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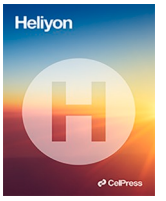

Research article

Cultural adaptation and reliability testing of the Chinese version of evidence-based practice knowledge assessment in nursing: A cross-sectional study

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ABSTRACT

Objective: The EKAN is a reliable and validated tool for objectively measuring the evidence-based practice (EBP) knowledge of nurses. Thus, we set out to translate and culturally modify the Evidence-Based Practice Knowledge Assessment in Nursing (EKAN), and then evaluate its validity and reliability among Chinese practicing nurses.

Methods: This cross-sectional study consisted of two phases. The first phase involved translating the EKAN into Chinese (EKAN-Chinese), using a process of forward translation, back translation, review, cultural adjustment as well as a pilot study. The second phase aimed to assess the psychometric properties of the EKAN-Chinese and establish a baseline measure of EBP knowledge among 120 nurses from a large general hospital in Beijing, China. Data were collected from August to November 2022 and analyzed with Rasch software. This study was reported using the cross-sectional STROBE checklist.

Results: The newly translated, EKAN-Chinese was pilot-tested after slight modification of four items without altering the intended meaning. The outfit unweighted mean square was 1.03 (SD = −0.13), the infit weighted mean square was 1.00 (−0.17), and the mean difficulty index ranged from −3.43 to 2.85 according to validity indices. The results of the reliability indices revealed low person reliability (0.49), high item reliability (0.96), moderate person separation index (0.99), and sufficient item separation index (4.71). The mean EKAN-Chinese sum score was 9.8 (max score = 20, SD = 2.9).

Conclusion: The newly translated EKAN-Chinese showed sufficient psychometric evidence to support use in practicing Chinese nurses. The EKAN-Chinese can be used by nurse leaders in China as a potential screening tool to 1) objectively identify nurses who need educational training in evidence-based nursing practice, and 2) gauge the effectiveness of education and training programs to improve EBP knowledge and ultimately, evidence-based care.

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1. Introduction

Evidence-based practice (EBP) is a clinical problem-solving approach and an important global movement to optimize care and outcomes for patients, providers, and organizations [1]. Studies have shown that EBP has become an important initiative to ensure patient safety because it can improve the science of nursing decisions [2], the quality of care delivery [3], patient outcomes, patient compliance, and satisfaction [4,5].

A gap between evidence and practice remains a serious problem in the global nursing field, especially in China, where the current state of EBP is even less objective [6]. At present, the development of evidence-based nursing practice in China is still in its infancy, and nearly 86% of clinical nurses use traditional empirical methods to solve clinical problems. Education is needed as clinical nurses have minimal awareness of evidence-based nursing practice and insufficient knowledge of supporting theory, contributing to a low frequency of implementing evidence-based interventions [7]. Further, evidence-based interventions vary widely across regions and are not widespread [8].

Studies have shown that many obstacles limit the initiation, integration, evaluation, dissemination, application, and evaluation of EBP in clinical practice [9,10]. Nurses' evidence-based care is influenced by individual and organizational factors. Individual factors include knowledge, competence, and willingness to engage in evidence-based nursing practice [11,12]. Organizational factors include resource provision, organizational climate, teamwork, and financial support [11,13]. However, the barrier that needs to be urgently addressed in China is evidence-based nursing practice competence, which was a reflection of knowledge, skills, and application [7]. To address this need, leaders and educators must assess nurses' EBP knowledge as a foundation for skills and application.

Although there are many tools used to assess nurses' EBP knowledge, most are subjective self-rating scales [14]. Ongoing evidence has shown that subjective measures are proxy indicators of objective constructs such as EBP knowledge, and correlate poorly with objective measures [15]. Therefore, objective assessment is vital to understand what nurses know and what education is needed to address their knowledge gaps. Since EBP is a global movement, using a globalized assessment tool to measure EBP knowledge objectively is especially important to reduce evaluation variability and facilitate collaboration on curricula, teaching strategies, and other supports that encourage ongoing efforts to provide evidence-based care.

The Evidence-Based Practice Knowledge Assessment in Nursing (EKAN) instrument is a simple, convenient, 20-item multiple-choice tool. It was developed and tested in the USA using single parameter Rasch analysis to assess the EBP knowledge of nurses across levels of education [16]. EKAN assesses knowledge of EBP-related aspects (e.g., phases of the global quality improvement cycle, significance of statistical results, etc.). Previous studies have indicated that the English version of EKAN, as well as the translated versions in Spanish, French, and Portuguese, demonstrated good reliability and effectiveness [17–19]. However, Chinese is the world's most widely spoken first language [20]; and there was no Chinese version of the EKAN (EKAN-Chinese) as far as we know.

In China, there have been limited studies reporting on the objective assessment of nurses' evidence-based knowledge competence. Most of these studies have relied on subjective evaluation scales [21], which do not accurately capture the true level of nurses' competence in evidence-based practice. Therefore, the utilization of objective assessment tools that demonstrate good reliability and validity is crucial in analyzing the structure and level of evidence-based practice knowledge among Chinese nurses. Such tools can also serve as a reference for the subsequent development of appropriate educational measures. Moreover, utilizing established and widely recognized objective tools enables cross-national comparisons of Chinese nurses' level of evidence-based knowledge. This approach enhances the validity of tool establishment across multiple languages and facilitates the adoption of a standardized global methodology for documenting nurses' knowledge of evidence-based practice. Accordingly, the aim of this study was to: a) translate and culturally adapt the EKAN to produce a Chinese version that could objectively evaluate Chinese nurses' EBP knowledge, and b) assess the reliability and validity of the newly translated tool.

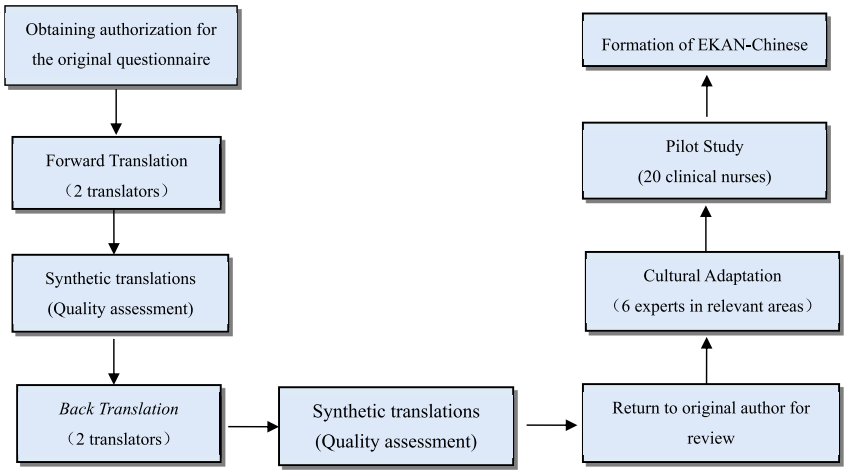

Fig. 1. Cross-cultural adaptation and the translation process.

2. Method

2.1. Study design

In this study, a cross-sectional design was used. The first was translating the EKAN's original English version into a Chinese version; the second phase: was a psychometric assessment. The methodology for this study was part of a multi-site research project to objectively document the EBP knowledge of nurses worldwide. The study was reported under the Strengthening the Reporting of Observational Studies in Epidemiology checklist (STROBE) [22].

2.2. Translation and cross-cultural adaptation

This study used Brislin's translation procedure principle to guarantee semantic equivalency in the translation process [23]. The process of cross-cultural adaptation and translation is shown in Fig. 1. EKAN's translation and cross-cultural modification took the following steps:

Step 1. Forward Translation

Two Nursing faculty who are native-Chinese speakers and proficient in English separately translated the EKAN into Chinese. The Chinese-speaking authors then discussed both translations. The team reconciled phrasing variations to create the EKAN-Chinese version.

Step 2. Back Translation

Two English teachers with backgrounds in evidence-based nursing and medicine who had never seen the EKAN-English independently completed a back translation from Chinese into English. The research team fully discussed both translations to create the final back-translated form.

Step 3. Review

The team collaborated with EKAN authors to promote semantic equivalence and finalize the first draft of the EKAN-Chinese.

Step 4. Cultural Adaptation

The first draft of the EKAN-Chinese was sent to a bilingual expert team for review. Experts were selected, using the following criteria: (1) research areas included evidence-based nursing, medical statistics, psychology, and nursing education; (2) mid-level or higher professional or technical title, master's degree or higher; (3) foreign study experience or familiarity with relevant research areas; and (4) active and voluntary participation in this study. The team (two experts in evidence-based nursing, one in medical statistics, two in nursing education, and one in psychology) reviewed the newly translated EKAN-Chinese based on their theoretical knowledge and clinical nursing practice experience. This was done to ensure consistency with the original version and to evaluate its suitability in the Chinese cultural context. Based on their theoretical understanding and practical experience in clinical nursing, the team—which included two specialists in evidence-based nursing, one in medical statistics, two in nursing education, and one in psychology—reviewed the recently translated EKAN-Chinese. This was done to make sure it was in line with the original version and to assess how well it fit the cultural setting of China.

Step 5. Pilot Study

A total of 20 clinical nurses with undergraduate degrees from another general hospital in Beijing, China, were enrolled. We obtained informed consent from the eligible nurses after explaining the study's purpose and methods. Each participant used pen and paper to complete the hard-copy version of EKAN-Chinese. Following the EKAN-Chinese evaluation, research assistants interviewed participants to investigate factors such as language appropriateness, accurate comprehension, and overall acceptability of the EKAN-Chinese. The purpose of these interviews was to document individuals' comprehension and gain feedback on the program. We made modest changes to the EKAN-Chinese after consulting with the original writers to ensure that the questions were understandable without changing the original objective. Examples of changes include 1) modifying the term Institutional Review Board in EKAN-English to "Chinese legal code" to reflect cultural understanding of human subject protection; 2) revising "point-of-care decision" in EKAN-English to "clinical care decision," which aligns more closely with the Chinese language and culture; and (3) adding explanations about specialized EBP roles and terminology like PDSA.

2.3. Measures

EKAN instrument. We utilized the English original version of EKAN, which served as an objective tool to assess the level of EBP knowledge among nurses with varying educational backgrounds. It consists of 20 multiple-choice questions with three response choices but only one correct answer, for a total possible score of 20 points.

Demographic questionnaire. Our research team additionally translated the demographic questionnaire from English into Chinese, adapting some of the items (i.e., ethnicity questions) to be more suitable for this population. This questionnaire consists of some basic information such as age, gender, level of education, and EBP-related training, among others.

2.4. Study setting and participants

The EKAN-Chinese was finalized in October 2022, and the survey was officially launched in November 2022. Convenience sampling methods were used to recruit 1780 licensed clinical nurses with a bachelor's degree or higher from a large general hospital in Beijing, China, which hires nurses from various cities in China. The research team obtained consent from the head of the nursing administration and was responsible for recruiting participants. Those who agree to participate in the survey will receive a nurse's watch.

Recruitment was done mainly through posters and announcements. First, we sent out invitations through announcements on the hospital intranet. Second, we publicized the posters through the nursing administration, in a group of nurse managers throughout the hospital, and the nurse managers of each department sent the poster invitations to the team of nurses in their departments. The research team personally met the interested nurses to explain the purpose of the study and the survey methodology. The inclusion criteria for participating in the study were: clinical nurses who had received EBP education at the undergraduate and/or graduate level, and who had received EBP education through in-service continuing education after entering the profession.

Nurses who met the inclusion criteria for the study and were interested in completing the study forms were scheduled for appointments in the conference room. We obtained informed consent and reminded participants not to include any identifying information on the questionnaire. We asked participants to select answers based on their initial thoughts and to fill out the questionnaire completely. We prohibited participants from using electronic devices to look up the answers. To avoid interruptions, we allocated each

Table 1
Sample characteristics of clinical nurses – Beijing, Beijing Municipality, China, 2022.

Characteristics	Clinical Nurses (N = 120)
Age	
22–30	43(35.8%)
31–40	64(53.4%)
41–50	10(8.3%)
51–52	3(2.5%)
Gender	
Female	4(3.3%)
Male	116(96.7%)
Ethnicity	
Han	112(93.3%)
Hui	4(3.3%)
Man	3(2.5%)
Li	1(0.9%)
Nurse stage	
Nurse	22(18.3%)
Senior Nurse	45(37.5%)
Nurse in Charge	48(40.0%)
Nurse Deputy Director and above	5(4.2%)
English level	
No English level yet	71(59.2%)
English level 4	24(20%)
English level 6	25(20.8%)
Exposure to statistics course	
Have not taken	51(42.5%)
Completed <6 months ago	18(15%)
Completed 6 months to 1 year ago	14(11.6%)
Completed >1 year to < 3 years ago	17(14.2%)
Completed >3 years ago	20(16.7%)
Computer and network application level	
Very poor	2(1.7%)
Poor	8(6.7%)
Average	79(65.8%)
Good	27(22.5%)
Very good	4(3.3%)
Perceived exposure to EBP content[a]	
Not taken any content	84(70%)
Exposed to less than 1 day of content	9(7.5%)
Took 1–2 days of EBP workshop	9(7.5%)
Took more than 2 days of EBP workshop	18(15.0%)
Self-rated confidence in providing EBP care	
Strongly agree	21(17.5%)
Agree	38(31.7%)
Neither agree or disagree	48(40.0%)
Disagree	9(7.5%)
Strongly disagree	4(3.3%)

[a] In the past year, have you completed a specialized course, seminar, or intensive training on evidence-based nursing practice.

time slot (approximately 25–35 min) to only one participant. Trained research assistants sealed the questionnaires in envelopes and delivered them to the research team.

We used the Rasch model to analyze the data in this study. Rasch analytic techniques use a probabilistic model that falls under the broader category of item response theory (IRT); the beauty of Rasch analytics is that relationships between individuals' abilities and their performances on assessments or tests can be done by also analyzing each item's level of difficulty. In this manner, meaningful comparisons can be done between individual ability and the difficulty of items on a test when item difficulty is taken into account [24].

The Rasch model requires 100–200 data points per item to increase the reliability of the results [25,26]. Our study satisfied this requirement. We recruited a total of 120 clinical nurses. The age of participants ranged from 22 to 52 years (Mean = 32.63), and their professional experience and educational background (bachelor's degree or higher) spanned from 1 to 34 years (Mean = 10.2).

2.5. Statistical analysis

Rasch modeling analysis is employed to derive objective, fundamental, and supplementary metrics based on the correspondences to ordered categories [27]. The primary assumption of Rasch's model posits that the interaction between individuals and their responses to an item is solely determined by the disparity between the respondent's ability or knowledge and the difficulty of the item within the same trait dimension [24]. This model is firmly established as a preferred model to employ when psychometric evaluations are needed for outcomes scales. The analytic techniques can be used to test a new instrument during refinement but also once established, the Rasch model can be used to determine test-taker performance against the item performance. Hence we chose the Rasch modeling analytics for this project.

The reliability and validity of the EKAN-Chinese were assessed using the Rasch model analysis method in four steps, employing Winsteps v4.50 software [28]. These steps included: 1) dimensionality and local independence to see if the model meets Rasch assumptions, 2) validity fit indices for items and persons, 3) reliability and separation indices for items and persons, and 4) distributions of student ability and item difficulty using Wright maps [27].

(1) Unidimensionality hypothesis test: The Rasch model must be based on the unidimensionality hypothesis, that is, the measurement only examines the subjects' single ability or latent trait. Residual factor analysis was performed on EKAN-Chinese, and the first principal component standardized residual eigenvalue was less than 2 [24]. (2) In Rasch modeling, the standard indices for assessing item fit include the internal fit index (Infit Mean Square, infit MNSQ) and the external fit index (Outfit Mean Square, outfit MNSQ). These indices gauge the congruence between the measurement items and the model. Optimal fit is indicated by values of infit MNSQ and outfit MNSQ approaching 1, and the acceptable range typically falls between 0.50 and 1.50 [29]. (3) Check the reliability and separation index of items and persons. Reliability is a reflection of the consistency and stability of repeated measurement results. Item reliability indicates whether the items maintain the same order when measuring with another similar sample. Separation degree is used to describe the degree of independence between different items [30]. A reliability exceeding 0.7 and a separation index exceeding 2 signify effective discrimination. (4) Wright map difficulty analysis, compares the item difficulty with the ability estimation value of the subjects on the same scale, to further explain how the item difficulty matches the latent characteristics of each subject [31]. In describing the general demographic characteristics of the nurses, measures such as means and standard deviations were utilized.

3. Results

3.1. Demographic information

Table 1 describes the demographic questions of the 120 participants. The age of clinical nurses ranged from 22 to 52 years ($M = 32.63 \pm 6.33$). Most were female (96.7%), and Han Chinese (93.3%) ethnicity, and the proportion of nurses at the level of Charge

Table 2
Test for Dimensionality and approximate relationships between measures.

PCA Sub Component	Item Cluster	Disattenuated Correlation
1	1–3	−1.00
1	1–2	−1.00
1	2–3	0.61
2	1–3	−1.00
2	1–2	1.00
2	2–3	1.00
3	1–3	0.70
3	1–2	0.99
3	2–3	1.00
4	1–3	1.00
4	1–2	1.00
4	2–3	1.00
5	1–3	1.00
5	1–2	1.00
5	2–3	0.76

Nurse or above was 53%.

3.2. Psychometric performance

3.2.1. Dimensionality and independence

When evaluating dimensionality and testing for independence in the EKAN-Chinese, the scale quality statistics demonstrated support for the unidimensional nature of the newly translated EKAN-Chinese instrument in measuring EBP knowledge, with an adjusted variance of 0.98 for the items (SD = 0.99) (Table 2). The other four components were below the benchmark of <2.0 which is good. So, the team investigated the disattenuated correlation results (removing error of measurement). The results showed three clusters correlated strongly and negatively at −1.00, showing there could be some independence. All other components correlated highly, showing local dependence. Since all were within the desired range, there is sufficient evidence for unidimensionality.

3.2.2. Fit indices for items and persons

Weighted mean square (WMS) and unweighted mean square (UMS) statistics were used to analyze the validity characteristics and dimensionality. Testing item and person separations as well as item and person reliabilities were included in reliability assessments (Table 3). The range for the infit WMS was 0.80–1.36, with a mean of 1.00 (−0.17). It is recommended that the outfit UMS, or outlier-sensitive fits, be centered around 1.0. Fits that are unpredictable (values below 1.00) or that depend too much on conjecture (values over 1.00) ought to be avoided. For this study, the mean of the outfit UMS was 1.03 (−0.13) which approximates 1.0 very closely. The range was 0.70–1.76, demonstrating a much broader range of unexpected results; certain students' responses demonstrate a level of predictability, consistently opting for the same answer (e.g., B, B, B, B) when addressing consecutive questions. Meanwhile, another group of students lacks the necessary knowledge and relies solely on subjective guesswork when providing answers. Our average difficulty index was (0 = −2.48 to 2.07), which was consistent with the benchmark parameters identified by Bond and Fox [32]. The fit statistics are within parameters by Linacre [29] > 0.5–1.5. Our results indicated that these items fully met the relevant requirements of the Rasch model.

Once the model had met assumptions, we evaluated how the 20 EKAN questions corresponded to the infit and outfit statistics (Table 4). As noted, most items fell within the recommended infit WMS limits. Three items, specifically, questions 7 (decision-making), 10 (Odds ratios), and 13 (decision-making) had a high number of incorrect responses. Rasch analysis shows these three questions elicited unexpected responses from the nurses, indicating areas to focus on during continuing education sessions. Most outfit UMS parameters fell within the recommended boundaries except for four; the same three questions (questions 7, 10, 13), and an additional one–question 20 (differentiating between statistical significance and clinical significance), also fell above the acceptability range.

When reviewing the item difficulty in the same table, all of the problematic questions with unacceptable fit statistics (7, 10, 13, and 20) also had high difficulty. Rephrasing these questions may improve the fit of the model. However, all of our item outcomes after standardization complied with the requirements of the outfit UMS and infit WMS.

Subsequently, the research team examined the response patterns for each item in EKAN-Chinese. All 120 respondents chose an answer for all 20 questions. Finally, it is wise to remember the analysis of fit is never completed—it must be ongoing when testing EBP knowledge with additional cohorts of nurses.

3.2.3. Reliability and separation indices

In this study, the assessment of reliability was carried out using the Item Separation Index (ISI) and Person Separation Index (PSI), along with Item Reliability (IR) and Person Reliability (PR). Table 5 shown the findings. The item separation index of 4.71 suggests that items could be categorized into four and a half, almost five different difficulty levels. Simultaneously, the person separation index was 0.99, indicating that the tool could not differentiate between high and low performers; there was only one level of ability within the group of individuals.

IR of 0.96 met standard benchmarking (>0.80), meaning the items performed well, and will perform equally again in the future with a group of nurses similar to the sample. A high IR further suggests that the sample size was enough [24]. The PR value was 0.49, positioning it at a moderate level, neither exceptionally low nor reaching the benchmark value of >0.80. A PR value of 0.49 indicates that the variability in the sample's knowledge was moderate, reflecting a balanced range of responses encompassing both homogeneity and heterogeneity [29,33]. The PR parameter showed moderate reliability. However, the results did indicate the necessity for further

Table 3
Pooled validity indices for the EKAN-Chinese – Beijing, Beijing Municipality, China, 2022.

Rasch Validity Indices	EKAN-Chinese	[a]EKAN -English	Benchmark
Difficulty index range (in logits)	−3.43 to 2.85	−2.00 to 2.8	−3.0 to 3.0
lnfit Weighted MS Mean (SD)	1.00 (−0.17)	1.01	
Infit Weighted MS Range	0.80 to 1.36	−0.7 to 1.6	0.7 to 1.3**
Outfit Unweighted MS Mean (SD)	1.03 (−0.13)	1.02 (n/r)	
Outfit Unweighted MS range	0.70 to 1.76	0.93 to 1.14	0.7 to 1.3**

Note.
n/r = not reported.
••Validity benchmarks recommended by Bond & Fox[32].
[a] Results from Spurlock & Wonder.[16].

Table 4
Descriptions of each EKAN item and Rasch fit parameters - Beijing, Beijing Municipality, China, 2022.

Item and Content Description	Difficulty (SE)	Infit		Outfit	
		WMS	SWMS	UMS	SUMS
1. Purpose of regression versus other tests	0.85 (0.21)	0.90	−1.04	0.91	−0.72
2. Sampling and study design	.05 (0.20)	0.84	−2.65	0.82	−2.55
3. Purpose of Institutional Review Board	1.74 (0.26)	1.04	0.32	1.10	0.53
4. Distinguishing measures of central tendency	0.85 (0.21)	0.87	−1.51	0.82	−1.57
5. Distinguishing validity, reliability, and generalizability	0.72 (0.21)	0.98	−0.16	0.97	−0.28
6. Proper use of pre-appraised evidence	−0.60 (0.20)	0.82	−2.80	0.76[a]	−2.77
7. Role of judgement in EBP decision making	0.47 (0.20)	1.36[a]	4.38[b]	1.47[a]	4.58[b]
8. Steps of the EBP process	−2.05 (0.27)	0.99	−0.01	0.88	−0.39
9. Facilitating EBP in practice settings	0.85 (0.21)	1.04	0.46	1.04	0.37
10. Interpreting odds ratio	−0.26 (0.20)	1.25[a]	3.78[b]	1.29[a]	3.41[b]
11. Understanding credibility and bias	−1.50 (0.23)	1.09	0.73	1.07	0.43
12. Identifying steps in plan-do-study-act cycle for quality improvement	−0.14 (0.19)	0.85	−2.58	0.82	−2.58
13. Priority of evidence, patient values, and clinical judgement in EBP decision making	−0.57 (0.20)	1.36[a]	4.79[b]	1.48[a]	4.52[b]
14. Distinguishing causation from correlation in regression	−0.37 (0.20)	0.88	−2.02	0.86	−1.75
15. Ranking of evidence quality (hierarchy)	0.47 (0.20)	0.80	−2.81	0.78	−2.61
16. Strength of measurement approaches	−1.50 (0.23)	1.09	0.77	1.22	1.19
17. Role of PICOT question in evidence searching	−1.29 (0.22)	0.84	−1.60	0.70	−2.05
18. Nurse-sensitive quality indicators	−0.64 (0.20)	0.88	−1.83	0.84	−1.68
19. Understanding effect sizes	0.55 (0.20)	0.97	−0.40	0.94	−0.62
20. Statistical v. clinical significance	2.37 (0.31)	1.18	0.80	1.76[a]	2.01

Abbreviations: EBP = Evidence-based Practice; PICOT= Population, Intervention, Comparison, Outcome, Timeframe; WMS= Weighted Mean Square; SWMS = Standardized Weighted Mean Square; UMS = Unweighted Mean Square; SUMS= Standardized Unweighted Mean Square.
Note.
[a] Fit statistic falling outside the acceptability range 0.8–1.2, as recommended by Bond & Fox.[32].
[b] Standardized fit statistics falling outside the acceptability range of −3.0 to 3.0, as recommended by Meyer.[33].

Table 5
Pooled reliability indices for the EKAN-Chinese – Beijing, Beijing Municipality, China, 2022.

Rasch Reliability Indices	EKAN-Chinese	[a]EKAN -English	Benchmark
Item Separation Index (ISI)	4.71	7.05	>2[b]
Person Separation Index (PSI)	0.99	1.66	>2
Item Reliability (IR)	0.96	.98	>.80
Person Reliability (PR)	0.49	.66	>.80

Note.
[a] Results from Spurlock & Wonder.[16].
[b] Reliability benchmarks recommended by Tennant & Conaghan.[24].

education and training on the EBP concepts. Given that experienced nurses who have been in practice for an extended period may not have been exposed to the concept of EBP in their continuing education and training courses, it is logical that their scores were similar.

3.2.4. Nurses and item performance

Two indicators show students' ability, namely the sum scores and the Wright map. According to the recently modified EKAN-Chinese, nurses obtained an EKAN total score that ranged from 5.0 to 16.0, with an average of 9.8 (2.9). The aggregate scores of the initial English-language study conducted on a U.S. population were comparable to this. (Table 6).

The Wright map, commonly used in Rasch analysis, can also show participant's ability to answer questions correctly as well as item difficulty performance [34]. The distribution of participants' knowledge abilities was shown in Fig. 2. Results are shown in logits, also known as log odds. For this cohort, the distribution of nurses' knowledge abilities (right side of the map) displays platykurtotic characteristics with a broad distribution in the number of nurses' abilities falling within 1 SD. Of the nurses, half (n = 61, 51%) scored higher than the mean (M), and the other half (n = 59, 49%) scored lower than the mean. The knowledge abilities of the respondents are relatively spread out, showing a more balanced distribution of knowledge. There are fewer individuals with extremely high or low

Table 6
Summary scores for EKAN-Chinese version (maximum score 20) – Beijing, Beijing Municipality, China, 2022.

Statistics	Clinical Nurses (N = 120)	[a]EKAN - English
Person Mean (SD)	9.8 (2.9)	10.4 (2.13)
Person Range Min – Max	5.0 to 16.0	5.0 to 16.0

[a] Note : *Results from Spurlock & Wonder[16]

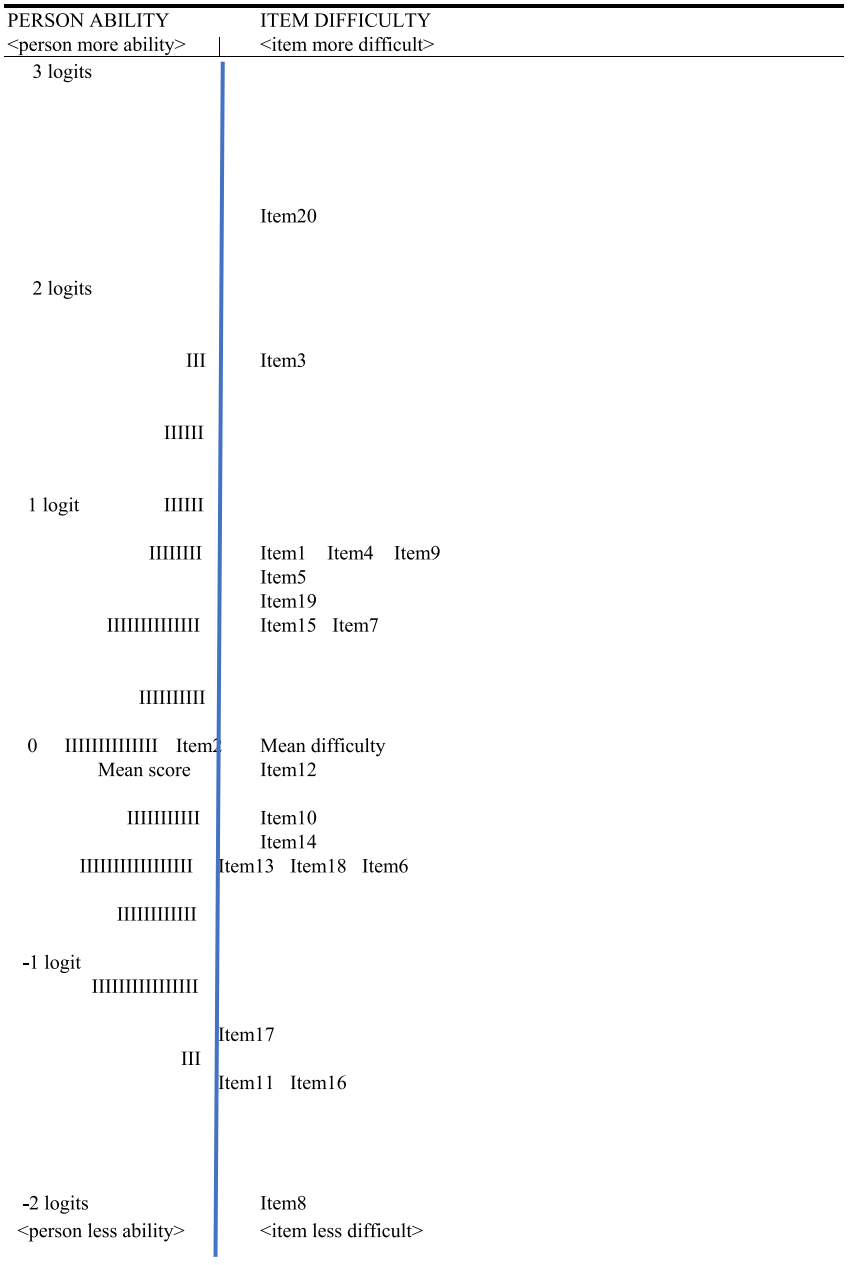

Fig. 2. Wright map showing participants' ability and Item difficulty using Means and SD standardized in Logits.

abilities. When comparing the mean (M) for item difficulty against the mean (M) for student ability, it is again, almost equal.

The Wright map can also show how items performed in the exam. In this instance, the map shows how the item performed using a similar ranking system—higher-ranked items were more difficult while lower-ranked items were easy for nurses to answer. The ranking was depicted on the right side of the map. The item difficulty revealed that 10 items were at or above the mean difficulty (more challenging to answer), with eight of these 10 falling within one standard deviation (SD), suggesting that the questions were moderately difficult to answer. Two questions, item 3 and Item 20 were very difficult to answer or were more challenging for the

respondents to answer (which interestingly, also showed a poor fit in Table 4). The other ten items fell below the mean difficulty, indicating items were easier to answer—in other words, nurses with an average level of EBP expertise were more likely to answer these questions correctly.

4. Discussion

Our research has shown that minor modifications to the EKAN-Chinese instrument based on cultural differences are applicable among the Chinese practicing nurse population. Our changes to the items were made to better fit the Chinese cultural background education and did not change the original intent. The modifications involved 1 item option and added textual explanatory notes to 3 other item options, resulting in good reliability and validity of the 20-item EKAN-Chinese; these changes maintained consistency with the original meanings of the English version.

The EKAN-Chinese testing went through the 4 analytic steps of Rasch modeling. Results aligned with previous studies showing the instrument's unidimensionality, sufficient infit and outfit, reliability, and very few repetitive choosing or random guessing. This phenomenon also occurred in previous studies and has been identified as a possible demonstration of the current lack of knowledge of EBP and the low ability of evidence-based care among clinical nurses in China [35,36].

For the Wright map, which can distinguish the difficulty of the questions [37,38], four questions reflected a higher level of difficulty, which was likely due to differences in the educational preparation in EBP concepts, the complexity of the content, or the way the questions are phrased.

Having half the respondents achieve higher than the mean score, while the other half achieved lower than the mean score may suggest that the test or assessment is capturing a broad range of abilities without concentrating too much at either end of the spectrum. This finding supports the use of the EKAN test globally, as it is being used to measure knowledge traits across a diverse group of nurses around the world. The connection between the difficulty of certain questions and differences in educational preparation is an important finding. The information suggests that nurses with varying educational backgrounds may perceive and respond to certain questions differently. For instance, 42.5% of nurses who did not complete a program including a course on statistics may find certain statistical aspects of evidence-based practice (EBP) more challenging. In addition, in China, nurses can enter the workforce with either specialist, undergraduate, master's, or doctoral degrees [39]. Specialists are not exposed to EBP courses during their schooling, and those with undergraduate degrees obtain continuing education, but these CEs typically do not include EBP [40]. In undergraduate programs, there is inconsistency in what and how EBP is taught and evaluated [41].

While the nurses taking the EKAN-Chinese showed a mean score of 9.8 of 20 points possible (SD of 2.9), half (49.2%) of the 120 nurses, who were part of the study, agreed or strongly agreed that they were "confident in providing EBP care." This discrepancy between low knowledge of EBP and high confidence in providing EBP is consistent with results from previous EKAN validation studies. In all other populations tested, the same phenomenon has been found in other literature ([15–18,42]). These results highlight the importance of rigorous, objective evaluation of knowledge to gauge what nurses know, what education is needed, and the impact of targeted interventions to support evidence-based care.

The present study represents a psychometric testing and validation of the EKAN within the Chinese clinical nurse population. Specifically, this research was to evaluate the psychological characteristics of the EKAN-Chinese in a cohort of Chinese clinical nurse practitioners who have completed their education. It is noteworthy that previous versions of the EKAN in other languages were primarily applied among nursing students and intern nurses. Therefore, in comparison to prior studies, our research extends the application of the EKAN to a population of practicing nurses. This extension also contributes to fostering global consistency in evaluating EBP.

Our study demonstrated that the EKAN-Chinese proved to be a reliable tool for objectively measuring the level of evidence-based practice knowledge among Chinese nurses. The EKAN-Chinese scores indicated that within this group of nurses, some individuals might have lacked sufficient understanding of concepts related to EBP. Additionally, they may have had limited comprehension of the procedural steps involved in clinical nursing practice and the significance of statistical results. Hence, the EKAN-Chinese instrument had several potential applications in nursing practice. Firstly, Chinese is the language that is spoken the most everywhere in the world. The establishing of the instruments' efficacy across languages was made easier by the EKAN-Chinese, which encouraged the standardization of nurses' EBP expertise worldwide. Secondly, the EKAN-Chinese could function as a potential screening tool for identifying nurses who required EBP education and training. Thirdly, the instrument can be used as a baseline survey to objectively assess Chinese nurses' EBP knowledge, which can then inform the development and testing of curriculum, teaching strategies, and organizational supports (such as policies and mentors). Finally, the EKAN-Chinese can be utilized to determine the most effective type and frequency of education for nurses with different educational backgrounds. These findings will collectively enhance Chinese nurses' EBP knowledge and ultimately improve the quality of nursing care.

Our tool was translated following international guidelines and psychometrically tested using Rasch software. While the results of the cross-cultural adaptation testing for the EKAN-Chinese were satisfactory, there were still some limitations. Firstly, a convenience sampling method was employed to recruit participants from practicing nurses at a single general hospital in only one city, Beijing, China. Therefore, the study results represent a baseline assessment of nurses' EBP knowledge in only one hospital. Future studies, using EKAN-Chinese, should include sampling from multiple centers and regions to assess the current status of EBP knowledge in practicing nurses. Second, we did not compare separately the bachelor's and master's prepared nurses who obtained their degree on a full-time basis with those who obtained it during continuing education; therefore, the potential of the EKAN-Chinese to measure EBP knowledge acquisition among nurses with different degrees and educational training systems in China is less clear. Third, we did not perform a standardized validity assessment of the structure of the EKAN-Chinese related to other tools. Future research could make use of

pertinent instruments to confirm the EKAN-Chinese's criterion-related validity.

5. Conclusion

This work expands the availability of the EKAN instrument for objective assessment of EBP knowledge and makes it available to practicing nurses in China. The EKAN-Chinese showed evidence of reliability and validity; the results were consistent with the original EKAN-English and other translated forms. This research endeavors to support nurses' EBP knowledge in China while also contributing to the promotion of evidence-based nursing practice, globally.

Ethics statement

The study received approval from the Ethics Committee of Peking University People's Hospital (2021PHB043), adherence to the principles of the Declaration of Helsinki was ensured, and informed consent was obtained from all participants.

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Additional information

No additional information is available for this paper.

Data availability statement

The data will be made available on request from the corresponding author.

CRediT authorship contribution statement

Yongli Wang: Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization. **Jan M. Nick:** Writing – review & editing, Methodology, Data curation. **Shunhang Xu:** Writing – original draft, Software, Investigation, Data curation. **Yiqian Chen:** Writing – review & editing, Data curation. **Xiaodan Li:** Writing – review & editing, Project administration, Funding acquisition, Conceptualization. **Amy H. Wonder:** Writing – review & editing, Methodology, Formal analysis, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e26138.

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