.85	0.47	0.20	—	—	—
8	NRS pain intensity rating	4.73±0.44	0.73	0.09	4.80±0.54	0.87	0.11

No.	Item	Round 1			Round 2		
		Importance Score (M±SD)	Full Score Ratio	CV	Importance Score (M±SD)	Full Score Ratio	CV
9	Current pain level	3.73±1.00	0.27	0.27	4.00±0.63	0.20	0.16
10	24-hour pain level	4.20±0.75	0.40	0.18	—	—	—
11	72-hour pain level	4.27±0.77	0.47	0.18	—	—	—
12	Peak pain level	4.13±0.96	0.47	0.23	4.60±0.61	0.67	0.13
13	Average pain level	3.93±0.85	0.27	0.22	4.20±0.75	0.40	0.18
14	Pain duration	4.27±0.77	0.47	0.18	4.33±0.70	0.47	0.16
15	Breakthrough pain frequency/hour	4.33±0.94	0.60	0.22	4.73±0.57	0.80	0.12
16	Weather-induced pain exacerbation	3.07±0.85	0.07	0.28	—	—	—
17	Touch-evoked pain	4.67±0.47	0.67	0.10	4.53±0.62	0.60	0.14
18	Lesion area numbness	3.80±0.98	0.27	0.26	3.47±1.02	0.20	0.30
19	Lesion area itching	3.67±1.25	0.33	0.34	—	—	—
20	Muscle weakness/abdominal distension	3.47±1.15	0.20	0.33	—	—	—
21	Life/work impact	4.40±0.61	0.47	0.14	4.73±0.57	0.80	0.12
22	Mobility impact	3.67±0.94	0.13	0.26	—	—	—
23	Sleep impact	4.80±0.40	0.80	0.08	4.80±0.54	0.87	0.11
24	Anxiety impact	4.33±0.79	0.53	0.18	4.47±0.81	0.60	0.18
25	Depression impact	4.33±0.67	0.47	0.16	4.53±0.81	0.67	0.18
26	Appetite impact	3.80±0.91	0.20	0.24	—	—	—
27	Health status score	3.73±0.85	0.20	0.23	—	—	—
28	Allodynia test	4.67±0.47	0.67	0.10	—	—	—
29	Pinprick threshold change	4.13±0.88	0.40	0.21	—	—	—

Note: CV = Coefficient of Variation; VAS = Visual Analogue Scale; NRS = Numeric Rating Scale.

Table 5. Threshold Values for Delphi Expert Consultation (n=15).

Item	Round 1 (M ± SD)	Threshold	Round 2 (M ± SD)	Threshold
Importance Score	4.15 ± 0.42	3.74	4.39 ± 0.37	4.03
Full Score Ratio	0.44 ± 0.20	0.25	0.58 ± 0.22	0.36
Coefficient of Variation (CV)	0.20 ± 0.07	0.27	0.17 ± 0.05	0.22

Table 6. Provisional Chinese Scale for Assessing Herpes Zoster-Associated Neuralgia.

No.	Item	Options	Score
1	Primary location of pain in herpes zoster lesions?	None	0

No.	Item	Options	Score
2	Area of herpes zoster lesions/pigmentation (cm ²)?	Lower limbs, upper limbs, perineum, other areas	5
		Head/face, neck, chest/back, waist/abdomen	10
		0	0
		<10 (≈1 palm size)	2.5
		10–30	5.0
		>30–50	7.5
3	Depth of herpes zoster-associated pain?	>50	10.0
		No pain	0
		Superficial or deep pain only	5
		Both superficial and deep pain	10
4	Nature of herpes zoster-associated pain?	Abnormal sensation	0
		Other types of pain	5
		Burning, electric-shock, stabbing, lancinating, tearing pain	10
		Complete relief after episodes	0
5	Pattern of herpes zoster-associated pain attacks?	Partial relief after episodes	3.3
		Persistent pain with mild fluctuations	6.7
		Persistent pain with acute attacks	10.0
		No pain	0
		Mild pain	2
6	Verbal description of pain intensity?	Uncomfortable	4
		Distressing	6
		Horrible	8
		Excruciating	10
7	Current pain intensity (0–10)?	No pain → Excruciating (as above)	0–10
8	Peak pain intensity in past 24h (0–10)?	(Same as Item 6)	0–10
9	Average pain intensity in past 24h (mean of AM/noon/PM scores)?	(Same as Item 6)	0–10
10	Duration of persistent pain in past 24h (hours)?	0	0
		>0–3	2.5
		>3–7	5.0
		>7–12	7.5
		>12	10.0
11	Frequency of breakthrough pain per hour in past 24h?	0	0
		1–6	3.3
		>6–12	6.7
12	Does touching the painful area (e.g., with fingers/clothes/bedding/wind/vibration) induce or worsen pain compared to non-painful	>12	10.0
		0–10	0–10

No.	Item	Options	Score
	areas (0–10)?		
13	Impact of pain on daily activities/work (0–10)?	0–10	0–10
14	Impact of pain on sleep (0–10)?	0–10	0–10
15	Does the pain cause anxiety/worry/irritability (0–10)?	0–10	0–10
16	Does the pain cause depression/feeling life is meaningless (0–10)?	0–10	0–10

Note: 10 cm² $\approx$ size of one adult palm. Items 7–16 use the same 11-point scale (0–10) anchored to the descriptors in Item 6.

3.1.5. Quality Control Results

(1) Reliability Analysis: The statistical results showed that the Cronbach's α coefficient for the first round of the questionnaire was 0.847, and for the second round, it was 0.909, indicating high data quality and reliability.

(2) Consistency Test: Kendall's W test was used to measure

consistency between multiple raters. This study used it to evaluate the consistency of expert assessments of all questionnaire items. The results showed that in the first round, Kendall's W was 0.259 ($\chi^2=108.814$, $P < 0.001$), indicating a moderate level of consistency. In the second round, Kendall's W was 0.291 ($\chi^2=74.130$, $P < 0.001$), showing improved consistency compared to the first round.

3.2. Validation of the ZAP Assessment China Scale

3.2.1. General Data

A total of 209 participants were included, with 108 males and 101 females. The detailed basic information of the patients is shown in Table 7.

Table 7. Baseline Characteristics of 209 Patients with Herpes Zoster-Associated Pain.

Disease Name	Gender (n, Male/Female)	Age [years, Median (IQR)]	Height (cm, Mean $\pm$ SD)	Weight (kg, Mean $\pm$ SD)
Herpes Zoster	108/101	66.0 (58.5–72.0)	163 $\pm$ 8	62 $\pm$ 12

3.2.2. Item Analysis

The study used the discrete trend method, correlation coefficient method, and critical ratio method for item screening.

Discrete Trend Method: The standard deviation of each item was greater than 0.7, and the coefficient of variation was greater than 0.15, indicating high sensitivity and distinguishing ability of the items, all of which were retained.

Correlation Coefficient Method: The Spearman correlation coefficient was calculated for each item's score with the total score of the provisional scale. The analysis showed that Item

1 had a correlation coefficient of 0.099 ($P > 0.01$), suggesting poor homogeneity with the total scale and leading to its exclusion. The remaining items had Spearman correlation coefficients ranging from 0.290 to 0.779 ($P < 0.01$), indicating good homogeneity with the total scale.

Critical Ratio Method: Using two independent sample non-parametric analysis to compare the high and low score groups for each item, the results showed that Item 1 had no significant statistical difference ($P > 0.05$), so it was excluded. Other items showed significant statistical differences ($P < 0.01$), so they were retained. Detailed results are provided in Table 8.

Table 8. Item Analysis Results of 209 Patients with Herpes Zoster Neuralgia.

Item	Mean	SD	CV	Correlation Coefficient	Z-score
1	9.35	1.68	0.18	0.099	-1.138

Item	Mean	SD	CV	Correlation Coefficient	Z-score
2	4.65	2.32	0.50	0.249*	-3.550*
3	7.80	2.49	0.32	0.332*	-4.836*
4	9.62	1.50	0.16	0.266*	-3.298 [#]
5	6.35	4.30	0.68	0.443*	-5.962*
6	5.54	2.11	0.38	0.552*	-6.865*
7	3.84	2.02	0.53	0.712*	-8.319*
8	5.63	2.12	0.38	0.715*	-8.396*
9	4.68	1.89	0.40	0.774*	-8.988*
10	6.87	3.20	0.47	0.482*	-5.897*
11	4.63	3.09	0.67	0.504*	-5.619*
12	4.23	2.32	0.55	0.582*	-6.465*
13	4.93	2.65	0.54	0.779*	-8.956*
14	5.52	2.97	0.54	0.762*	-8.753*
15	3.44	2.89	0.84	0.666*	-7.794*
16	2.80	2.72	0.97	0.613*	-7.089*

Note: * $P < 0.01$, [#] $P < 0.05$

3.2.3. Reliability and Validity Testing

(1) Validity Testing

Content Validity: Based on a review of extensive literature on Zoster-Associated Pain (ZAP), the research team developed a preliminary version of the scale reflecting the epidemiological features and clinical manifestations of ZAP in China. This scale was then refined through two rounds of Delphi expert consultations, followed by evaluations from six pain specialists. After these assessments, it was concluded that the content validity of the provisional scale was satisfactory.

Construct Validity: An exploratory factor analysis (EFA) was conducted on the 15 items. The Kaiser-Meyer-Olkin (KMO) value was 0.862 (> 0.6), and the Bartlett's Test of Sphericity yielded a χ^2 value of 1,423.322 ($P < 0.001$), indicating that the variables were correlated and the factor analysis was valid, with common factors present in the data, making it suitable for conducting EFA. Principal Component Analysis (PCA) was used to extract the factors, and the Varimax rotation method was applied. Based on factor loadings > 0.40 and eigenvalues > 1 , common factors were extracted. Four common factors were identified, and the cumulative variance contribution was 64.283%.

Table 9. Total Variance Explained by Factors in the Chinese Herpes Zoster-Associated Neuralgia Assessment Scale (Provisional Version).

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Eigen-value	Variance Explained (%)	Cumulative (%)	Eigen-value	Variance Explained (%)	Cumulative (%)	Eigen-value	Variance Explained (%)	Cumulative (%)
1	4.574	41.583	41.583	4.574	41.583	41.583	4.238	38.529	38.529
2	1.476	13.414	54.998	1.476	13.414	54.998	1.611	14.643	53.173
3	1.077	9.793	64.791	1.077	9.793	64.791	1.278	11.618	64.791

Item 11 had factor loadings <0.40 for all corresponding factors, thus it was excluded. Items 8 and 12 had factor loadings >0.40 for two factors, so these items were also excluded. Factor 4 contained only item 2 with a factor loading >0.40 , which led to the exclusion of item 2. The remaining items had factor loadings between 0.628 and 0.860, with each item loading on only one factor, and the factor loadings for these items were all >0.40 . After excluding items 2, 8, 11, and 12, a second exploratory factor analysis was performed. The new KMO value was 0.837 (>0.6), and Bartlett's Test yielded a χ^2 value of 984.103 ($P<0.001$), confirming that the data were suitable

for factor analysis. Three common factors were extracted in this second analysis, and the cumulative variance contribution was 64.791%, as shown in Table 10. The factor loadings for the remaining items ranged from 0.690 to 0.827, with each item loading on only one factor, and the factor loadings were all >0.40 . This demonstrated that the scale had a well-defined structural dimension. The factor loading matrix for each item is shown in Table 10. The research team named Component 1 as "Pain Intensity," Component 2 as "Pain Duration," and Component 3 as "Pain Nature."

Table 10. Exploratory Factor Loading Analysis of Items in the Provisional Chinese Scale for Herpes Zoster-Associated Pain Assessment.

Item	Factor		
	F1	F2	F3
15	0.827	-	-
13	0.815	-	-
9	0.785	-	-
16	0.780	-	-
14	0.777	-	-
6	0.731	-	-
7	0.690	-	-
5	-	0.872	-
10	-	0.833	-
4	-	-	0.759
3	-	-	0.750

(2) Reliability Testing

The reliability test results of this study show that the Cronbach's α coefficient for this scale is 0.808, indicating good reliability ($\alpha > 0.8$). The final version of the scale is presented in Table 11.

Table 11. Chinese Assessment Scale for Zoster-Associated Pain.

No.	Item	Option	Score
1	Depth of pain	No pain	0
		Superficial or deep	5
		Both exist	10
2	Characteristics of pain	Abnormal sensation	0
		Other characteristics	5
		Burning, lightning, knife-like, prickling-like, tearing	10
3	Pattern of attack	Pain completely relieved after attack	0
		Pain partially relieved after attack	3.3

No.	Item	Option	Score
4	Verbal description of pain intensity	Persistent pain with slight fluctuation	6.7
		Persistent pain with paroxysmal exacerbation	10
		No pain	0
		Mild	2
		Unbearable	4
		Agonizing	6
		Dreadful	8
5	The current pain intensity? (Score)	Extremely painful	10
		0-10	0-10
6	The average pain intensity in the past 24 h? (h)	0-10	0-10
		0	0
		>0-3	2.5
7	The duration of persistent pain in the past 24 h? (h)	>3-7	5
		>7-12	7.5
		>12	10
8	Impact of pain at the herpes site on daily activities or work? (Score)	0-10	0-10
9	Impact of pain at the herpes site on sleep? (Score)	0-10	0-10
10	Whether feeling uneasy, worried, anxious and irritable due to pain at the herpes site? (Score)	0-10	0-10
11	Whether feeling unhappy, depressed, or even hopeless due to pain at the herpes site? (Score)	0-10	0-10

4. Discussion

There are many current treatment options for Zoster-Associated Pain (ZAP) in pain management, including pharmacological therapy, minimally invasive interventions, physical rehabilitation therapy, and traditional Chinese medicine treatments [1, 2, 9-11]. How to quickly form a comprehensive understanding of the ZAP patient's condition upon their visit to the clinic is key to determining the appropriate treatment plan. Similarly, assessing the effectiveness of treatment quickly is crucial for determining the patient's prognosis and recovery after treatment. The development of the ZAP assessment scale aims to provide accurate evaluation of the patient's condition and treatment outcomes, while keeping the number of items small, using simple language, and making it easy to analyze, thus offering a reference for clinical management and having a far-reaching significance in the rational distribution and utilization of healthcare resources.

This study strictly adhered to the guidelines for scale development, creating an item pool of 29 items based on important

norms, guidelines, consensus, and expert opinions within the field, ensuring comprehensive, rigorous, and authoritative inclusion of items. All experts invited in this study had extensive theoretical and practical experience in pain management and related fields, with over 10 years of experience and at least an associate senior professional title, ensuring the professionalism of the research. Based on the results of two rounds of Delphi expert consultations, a provisional scale with 16 items was created. To avoid bias, experts who participated in the initial questionnaire formulation were not invited to take part in the Delphi consultations.

During the validation phase of the scale, this study included 209 cancer pain patients at the First Affiliated Hospital, Zhejiang University School of Medicine. In selecting the statistical screening methods, the study adopted three commonly used methods from the literature for item selection. The final scale, containing 3 dimensions and 11 items, was established. The Cronbach's α coefficient for the scale was 0.808, and the KMO value for validity testing was 0.837, both exceeding 0.7, indicating that the scale has good reliability and validity and can be widely applied in clinical practice.

The research on this scale is still in its initial stages. Despite

fully considering the scientific rigor, feasibility, expert distribution, authority, and professional representativeness of the Delphi method, the reliability of the study results may still be affected by the limitations of expert thinking and subjectivity. The analysis of expert coordination revealed that Kendall's W was relatively low, suggesting that the overall consistency of expert opinions on the importance of the items was not high. This may be related to the experts' knowledge background and clinical experience, and factors such as item setting and language expression may have contributed to the lower Kendall's W value. The study carefully considered these factors when adjusting the scale based on expert opinions. Due to implementation challenges, only partial reliability and validity testing were conducted, with further reliability analysis (e.g., test-retest reliability, inter-rater reliability) and additional validity indicators (e.g., criterion validity, convergent validity, discriminant validity) to be performed in the future [31].

The design of this scale is based on common symptoms and signs of ZAP, and each item's options are assigned values to assess the pain characteristics and their impact on the body from multiple dimensions, including pain nature, sensory abnormalities, hyperalgesia, daily living ability, and emotional impact. Compared to current clinical assessment scales, this scale covers a more comprehensive range of content. However, the scale's development involved the Delphi method, discrete trend method, correlation coefficient method, critical ratio method, and factor analysis method for item analysis, and the high standards for item screening might have led to the exclusion of items slightly below the threshold. Moreover, the validation phase only included patients from a single hospital, and the sample size was relatively small, leading to limitations in the study population and the potential for bias due to the lack of strict control over follow-up time.

5. Conclusion

In summary, the ZAP Assessment China Scale developed in this study includes 3 dimensions (pain severity with 7 items, pain duration with 2 items, pain nature with 2 items), totaling 11 items. It has good reliability, validity, and applicability for ZAP patients, making it an effective, reliable, and easy-to-use tool for assessing ZAP patients' conditions, and providing a valuable instrument for clinical practice and scientific research.

Abbreviations

ZAP	Zoster-Associated Pain
KMO	The Kaiser-Meyer-Olkin Value
PHN	Postherpetic Neuralgia
VAS	The Visual Analogue Scale
NRS	The Numerical Rating Scale
DN4	The Douleur Neuropathique 4
SD	Standard Deviation

CV	Coefficient of Variation
EFA	Exploratory Factor Analysis
CV	Coefficient of Variation
PCA	Principal Component Analysis

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Conflicts of Interest

The authors declare no conflicts of interest.

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