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Cross-Cultural Adaptation and Exploratory Psychometric Evaluation of the Bilingual Cervical Cancer Screening Health Belief Model Scale (CCS-HBMS) in Kazakhstan

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Highlights

Public health relevance—How does this work relate to a public health issue?

- Cervical cancer remains a largely preventable malignancy, and improving participation in cervical cancer screening remains an important public health priority.
- Understanding culturally influenced health beliefs and perceived barriers to screening requires measurement instruments with demonstrated validity in the target population.

Public health significance—Why is this work of significance to public health?

- This study cross-culturally adapted and evaluated the Russian and Kazakh bilingual version of the 35-item CCS-HBMS among women attending primary healthcare facilities in Kazakhstan.
- Psychometric evaluation showed heterogeneous performance across the original domains, and confirmatory factor analysis did not support the original five-factor structure.

Public health implications—What are the key implications or messages for practitioners, policy makers and/or researchers in public health?

- The findings indicate that health beliefs related to cervical cancer screening may not be organized identically across cultural contexts, particularly for the Seriousness and Health Motivation domains.
- Further refinement and independent validation of the adapted instrument may support more accurate assessment of screening-related beliefs and barriers and inform culturally appropriate cervical cancer prevention strategies in Kazakhstan.

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Abstract

Background: Cervical cancer remains an important preventable cause of morbidity and mortality among women in Kazakhstan. Reliable assessment of beliefs related to cervical cancer screening requires instruments that are linguistically and culturally appropriate

for the target population. This study aimed to cross-culturally adapt the CCS-HBMS for bilingual Kazakh–Russian administration and to evaluate the preliminary psychometric properties of this bilingual administration format. Methods: An exploratory cross-sectional psychometric study was conducted among 199 women aged 20–60 years attending primary healthcare facilities in Astana, Kazakhstan. The 35-item CCS-HBMS underwent forward and back translation, expert review, and pilot testing and was administered in a simultaneous Russian–Kazakh bilingual format. Psychometric analyses were performed in 196 participants with complete responses to all 35 items. Internal consistency was assessed using Cronbach's alpha, and structural validity of the original five-factor model was evaluated using confirmatory factor analysis (CFA) with the weighted least squares mean- and variance-adjusted estimator. Exploratory factor analysis (EFA) was subsequently conducted because of inadequate CFA model fit. Composite reliability (CR), average variance extracted (AVE), and the heterotrait–monotrait ratio (HTMT) were also examined. Results: Internal consistency varied across the five original subscales, with Cronbach's α ranging from 0.481 to 0.827. Reliability was highest for Barriers ($\alpha = 0.827$) and Benefits and Health Motivation ($\alpha = 0.804$), followed by Susceptibility ($\alpha = 0.725$), whereas lower values were observed for Seriousness ($\alpha = 0.662$) and Health Motivation ($\alpha = 0.481$). The original five-factor CFA model showed inadequate fit ($\chi^2(550) = 1952.71$, $p < 0.001$; CFI = 0.751; TLI = 0.731; RMSEA = 0.114, 90% CI 0.109–0.120; SRMR = 0.137). Parallel analysis supported retention of six factors. The six-factor solution showed lower residual misfit than the original five-factor solution (RMSR = 0.045 vs. 0.055). Given the redistribution of items across factors and the exploratory nature of these analyses, no definitive alternative factor structure was established. Convergent validity was strongest for Susceptibility (CR = 0.766; AVE = 0.523), while weaker evidence was observed for Seriousness and Health Motivation. Conclusions: The original five-factor structure of the CCS-HBMS was not supported in the present exploratory bilingual sample, and only two of the five original subscales showed Cronbach's alpha values above 0.80. Exploratory analyses suggested a different dimensional organization but did not establish a definitive alternative factor structure. These findings should be interpreted as preliminary evidence regarding the bilingual administration format rather than as separate validation of the Kazakh- or Russian-language versions, and further evaluation in larger, more diverse, and independent samples is required.

Keywords: cervical cancer; cervical cancer screening; Papanicolaou test; Health Belief Model; cross-cultural adaptation; psychometric evaluation; confirmatory factor analysis; Kazakhstan

1. Introduction

Cervical cancer is largely preventable through HPV vaccination, screening, and appropriate management of precancerous lesions, and the WHO has established its elimination as a global public health priority, yet it continues to contribute substantially to premature morbidity and mortality among women in middle-income countries, including the Republic of Kazakhstan [1]. Persistent infection with oncogenic human papillomavirus (HPV) genotypes is the primary cause of cervical cancer, which is characterized by a prolonged precancerous phase that provides an important opportunity for early detection and prevention. Cytological screening using the Papanicolaou (Pap) test enables the detection of cervical intraepithelial neoplasia (CIN) before progression to invasive disease [2,3]. When precancerous lesions are detected and treated at an early stage, the prognosis is highly favorable [4].

In Kazakhstan, cervical cancer remains an important public health concern. According to GLOBOCAN 2022 estimates [3], 1824 new cases of cervical cancer were diagnosed in Kazakhstan in 2022, making it the second most frequently diagnosed cancer among women in the country. National epidemiological data have also demonstrated changes in cervical cancer incidence over time [5]; an analysis of 16,441 newly diagnosed cases between 2009 and 2018 reported an average age-standardized incidence rate of 17.7 per 100,000 women and an overall increasing trend during the study period. Kazakhstan introduced a national organized cervical cancer screening programme in 2008, initially targeting women aged 30–60 years at five-year intervals. The programme has subsequently undergone several revisions, including shortening of the screening interval and expansion of the eligible age range. Under the current national screening regulations, cervical cytology is offered within primary healthcare to women aged 30–74 years at four-year intervals. Despite the availability of organized screening, maintaining adequate participation remains an important public health challenge. Earlier national data showed that cervical cancer screening coverage decreased from 72.9% in 2008 to 45.9% in 2016, underscoring the importance of understanding the beliefs and perceived barriers that may influence women's participation in cervical cancer screening [6].

Awareness of cervical cancer and screening alone does not necessarily translate into participation in preventive health behaviors [7,8]. The decision to undergo cervical cancer screening may be influenced by individual perceptions of disease risk and severity, perceived benefits of screening, perceived barriers, health motivation, as well as cultural and healthcare-related factors [8]. These determinants can be examined within established theoretical frameworks, including the Health Belief Model (HBM) developed by Janz and Becker [9] and subsequently applied to cancer prevention and screening by Champion [10].

The HBM proposes that preventive health behavior is influenced by perceived susceptibility to disease, perceived severity, perceived benefits of preventive action, perceived barriers, and health motivation [9,11]. Subsequent developments of the model have also incorporated self-efficacy, defined as an individual's confidence in their ability to perform a health-related behavior [12]. To assess health beliefs specifically related to cervical cancer screening, Guvenc et al. developed the Health Belief Model Scale for Cervical Cancer and the Pap Smear Test, a 35-item instrument comprising five subscales [13]. The instrument has subsequently been adapted and evaluated in different populations, supporting its use for assessing beliefs related to cervical cancer screening across different cultural settings [13,14].

However, self-reported psychometric instruments developed in one linguistic and cultural setting cannot be assumed to retain equivalent measurement properties when applied in another population [15]. Kazakhstan represents a particularly relevant context for cross-cultural adaptation because both Kazakh and Russian are widely used in healthcare communication, while cultural perceptions related to cervical cancer, gynecological examinations, preventive behavior, and interactions with healthcare services may differ from those of the population in which the original instrument was developed. Therefore, linguistic translation alone is insufficient, and evaluation of the psychometric properties and structural validity of the adapted instrument is required [15].

This exploratory study aimed to cross-culturally adapt the CCS-HBMS for bilingual Kazakh–Russian administration and to evaluate the preliminary psychometric properties of this bilingual administration format among women attending primary healthcare facilities in Kazakhstan.

2. Materials and Methods

2.1. Study Design and Participants

An exploratory cross-sectional psychometric study was conducted from April to August 2026 among adult female primary healthcare (PHC) attendees visiting outpatient facilities at the Republican Center for Primary Health Care and associated municipal polyclinics in Astana, Kazakhstan. The electronic questionnaire was distributed through participating polyclinics using a direct web link or QR code. Women who accessed the questionnaire were provided with electronic study information and were required to provide electronic informed consent before completing the survey. Because the questionnaire was disseminated through participating healthcare facilities using electronic links and QR codes, the total number of women who received or viewed the invitation could not be reliably determined; therefore, a response rate could not be calculated.

Eligible participants were women aged 20–60 years who were citizens of the Republic of Kazakhstan, had no previous diagnosis of cervical cancer or ongoing treatment for gynaecological malignancy, were able to understand the questionnaire items, and provided electronic informed consent. Women who did not meet these eligibility criteria or did not provide informed consent were not eligible to participate.

A total of 199 women were included in the main study. Of these, 196 provided complete responses to all 35 CCS-HBMS items and constituted the complete-case sample used for the psychometric analyses. The remaining participants were retained for descriptive analyses where valid responses were available. The 15 women who participated in the preceding pilot testing and cognitive debriefing were not included in the main study sample.

2.2. Research Instrument and Measures

Data were collected using a bilingual electronic questionnaire. Formal permission to translate, cross-culturally adapt, and psychometrically evaluate the Health Belief Model Scale for Cervical Cancer and the Pap Smear Test was obtained from the original developer [12].

Section A: Socio-Demographic and Health-Related Characteristics. This section collected information on age, place of residence, educational attainment, marital status, Mandatory Social Health Insurance (MSHI) coverage, Pap-test awareness, previous Pap-test experience, chronic disease, attitudes toward disease prevention, trust in healthcare professionals and the healthcare system, smoking status, and other health-related characteristics.

Section B: Core Psychometric Instrument. The adapted CCS-HBMS consists of 35 items rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). In accordance with the original instrument [12], the items are organized into five subscales: Benefits of Pap Smear Test and Health Motivation (8 items), Barriers to Pap Smear Test (14 items), Perceived Seriousness of Cervical Cancer (7 items), Susceptibility to Cervical Cancer (3 items), and Health Motivation (3 items). Higher scores indicate stronger endorsement of the construct represented by each subscale, whereas higher scores on the Barriers subscale indicate greater perceived barriers to screening. The original 35-item CCS-HBMS used in the present study does not include a separate self-efficacy subscale; therefore, self-efficacy was not assessed as part of the adapted instrument.

Bilingual Administration Format. This administration format was selected to reflect the bilingual context of healthcare communication in Kazakhstan, where both Kazakh and Russian are commonly used in healthcare settings. The questionnaire was administered in a simultaneous bilingual format, with the Kazakh and Russian versions of each item and the corresponding five-point Likert response options presented side-by-side in the electronic questionnaire. Participants could therefore refer to either language version while completing the same questionnaire. Because both linguistic formulations were displayed

simultaneously and a single response was recorded for each item, responses could not be attributed independently to either the Kazakh or Russian wording. Accordingly, the psychometric analyses evaluated the bilingual administration format as a whole rather than either linguistic version separately.

2.3. Translation and Cross-Cultural Adaptation Protocol

Cross-cultural adaptation was conducted using a multistage procedure aimed at maintaining conceptual, semantic, idiomatic, and experiential equivalence between the original and adapted versions, in accordance with established recommendations for cross-cultural adaptation of self-report instruments [15]. The procedure included: (1) forward translation into the target languages; (2) synthesis and reconciliation of the translated wording; (3) back-translation to assess consistency with the source instrument; (4) expert review for conceptual relevance, linguistic clarity, and cultural appropriateness; and (5) pilot testing and cognitive debriefing in the target population.

The preliminary bilingual version was pilot-tested in 15 women from the target population who were not included in the subsequent main study sample. Participants evaluated the clarity, comprehensibility, and appropriateness of the translated items and response options. Based on their feedback, minor wording modifications were introduced to improve comprehension and cultural appropriateness while preserving the conceptual meaning of the original items. No items were added or removed, and the final adapted instrument retained all 35 items of the original scale.

Content relevance was additionally evaluated by a panel of three gynaecological experts. Item-level content validity indices (I-CVI) were calculated according to the approach described by Polit and Beck [16]. All 35 items received unanimous relevance ratings, resulting in an I-CVI of 1.00 for each item. Given the small number of expert raters, these estimates were interpreted cautiously as supportive evidence of content relevance rather than definitive evidence of content validity.

2.4. Statistical Analysis

Statistical analyses were performed using R version 4.6.1 (R Foundation for Statistical Computing, Vienna, Austria), with the psych, lavaan, and semTools packages used for psychometric and factor analyses. Psychometric analyses were conducted using the common complete-case sample of 196 participants who provided responses to all 35 CCS-HBMS items.

Descriptive statistics were used to characterize the study population and item distributions. Continuous variables were summarized using means and standard deviations (SD) and, where appropriate, medians and interquartile ranges (IQR). Categorical variables were presented as frequencies and percentages. Percentages were calculated using the number of valid responses for each variable.

Item-level psychometric performance was assessed using descriptive item statistics, floor and ceiling frequencies, and corrected item-total correlations. Internal consistency of each of the five original subscales was evaluated using Cronbach's alpha (α). The 95% confidence intervals for Cronbach's α were estimated using 5000 bootstrap resamples.

No a priori sample-size calculation specifically for factor analysis was performed; therefore, the structural analyses were interpreted cautiously and, given the available sample size, were considered exploratory.

Structural validity was first assessed using confirmatory factor analysis (CFA) to test the original five-factor measurement model. Because the 35 items were measured using a five-point ordinal Likert scale, CFA was performed using the weighted least squares mean- and variance-adjusted (WLSMV) estimator. Model fit was evaluated using the chi-square

statistic (χ^2), Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) with its 90% confidence interval, and Standardized Root Mean Square Residual (SRMR).

Because the prespecified five-factor model did not demonstrate adequate fit, exploratory factor analysis (EFA) was subsequently conducted to investigate the dimensional structure of the adapted questionnaire. Sampling adequacy was assessed using the Kaiser–Meyer–Olkin (KMO) measure, and factorability of the correlation matrix was evaluated using Bartlett's test of sphericity. The number of factors to retain was informed by parallel analysis using 500 random replications. Exploratory factor analysis was performed using minimum residual (MINRES) extraction with oblimin oblique rotation, allowing correlations among factors. The primary exploratory analysis was based on the Pearson correlation matrix. A supplementary analysis based on polychoric correlations was also performed; because the polychoric correlation matrix demonstrated numerical instability and required smoothing, this analysis was treated as a sensitivity analysis rather than as the basis for selecting the final exploratory solution.

Convergent validity of the original five-factor measurement model was examined using composite reliability (CR) and average variance extracted (AVE). Discriminant validity was explored using the heterotrait–monotrait ratio of correlations (HTMT). These indices were interpreted in conjunction with the overall CFA findings.

Statistical significance was set at $p < 0.05$ where applicable.

2.5. Ethical Considerations

The study protocol was reviewed, approved, and continuously monitored by the Local Ethics Committee of NJSC "Astana Medical University" (Meeting Protocol No. 4; 27 February 2026). All procedures strictly respected the ethical standards of the Declaration of Helsinki regarding human clinical research. Informed consent for participation was obtained from all subjects involved in the study. Participants received a detailed electronic information sheet explaining the academic scope, voluntary nature, and absolute absence of physical risks. Explicit electronic informed consent was a mandatory prerequisite for accessing survey items. Strict cryptographic de-identification was enforced inside the electronic repository: no surnames, initials, personal identification numbers (IIN), or medical record numbers were stored, guaranteeing absolute anonymity.

3. Results

A total of 199 women were included in the study. The mean age was 41.32 ± 10.07 years, with a median age of 42 years (IQR 33–50) and a range of 20–60 years. Most participants resided in urban areas (82.9%), 65.8% had higher education, 63.3% were married, and 40.7% were healthcare professionals. Previous experience of Pap testing was reported by 68.8% of participants. Detailed sociodemographic and health-related characteristics of the study population are presented in Table 1.

Table 1. Sociodemographic and health-related characteristics of the study participants (n = 199).

Characteristic	n (%) or Mean ± SD
Age, years	**41.32 ± 10.07**
Median (IQR)	42 (33–50)
Place of residence	
Urban	165 (82.9)
Rural	34 (17.1)

Table 1. *Cont.*

Characteristic	*n* (%) or Mean ± SD
Education	
Secondary	18 (9.0)
Vocational	31 (15.6)
Higher	131 (65.8)
Postgraduate	19 (9.5)
Marital status	
Married	126 (63.3)
Unmarried	45 (22.6)
Divorced	24 (12.1)
Widowed	4 (2.0)
Mandatory health insurance	
Insured	164 (82.4)
Uninsured	26 (13.1)
Do not know	9 (4.5)
Pap-test awareness	
Good awareness	65 (32.8)
Partial awareness	102 (51.5)
No awareness	31 (15.7)
Previous Pap-test experience	
Yes	137 (68.8)
No	43 (21.6)
Do not remember	19 (9.5)
Chronic disease	
Yes	98 (49.2)
No	101 (50.8)
Attitude toward disease prevention	
Positive	139 (69.8)
Neutral	34 (17.1)
Indifferent	26 (13.1)
Trust in doctors/healthcare system	
High	49 (24.6)
Moderate	138 (69.3)
Low	12 (6.0)
Smoking status	
Non-smoker	166 (83.4)
Smoker	33 (16.6)

Data are presented as *n* (%) unless otherwise indicated. One participant had missing data for Pap-test awareness; percentages for this variable were calculated using valid responses (*n* = 198).

3.1. Cross-Cultural Adaptation and Content Validity

The cross-cultural adaptation process included forward translation, back-translation, expert review, and pilot testing. The translated versions were reviewed for linguistic

clarity, conceptual equivalence, and cultural appropriateness while preserving the intended meaning of the original instrument.

The preliminary adapted questionnaire was subsequently pilot-tested among 15 women from the target population. Feedback obtained during pilot testing identified wording and comprehension issues in several items, and minor linguistic modifications were introduced to improve clarity and cultural appropriateness. These modifications did not alter the underlying concepts assessed by the original instrument. No items were removed or added, and the final adapted version retained all 35 items for subsequent psychometric evaluation.

All 35 items received unanimous relevance ratings from the three expert reviewers (I-CVI = 1.00). Given the small expert panel, this finding was interpreted cautiously as preliminary evidence of content relevance rather than as definitive evidence of content validity.

3.2. Item Analysis and Internal Consistency

Of the 199 participants included in the study, 196 provided complete responses to all 35 questionnaire items. To ensure a consistent analytical sample across the psychometric analyses, these 196 complete cases were used for item analysis, internal consistency assessment, and factor analyses. Corrected item-total correlations varied across the five original subscales. Seven items (items 9, 12, 21, 26, 29, 33, and 34) demonstrated corrected item-total correlations below 0.30. No items were removed at this stage because the primary objective was to evaluate the psychometric performance of the complete 35-item adapted version of the original instrument.

Internal consistency varied across the five original subscales. Cronbach's alpha was 0.804 for Benefits and Health Motivation and 0.827 for Barriers. The Susceptibility subscale demonstrated an alpha of 0.725, whereas lower coefficients were observed for Seriousness (α = 0.662) and Health Motivation (α = 0.481). Bootstrap 95% confidence intervals are presented in Table 2.

Table 2. Internal consistency of the adapted questionnaire (n = 196).

Original Subscale	No. of Items	Cronbach's α	95% CI *
Benefits and Health Motivation	8	0.804	0.740–0.850
Barriers	14	0.827	0.791–0.858
Seriousness	7	0.662	0.575–0.726
Susceptibility	3	0.725	0.629–0.798
Health Motivation	3	0.481	0.285–0.613

* CI, confidence interval. Confidence intervals were estimated using 5000 bootstrap resamples.

3.3. Structural Validity: Confirmatory and Exploratory Factor Analyses

Structural validity of the original five-factor CCS-HBMS model, comprising Benefits and Health Motivation, Barriers, Seriousness, Susceptibility, and Health Motivation, was first examined using confirmatory factor analysis (CFA) in the complete-case sample (n = 196). The prespecified five-factor model demonstrated inadequate overall fit: $\chi^2(550) = 1952.71$, $p < 0.001$; CFI = 0.751; TLI = 0.731; RMSEA = 0.114 (90% CI: 0.109–0.120); and SRMR = 0.137. The CFA solution also yielded an inadmissible latent covariance solution. Taken together, these findings indicate that the prespecified original five-factor measurement model was not supported in the present sample.

Inspection of the CFA results showed variation in item performance across the five original domains. The Benefits and Health Motivation and Susceptibility domains showed comparatively stronger factor loadings, whereas several items within the Seriousness and Health Motivation domains demonstrated weak loadings. In particular, the three-item

Health Motivation factor was poorly defined by its indicators. Given the inadequate fit of the prespecified model, exploratory factor analysis (EFA) was subsequently conducted to investigate the dimensional structure of the adapted questionnaire.

Sampling adequacy based on the Pearson correlation matrix was acceptable (Kaiser–Meyer–Olkin measure = 0.785), and Bartlett's test of sphericity was statistically significant, $\chi^2(595) = 3665.82$, $p < 0.001$, supporting the suitability of the correlation matrix for exploratory analysis. Parallel analysis based on 500 random replications suggested retention of six factors. The parallel-analysis-derived six-factor solution demonstrated lower residual error than the prespecified five-factor exploratory solution (RMSR = 0.045 vs. 0.055). Fit indices for the confirmatory model and both exploratory solutions are summarized in Table 3.

Table 3. Fit indices for the confirmatory and exploratory factor models of the adapted questionnaire (n = 196).

Fit Index	Original 5-Factor CFA	Prespecified 5-Factor EFA	Parallel-Analysis 6-Factor EFA
χ^2	1952.71	1089.07	923.31
df	550	430	400
p-value	<0.001	<0.001	<0.001
CFI	0.751	0.785	0.830
TLI	0.731	0.696	0.740
RMSEA	0.114	0.088	0.082
90% CI for RMSEA	0.109–0.120	0.082–0.095	0.075–0.089
SRMR	0.137	0.053	0.044
RMSR	-	0.055	0.045

CFA was estimated using WLSMV for ordinal indicators, whereas EFA was performed using MINRES extraction with oblimin oblique rotation based on the Pearson correlation matrix. Therefore, fit indices should be interpreted within their respective estimation frameworks rather than as strictly equivalent across CFA and EFA.

Inspection of the exploratory solutions showed substantial redistribution of items relative to the original CCS-HBMS subscale structure. In the six-factor solution, the first four Pap-test benefit items formed a relatively coherent cluster, with primary absolute loadings ranging from 0.60 to 0.75, whereas the general health-motivation items originally included within the same subscale showed a less consistent pattern across factors. Several barrier items clustered strongly on one factor (primary absolute loadings up to 0.86), while other barrier items loaded on different factors or showed cross-loadings. The Seriousness items also showed a heterogeneous pattern: four items primarily loaded on one factor (absolute loadings 0.46–0.68), whereas the remaining items were primarily associated with other factors (absolute loadings 0.52–0.56), indicating incomplete reproduction of the original Seriousness domain. The three Susceptibility items showed a comparatively coherent grouping on one factor (absolute loadings 0.37–0.76), whereas the three Health Motivation items did not form a clearly defined independent factor. Complete standardized pattern-matrix loadings for both the prespecified five-factor and parallel-analysis-derived six-factor EFA solutions, with all items organized according to their original CCS-HBMS subscales, are provided in Supplementary Table S1.

Overall, the exploratory findings were consistent with the CFA results in indicating that the dimensional structure observed in the present sample differed from the original five-factor configuration. Although the parallel-analysis-derived six-factor solution showed

lower residual error than the prespecified five-factor exploratory solution, it should be regarded as exploratory and not as a validated alternative measurement model. Confirmation of any revised factor structure will require evaluation in an independent sample.

3.4. Convergent and Discriminant Validity

Convergent validity was examined using composite reliability (CR) and average variance extracted (AVE) for the five factors specified in the original Turkish model. Evidence of convergent validity was heterogeneous across the domains. The Benefits factor demonstrated high composite reliability (CR = 0.868), although its AVE was slightly below the conventional 0.50 criterion (AVE = 0.461). Susceptibility showed both adequate composite reliability and AVE (CR = 0.766; AVE = 0.523). Barriers demonstrated high composite reliability (CR = 0.870), but the AVE was below 0.50 (AVE = 0.400). Lower values were observed for Seriousness (CR = 0.643; AVE = 0.277), while the Health Motivation factor showed particularly weak convergent validity (AVE = 0.042).

Discriminant validity was explored using the heterotrait–monotrait ratio of correlations (HTMT). In the Pearson-based sensitivity analysis, all pairwise HTMT values were below 0.85 (maximum HTMT = 0.734). However, because the prespecified CFA model showed inadequate overall fit and an inadmissible latent covariance solution, these findings were interpreted cautiously and were not considered sufficient to establish discriminant validity of the original five-factor model. Composite reliability and average variance extracted for the original five-factor measurement model are summarized in Table 4.

Table 4. Convergent validity of the original five-factor measurement model.

Factor	CR	AVE	Interpretation
Benefits	0.868	0.461	CR adequate; AVE below 0.50
Barriers	0.870	0.400	CR adequate; AVE below 0.50
Seriousness	0.643	0.277	Limited convergent validity
Susceptibility	0.766	0.523	Supported
Health Motivation	-	0.042	Not supported

CR was not interpreted for Health Motivation because the factor was poorly defined and the CFA solution was inadmissible.

3.5. Summary of Psychometric Findings

Overall, the psychometric evaluation demonstrated heterogeneous performance of the adapted 35-item instrument. The confirmatory analysis did not reproduce the original Turkish five-factor structure in the Kazakhstani sample. Only two of the five original subscales, Benefits and Health Motivation and Barriers, showed Cronbach's alpha values above 0.80, while lower reliability was observed for Susceptibility, Seriousness, and Health Motivation.

The subsequent EFA was undertaken to explore possible sources of the CFA misfit rather than to establish a replacement measurement model. Although parallel analysis supported six factors and the six-factor solution improved residual fit relative to the prespecified five-factor exploratory solution, the factor pattern did not provide a sufficiently stable and interpretable basis for proposing a definitive alternative structure. These exploratory findings therefore require confirmation in an independent sample. Convergent validity was supported for Susceptibility and partially supported for Benefits and Barriers, whereas limited evidence was observed for Seriousness and Health Motivation.

Taken together, the original five-factor measurement structure was not supported in the present sample, and the psychometric performance of the original subscales was heterogeneous. These findings should therefore be interpreted as preliminary evidence regarding the bilingual administration format and require further evaluation in independent samples.

4. Discussion

The present study evaluated the cross-cultural adaptation and psychometric properties of the Russian and Kazakh bilingual version of the 35-item CCS-HBMS among women attending primary healthcare facilities in Kazakhstan. The study population predominantly comprised urban women, with variation in educational level, previous Pap-test experience, and other health-related characteristics, providing a clinically relevant primary care sample for evaluating the adapted instrument. The findings provide a more nuanced assessment of the adapted instrument than internal consistency estimates alone. The psychometric performance of the original subscales was heterogeneous, and the prespecified five-factor structure was not supported in the present sample. These findings highlight the importance of evaluating structural validity when adapting health-belief instruments across linguistic and cultural settings rather than assuming measurement equivalence on the basis of translation and reliability coefficients alone [12,15]. Internal consistency varied across the five original domains. The Benefits and Health Motivation and Barriers subscales demonstrated the strongest internal consistency, with Cronbach's α values of 0.804 and 0.827, respectively, while Susceptibility also showed satisfactory reliability ($\alpha = 0.725$). Lower coefficients were observed for Seriousness ($\alpha = 0.662$) and particularly for the three-item Health Motivation subscale ($\alpha = 0.481$). In the original Turkish validation study, Cronbach's alpha coefficients ranged from 0.62 to 0.86 across the five subscales [12]. The comparatively weaker performance of some domains in the present study suggests that the individual constructs may not transfer uniformly across cultural and linguistic contexts. These differences should not necessarily be interpreted as evidence of translation failure, as reliability estimates are influenced by the number of items, inter-item relationships, characteristics of the study population, and the contextual relevance of the constructs being measured.

The confirmatory factor analysis provided the most important evidence regarding structural validity. The prespecified five-factor model showed inadequate global fit ($\chi^2(550) = 1952.71$, $p < 0.001$; CFI = 0.751; TLI = 0.731; RMSEA = 0.114, 90% CI 0.109–0.120; SRMR = 0.137). Thus, although the original five-domain organization provides a theoretically meaningful framework [12], the covariance structure observed in the present sample was not adequately represented by the original measurement model. This finding is particularly relevant because satisfactory internal consistency within individual subscales does not, by itself, establish structural validity. The present findings therefore suggest that some components of the original instrument are more robust to cross-cultural adaptation than others.

The exploratory analyses were broadly consistent with the CFA findings. Parallel analysis suggested retention of six factors rather than the prespecified five-factor configuration. Some groups of items remained relatively coherent, particularly those related to perceived benefits and susceptibility, whereas other domains showed a less distinct structure. General health-motivation items tended to separate from Pap-test-specific benefit items, and the three-item Health Motivation domain did not emerge as a clearly defined independent construct. Several items within the Barriers and Seriousness domains also demonstrated more complex relationships with the exploratory factors than anticipated from the original model.

These exploratory findings should not, however, be interpreted as establishing a new six-factor version of the CCS-HBMS. Although the six-factor solution provided a better exploratory representation of the observed data than the original five-factor configuration, alternative solutions were also observed and the supplementary polychoric analysis showed numerical instability. The EFA findings are therefore more appropriately interpreted as evidence that the original dimensional structure may require further re-

finement in the Kazakhstani context rather than as definitive evidence for a replacement measurement model. Confirmation of any modified structure will require evaluation in an independent sample.

The findings for convergent validity support a similarly cautious interpretation. Susceptibility demonstrated the clearest evidence of convergent validity (CR = 0.766; AVE = 0.523). Benefits and Barriers showed relatively high composite reliability (CR = 0.868 and 0.870, respectively), although their AVE values remained below 0.50. Evidence was weaker for Seriousness and particularly for Health Motivation. Although the exploratory HTMT analysis did not identify values exceeding the conventional threshold of 0.85, discriminant validity cannot be regarded as definitively established in the presence of inadequate overall CFA fit. In addition, the polychoric correlation matrix showed numerical instability and required smoothing; therefore, analyses based on the polychoric matrix were treated as sensitivity analyses rather than definitive evidence of dimensional structure. Taken together, these findings indicate that the psychometric performance of the adapted questionnaire is heterogeneous across its constituent domains.

The weaker structural performance of Health Motivation deserves particular consideration. The original CCS-HBMS includes both health-motivation content within the eight-item Benefits and Health Motivation subscale and a separate three-item Health Motivation domain addressing general health behaviours [12]. Such behaviours may reflect a broader orientation toward personal health rather than a construct specifically related to cervical cancer screening. Their relationship with screening-specific beliefs may therefore differ across populations. Similarly, perceived seriousness and barriers may be influenced by culturally specific perceptions of cancer, preventive examinations, embarrassment, anticipated diagnosis, and interactions with healthcare professionals. Previous research has demonstrated that screening behaviour cannot be understood solely in terms of knowledge and may be influenced by multiple perceived benefits, barriers, risks, and sociocultural factors [7,8].

The cross-cultural context is therefore relevant when interpreting the observed differences. Kazakhstan represents a bilingual healthcare environment in which both Kazakh and Russian are routinely used, while perceptions of preventive care, cancer, intimate gynaecological procedures, and communication with healthcare professionals may differ from those of the population in which the original instrument was developed. Cross-cultural adaptation consequently involves more than literal linguistic translation and requires consideration of conceptual and measurement equivalence [15]. The incomplete reproduction of the original factor structure does not necessarily indicate that the underlying Health Belief Model constructs are inapplicable to the Kazakhstani population. Rather, it suggests that some items may operationalize these constructs differently after transfer to a new linguistic and cultural setting. Further investigation of the weaker-performing items may therefore help determine whether linguistic refinement, cultural modification, or structural reorganization is warranted.

Strengths and Limitations

An important strength of this study is the comprehensive psychometric evaluation of the adapted instrument beyond internal consistency alone. The analysis incorporated item-level assessment, confirmatory and exploratory factor analyses, and evaluation of convergent and discriminant validity. The complete 35-item content of the original CCS-HBMS was retained during the initial evaluation, allowing direct assessment of the transferability of its original structure to the Kazakhstani context. Several limitations should be acknowledged. The psychometric analyses were based on 196 complete cases recruited from PHC facilities in Astana, which may limit the stability and generalizability of the observed factor

structure and warrants replication in larger and geographically diverse samples. Although the data demonstrated adequate factorability (KMO = 0.785; Bartlett's test, $p < 0.001$), the sample size limited the precision and stability of the estimated factor structure, particularly for models involving multiple latent factors. The factor-analytic findings should therefore be considered exploratory and require replication in a larger independent sample. Content validity was assessed by three experts; therefore, despite unanimous ratings, the I-CVI findings should be interpreted cautiously [17,18]. The simultaneous bilingual administration precluded attribution of individual responses to either the Kazakh or Russian wording and therefore did not permit separate psychometric validation of the two linguistic versions. Future language-specific validation will require separate administration of each version and appropriately designed between-language comparisons. Finally, because the confirmatory and subsequent exploratory analyses were conducted in the same sample, the exploratory factor structure should be regarded as preliminary and requires confirmation in an independent sample. The study sample was also highly selected with respect to educational and professional background: 75.4% of participants had higher or postgraduate education and 40.7% were healthcare professionals. These characteristics may have influenced participants' understanding and interpretation of the questionnaire items and may limit the generalizability of the findings to women with lower educational attainment or without a healthcare background. Future psychometric evaluation should therefore include more socioeconomically, educationally, and professionally diverse samples. As a next step, the Kazakh and Russian versions should be administered separately in larger independent samples to permit language-specific psychometric evaluation and confirmation or refinement of the factor structure identified in the present exploratory analysis. Subsequent studies may then examine measurement invariance across language groups and evaluate whether scale scores are associated with actual participation in cervical cancer screening. An additional limitation is that the original 35-item CCS-HBMS does not include a separate self-efficacy subscale; therefore, this construct was not assessed in the present study. Given the important role of self-efficacy in health-related intentions and behavior, its absence limits the range of behavioral determinants captured by the instrument. Future studies should consider assessing screening-specific self-efficacy alongside the CCS-HBMS constructs [19–21].

5. Conclusions

The original five-factor structure of the CCS-HBMS was not supported in the present exploratory bilingual sample. Only two of the five original subscales, Benefits and Health Motivation and Barriers, showed Cronbach's alpha values above 0.80, while reliability was lower for Susceptibility, Seriousness, and Health Motivation. Exploratory analyses suggested a different dimensional organization; however, they did not establish a definitive alternative factor structure. These findings indicate that the original five-subscale measurement structure cannot be considered psychometrically confirmed under the present bilingual mode of administration and requires further evaluation in independent samples. Importantly, the findings should not be interpreted as separate validation of either the Kazakh- or Russian-language version, as both linguistic formulations were presented simultaneously and a single response was recorded for each item. Nevertheless, the study provides preliminary evidence on the cross-cultural transferability of the CCS-HBMS in an understudied Central Asian and bilingual healthcare context and identifies domains requiring further refinement. Future studies should include larger and more diverse populations, administer the Kazakh and Russian versions separately when language-specific validation is intended, and confirm any revised factor structure in an independent sample.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph23101257/s1, Table S1: Standardized pattern-matrix loadings for the prespecified five-factor and parallel-analysis-derived six-factor EFA solutions, with items organized according to the original CCS-HBMS subscales.

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Abbreviations

The following abbreviations are used in this manuscript:

Abbreviation	Definition
AVE	Average Variance Extracted
CCS-HBMS	Cervical Cancer Screening Health Belief Model Scale
CFA	Confirmatory Factor Analysis
CIN	Cervical Intraepithelial Neoplasia
CFI	Comparative Fit Index
CR	Composite Reliability
EFA	Exploratory Factor Analysis
HBM	Health Belief Model
HPV	Human Papillomavirus
HTMT	Heterotrait–Monotrait Ratio of Correlations
I-CVI	Item-Level Content Validity Index
IQR	Interquartile Range
KMO	Kaiser–Meyer–Olkin Measure
MSHI	Mandatory Social Health Insurance
PHC	Primary Healthcare
RMSEA	Root Mean Square Error of Approximation
SD	Standard Deviation
SRMR	Standardized Root Mean Square Residual
TLI	Tucker–Lewis Index
WLSMV	Weighted Least Squares Mean- and Variance-Adjusted

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