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Adaptation and validation of a condom-related stigma scale for older adults in China

Wenwen Peng¹, Bei Wu², Jia Chen¹, Yan Shen¹, Qijian Deng^{3,4*} and Xianhong Li^{1*}

Abstract

Background Condom use has long been recommended as an effective method for preventing HIV/AIDS. However, a large proportion of older adults in China reported not using condoms, leading to an alarming increase in HIV prevalence among this population. Negative attitudes, especially condom-related stigma, have been identified as the main barrier. However, no condom-related stigma scale has been developed or validated for older adults in the Chinese cultural context. This study aimed to adapt and validate a condom-related stigma scale for older adults (CRSS-OA) in China, based on a scale previously developed for men who have sex with men (CRSS).

Methods Based on qualitative interviews, we adapted and revised the CRSS to better address the ageism and unique stigma faced by older adults in the Chinese cultural context. The reliability and validity of the adapted CRSS-OA were examined using a random sample of 498 older adults in Hunan Province, south-central China. Reliability was assessed by calculating Cronbach's alpha. Construct validity was assessed through exploratory and confirmatory factor analyses. Concurrent validity was assessed by examining the correlation between each factor of the CRSS-OA and two criterion scales (the HIV/AIDS Stigma Scale and the Aging Sexual Attitudes Scale). Predictive validity was evaluated by analyzing the association between condom-related stigma and engagement in condomless sexual behavior.

Results The adapted scale included 16 items, loading on three factors, and collectively explaining 70.646% of the variance. These factors were named "labeling condom use," "shaming condom purchase," and "violating traditional sex beliefs," demonstrating strong internal consistency with Cronbach's alpha coefficients of 0.942, 0.850, and 0.852, respectively. Concurrent validity was established by evaluating the correlation between each factor of the CRSS-OA and two criterion scales, with Pearson correlation coefficients ranging from 0.227 to 0.508 ($p < 0.05$). Predictive validity was assessed by measuring the scale's ability to correctly predict condomless sexual behavior, with an average predictability of 0.77.

Conclusions The adapted CRSS-OA has proven to be a valid and cultural-adaptive tool for assessing condom-related stigma among older adults in China. Further studies are needed to explore the external validity of this scale in the future.

Keywords Condom use, Stigma, Scale, Older adults, China

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Background

The HIV/AIDS epidemic has been spreading rapidly among older adults in China [1]. Data from the China Center for Disease Control and Prevention (CDC) revealed a notable shift in newly reported HIV infections, with individuals aged 50 and above accounting for 44% of new cases in 2020, a substantial increase from 22% in 2011 [2]. Sexual intercourse was the main mode of HIV transmission among this vulnerable population, accounting for a staggering 98.4% of cases [3]. The prevalence and a wide range of sexual risk behaviors, including unprotected sex, inconsistent condom use, multiple sexual partners, casual sex, or transactional sex, have made older adults a vulnerable population at risk for HIV [4–6]. In fact, among Chinese older adults, 60% were infected through commercial sex activities, while 30% were infected through non-commercial sexual activities [7]. Alarmingly, even after diagnosis, one-third of older adults continued to engage in unprotected sexual activities, further fueling the spread of the virus [8]. Consequently, older adults have emerged as a key demographic contributing to driving HIV transmission through sexual activities in China [9], underscoring the urgent need for tailored prevention strategies.

Against the backdrop of older adults' vulnerability to HIV transmission, the imperative role of condom use as a preventive measure has been underscored. Condom use has been the most acknowledged and supported method for HIV/AIDS prevention [10], offering a reliable barrier against sperm-sized particles and HIV pathogens when used consistently and correctly [11]. However, many studies in China pointed out that a high proportion of older adults reported not using condoms. For instance, Peng et al. [12] found that 72.85% of individuals aged 50 and above never used condoms during marital sexual activities, with only 1.31% reporting consistent use. Another study [13] reported that 90.6% of older male HIV-infected individuals engaged in commercial sex before diagnosis, with 81.5% never using condoms.

Moreover, factors such as inadequate HIV prevention knowledge [14], lack of HIV risk perception [15, 16], physical limitations like erectile dysfunction [17, 18], partner-related variables [19], discomfort with condom use [18, 19], and condom attitudes [20, 21] hindered condom utilization among older adults. However, evidence indicated that stigmatizing attitude towards condoms had the most significant impact on condom use [22]. Previous studies have indicated that negative attitudes, particularly condom-related stigma, significantly impact older adults' condom use patterns [23, 24]. Cultural biases and cognitive perceptions often lead to misconceptions about condom use, with older adults associating it with indecency, shame, and embarrassment [25, 26]. In Chinese culture, discussions about sexual topics are taboo, leading to a

lack of education and awareness about the importance of condom use in the general population [27]. Furthermore, ageism can intensify these perceptions, as older adults may perceive themselves as marginalized or overlooked in matters related to sexual health [28]. Lourdes et al. [29] found that older adults often face ageism, and even healthcare providers were reluctant to directly discuss sexual issues or HIV risk behaviors with them. This reluctance would hinder efforts to promote safe sexual behavior among older adults, leading to a lower rate of condom use among this population [29, 30]. Stereotypes about older adults as asexual or sexually inactive may further reinforce negative attitudes towards condom use, perpetuating the misconception that sexual activity in later life is inappropriate or shameful [19, 31]. These negative attitudes, including stigmatization and moral judgments, not only deter condom use but also contribute to increased sexual risk behaviors [32]. Understanding and addressing condom-related stigma are thus paramount in designing effective interventions to promote HIV prevention among older adults, especially in the Chinese context where such issues remain underexplored. Having a reliable and valid measurement will enable researchers to better understand the degree of negative perceptions of condom use, and help to evaluate the effectiveness of unprotected behavior reduction interventions among Chinese older adults.

After conducting a literature review until March 2024, we found that existing scales related to condom use have limitations in capturing specific beliefs related to condom-related stigma among older adults in China. There were four scales related to condom self-efficacy, two of which have been utilized among adolescents [33] and college students [34], while the other two have been adapted for use in different countries such as China [35] and Ethiopia [36]. However, it is important to note that the Condom Self-Efficacy Scale (CSES) was primarily designed to assess an individual's confidence in their condom use capability rather than to capture their attitudes and stigma associated with condom use. In addition, there are three instruments related to condom use attitudes: one developed for youth and adults in the Chilean context [37], another for migrant workers in India [38], and one developed in Tanzania [39]. These quantitative measures regarding condom use attitudes offered limited insights into condom-related stigma as they primarily assessed general approval levels, such as beliefs like "using condoms will protect me from HIV" [40], rather than exploring specific negative beliefs and stigmas associated with condoms in a particular cultural context.

What's more, evidence indicated that cultural variations could significantly influence individuals' perceptions and attitudes towards condoms [41, 42]. For instance, in developed countries like the United States,

older adults often feel at ease discussing sexual behavior and condom use with friends or healthcare providers (HCPs) due to their more open attitudes towards sexuality [43]. However, in China, older adults may feel shame when talking about sex-related topics, even with HCPs, which directly affects their protected sexual behaviors [44].

Our research team has developed a condom-related stigma scale (CRSS) for men who have sex with men (MSM), which measures the negative attitude or symbolic attitude towards condom use in the Chinese cultural context [45]. Drawing from the Social-Ecological Model (SEM) [46], we synthesized factors across individual, interpersonal, and societal levels to explore the influences contributing to stigma surrounding condom use. Then we established conceptual and operational definitions of condom-related stigma among MSM communities through conceptual synthesis [47]. Finally, we developed the CRSS, encompassing four domains: perceived distrust, perceived potential HIV/STI risk, perceived embarrassment, and perceived violation of traditional understandings of sexual intercourse. The scale exhibits good validity (content validity = 0.99; empirical validity > 0.70) and high reliability (Cronbach's alpha = 0.926, split-half reliability = 0.795, two-week test-retest correlation = 0.950). However, older adults' attitudes toward condom use may differ significantly from those of MSM, as they tend to experience ageism and stigma related to their sexual activities. Influenced by Confucianism in Chinese culture, older adults who have sexual practices are deemed as immoral and shameful [48].

Currently, there is a lack of validated instruments tailored to Chinese older adults that can comprehensively assess and interpret condom-related stigma within a Chinese cultural context. Given the unique population and social contexts surrounding sexuality and aging in China, it is imperative to modify the CRSS to meet the needs of older adults. By adapting this scale, we aim to provide a comprehensive tool for assessing condom-related stigma among older adults, ultimately facilitating the development of tailored interventions to promote safe sexual behaviors in this demographic group.

Methods

The adaptation and validation process of the condom-related stigma scale for older adults (CRSS-OA) followed the general principles of scale development, primarily relying on CRSS as a foundation [49]. The process consisted of two distinct phases.

Phase I: scale adaptation

Item revision

We initially conducted qualitative interviews to explore whether the content and items of CRSS were appropriate for older adults [50]. A group of fifteen older adults was invited to share their perceptions, attitudes, and behaviors related to condom use. The qualitative results indicated that several aspects of the CRSS needed to be adapted [50]. First, regarding the second domain of CRSS (perceived potential HIV/STI risk), older adults were more likely to perceive moral stigma related to condom use rather than perceiving HIV risk or infection. They believed that older adults using condoms would be deemed as “indecent” or “immoral”, because an older adult demonstrating sexual desire could not be morally respected in the Chinese cultural context. Therefore, we adapted the second domain to “perceived moral stigmatization”. The other three domains of the CRSS were supported by our interview results; therefore we retained these domains and only revised the item expressions to ensure they were more appropriate for older adults. Besides, those relevant and significant statements extracted from the interviews were added to their corresponding dimensions. For example, the statement “Purchasing/receiving condoms for older adults may be perceived by others as ‘Lao Bu Zheng Jing’ (referring to ‘indecent’ behaviors like having excessive sexual desires)” was added to the second domain of the CRSS-OA, specifying the unique expression of the moral stigma associated with condom use among older adults. The detailed item adaptations are presented in Additional file 1.

Finally, the initially adapted scale consisted of 22 items across four domains: perceived distrust, perceived moral stigmatization, perceived embarrassment, and perceived violation of the traditional understanding of sexual intercourse. A five-point Likert scale was employed, with response options ranging from “strongly disagree”, “disagree”, “neutral”, “agree”, to “strongly agree”. All items were scored positively, with a higher total score indicating greater perceived stigma associated with condoms among older adults.

Item selection and revision

Two rounds of multidisciplinary expert panels were conducted to evaluate the interpretability of the CRSS-OA [51]. Five experts from public health, nursing, gerontology, and psychology were invited to assess the scale's clarity and comprehensibility by evaluating factors such as ambiguity, double-barreling, value-laden wording, and readability. Subsequently, we conducted a pilot test with 15 older adults to assess the readability, simplicity, and appropriateness of the items. Considering the opinions from both rounds of expert panels and feedback from the participants, we made relevant revisions, additions, and

deletions to the items, resulting in the final development of a 19-item test scale (Additional file 1).

Phase II: psychometric evaluation

Participants

We included older adults aged 50 years old or above who self-reported having engaged in sexual practices in the previous year. Participants with psychiatric disorders, communication difficulties, or those involved in any other behavioral or psychological intervention programs were excluded. There were two reasons why we defined “older adults” as individuals aged 50 years or above. First, in the field of HIV/AIDS research, people aged 50 and above are classified as older adults to distinguish this group from the sexually active population typically considered within the 15–49 age range [52]. Second, the age of 50 marks a significant milestone where people experience physical changes and face greater challenges in maintaining sexual function, psychologically preparing them for the onset of old age [53, 54].

Setting

The study was primarily conducted in Hunan Province, located in south-central China, which comprises 14 cities. Notably, the proportion of the population aged 60 years and older in this province is 20.84%. Data from the Hunan Provincial CDC revealed that between January 2020 and October 2020, there were 5,729 newly reported cases of AIDS, with 53.8% of these cases occurring among individuals aged 50 years and older [55]. To ensure geographic diversity, five cities were randomly selected from Hunan Province, with one community selected from each city.

Data collection

Data collection primarily utilized a web-based professional survey tool called Sojump (www.sojump.com). Face-to-face, paper-pencil-based surveys were offered for those who opted not to participate in the online survey. The questionnaires were designed with careful attention to typography, font size, and textual expression to meet the needs of older adults, with detailed instructions provided.

Purposeful and convenient sampling methods were employed, and participants were recruited through referrals from the staff at the five community healthcare centers as well as self-referrals. Before data collection, informed consent was obtained from each participant, ensuring their understanding of the research purpose, procedures, data confidentiality, and associated benefits and risks. Participants received a package of gifts valued at 5 USD as compensation for their time. To ensure confidentiality, all data were de-identified and securely stored on an offline computer with restricted access. Ethical

approval was obtained from the Ethical Review Board of Xiangya School of Nursing, Central South University (Approval No. E202275).

Measurement tools

Demographic variables included age, gender, marital status, educational level, occupation (when on the job) and income among older adults.

Condom-related stigma among older adults (test version) was developed by this study, which included four dimensions and 19 items, as described above.

HIV/AIDS stigma was measured using Zelaya's HIV/AIDS Stigma Scale (Chinese version), revised by Xing et al. [56]. It adopted a 5-point Likert scoring to assess the level of stigma experienced by participants in each dimension. A higher score on each dimension indicated a higher level of stigma experienced by participants within that dimension. The overall Cronbach's alpha of this scale and its four dimensions ranged from 0.794 to 0.905.

Sexual attitude among older adults was measured using the Aging Sexual Knowledge and Attitudes Scale (ASKAS), which was developed by White based on a study of sexual physiology among older adults and subsequently translated into Chinese by Yan and colleagues [57, 58]. In our study, we employed the attitude section of ASKAS, which was a 7-point Likert scoring scale including 26 items. Total scores ranged from 26 to 182, with a threshold value of 104; scores exceeding 104 indicated a more positive attitude toward sexuality in older adults, while scores below this threshold suggested a more negative attitude. The Cronbach's alpha coefficient for the attitude scale was 0.85.

Sexual behaviors among older adults were measured by a questionnaire developed by our team, including the following items: the frequency of sexual activity and condom use in the past 6 months with different types of sexual partners (regular, commercial, casual), and the frequency of sexual activity and condom use in the most recent sexual intercourse with different partner types.

Testing the validity and reliability of CRSS-OA

Item analysis

The critical ratio (CR) method was employed as the primary approach of item selection. Participants were divided into high and low groups based on their total scores, and the mean score for each item was calculated separately for both groups. Two independent sample *t*-tests were conducted to examine the differences in item scores between the high and low groups. Items with a CR value greater than three were selected, indicating a significant difference between the high and low groups. Additionally, homogeneity tests were conducted, including the correlation coefficient between items and the total score of the scale (*r* values), the factor loading of items on the

common factors of the scale, and Cronbach's α after item deletion. Items were retained if they met the following criteria: (1) $r > 0.40$; (2) factor loading ≥ 0.45 ; and (3) the overall Cronbach's α coefficient of the scale decreased after item deletion [59].

Exploratory factor analysis

EFA was conducted to examine and identify the potential dimensions of the developed scale using SPSS 26.0. Principal component analysis (PCA) was conducted on the remaining variables with a direct oblimin rotation to extract principal components, and items were retained if their factors loading ≥ 0.45 on a single factor. However, if an item's factor loading exceeded 0.4 on more than one factor, it was classified as cross-loading. Conceptually or practically, cross-loading items could not distinguish between the measurement of different components of the scale; thus, they would be removed from the item pool. This criterion for removing cross-loading items was applied only to the original 19 items during the first EFA. To assess the suitability of PCA among item pools, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) was initially employed, with values exceeding 0.8 for both individual items and the complete item set [60]. Besides, scree plots and eigenvalues were utilized to determine the number of components in CRSS-OA.

Confirmatory factor analysis

It was conducted to establish factorial validity. The individual loadings on each variable were examined, and the percentage of variance accounted for was evaluated. In the path analysis, the connections between components and their associated items within the model were also assessed. Various fit indices were employed to evaluate the overall model fit using structural equation modeling. The following indexes were suggested to indicate good fit if they meet the required standards: Chi-Square ($\chi^2 < 3$), Root Mean Square Error of Approximation (RMSEA < 0.10), Goodness of Fit Index (GFI > 0.85), Relative Fitting Index (RFI > 0.85), Normed Fit Index (NFI > 0.85), Incremental Fit Index (IFI > 0.85), and Tucker Lewis Index (TLI > 0.85) [61–63].

Reliability testing

This study mainly examined the internal consistency and the split-half reliability. A Cronbach's α coefficient value of 0.7 or greater would indicate acceptable reliability of the scale [64].

Validity testing

Content validity. This was assessed using the item-level content validity index (I-CVI = Number of experts scoring 3 or 4 / Total number of experts), the scale-level content validity index (S-CVI = the mean of I-CVI of all items

of the scale), the random probability of chance agreement ($PC = \frac{n^2}{A^2(n-A)!} \times 0.5^n$), and the modified kappa statistic ($K^* = \frac{I-CVI-P_c}{I-P_c}$).

Criterion validity. This included both concurrent and predictive validity. We used the Pearson correlation method to compare the scores of CRSS-OA with the HIV/AIDS Stigma Scale and ASKAS to examine the developed scale's concurrent validity [51]. Predictive validity was examined by using binary logistic regression analysis to assess the association between condom-related stigma and condomless sexual behavior [65].

Results

Participants' general characteristics

A total of 498 older adults were recruited between November 2022 and February 2023. The samples were randomly split into two equal parts. The first subset was used for item analysis, EFA, and psychometric properties testing ($n = 249$), while the second subset was used for CFA ($n = 249$). The mean age was 57.27 years (SD = 5.85, range: 55–77). The male-to-female ratio was 1.2:1. Most respondents were married (85.7%). More than two-thirds (385, 77.3%) of older adults had a junior high school education and below. The majority of participants (75.9%) reported a monthly income of 6000 CNY or less (approximately 940 USD), indicating a predominance of low-to-middle income status among the group. The most common type of sexual behavior was regular sex (95.5%, $n = 477$), followed by commercial sex (7.0%, $n = 35$), and casual sex (5.4%, $n = 27$). Details are shown in Table 1.

Item analysis

All the CR values were significant ($t > 3$, $p < 0.05$). However, the results of the correlation between the individual item scores and the total score showed that three items (b10, b11, b18) did not meet the criteria (r values < 0.4). Their factor loadings were lower than 0.45 (0.374, 0.390, and 0.385, respectively). Consequently, these three items were removed, and 16 items were retained for the subsequent factor analysis (Table 2).

Exploratory factor analysis

The KMO value of the scale was 0.882 (> 0.8), and the MSA values ranged from 0.767 to 0.965. Bartlett's test revealed that χ^2 was 2783.157 ($p = 0.000$). Therefore, the 16 items shared common components, confirming the scale's appropriateness for EFA.

According to the component correlation matrix calculation, the absolute values of the correlation coefficients between factors in the scale were mostly greater than 0.300, indicating that the factors were not independent. Therefore, the direct oblimin rotation method, an oblique rotation allowing for factor correlation, was applied. PCA

Table 1 Participant characteristics (N=498)

Variables and Groups	N	Proportion (%)
Age (years)		
50–64	414	83.1
65–69	75	15.1
≥ 70	9	1.8
Gender		
Male	267	53.6
Female	231	46.4
Ethnicity		
Han	461	92.6
Other	37	7.4
Marital status		
Unmarried	4	0.8
Married	427	85.7
Divorced	44	8.8
Widowed	23	4.6
Educational level		
Primary school and below	169	33.9
Junior high school	216	43.4
High school or vocational school	90	18.1
College level		
Occupation (when on the job)	23	4.6
Farmer	102	20.5
Worker	135	27.1
Civil servant	42	8.4
Self-employed entrepreneurs	84	16.9
Unemployed	42	8.4
Other	93	18.7
Whom to live with		
Living alone	44	8.8
Only with spouse	320	64.3
With offspring	21	4.2
With spouse and offspring	92	18.5
With the opposite sex	15	3.0
With the same sex	6	1.2
Monthly income, CNY (USD)		
No income	19	3.8
≤ 3000 (470)	197	39.6
3001–6000 (471–940)	162	32.5
6001–8000 (941–1250)	69	13.9
8001–10,000 (1251–1560)	44	8.8
≥ 10,001 (1561)	7	1.4
Types of sexual behavior		
Regular sexual behavior ^a	477	95.5
Commercial sexual behavior ^b	35	7.0
Casual sexual behavior ^c	27	5.4

^a Regular sexual behavior: sexual activity that occurs with their partners who are in a marital relationship or have been living together long-term;

^b Commercial sex: sexual activity that is conducted for profit (involving money, goods, etc.);

^c Casual sex: sexual activity that occurs with non-fixed partners without involving money or commodity exchange, such as one-night stands, chance encounters, or sexual relationships lasting less than three months

and direct oblimin rotation results revealed three main components with the eigenvalues of 7.017, 2.494, and 1.793, collectively explaining 70.646% of the variance (Table 3). The scree plot test also showed that the slope flattened considerably after the third factor (Additional file 6). After rotation, all factor loadings of the retained 16 items exceeded 0.40 for each component, so all items should be retained (Table 4). The commonality of each item was also above 0.40, indicating that the common factors could explain the scale well.

These three factors were named to present three new domains in Additional file 2, namely, “Labeling condom use” (Factor 1 encompasses 7 items), “Shaming condom purchase” (Factor 2 encompasses 4 items), “Violating traditional sex beliefs” (Factor 3 encompasses 5 items).

Confirmatory factor analysis

We conducted CFA using the 16-item scale identified in EFA. Given the observed correlations between the individual items (see Table 2) and overlapping constructs from our qualitative analysis, we allowed certain error terms to co-vary. Examination of modification indices indicated that co-varying the error terms for items 1 and 2; 2 and 9; 12 and 13; and 14 and 15 enhanced the fit of the first-order model. The modified model fit indices all met the recommended thresholds, indicating a good fit ($\chi^2/df=2.99$, $GFI=0.090$, $NFI=0.903$, $RFI=0.880$, $IFI=0.933$, $TLI=0.917$, $RMSEA=0.909$) (Additional file 3). The modified path diagram is shown in Fig. 1.

Reliability testing

The overall Cronbach’s alpha for the scale was 0.910, while the subscales showed coefficients of 0.942, 0.850, and 0.852, respectively. Split-half reliability was measured as 0.929, 0.800, and 0.847 for each subscale. These values indicated satisfactory internal consistency.

Validity testing

Content validity

The I-CVI of each item was equal to or greater than 0.80 (>0.78), and the K* value for all items in the scale ranged from 0.76 to 1. The S-CVI for the entire scale was 0.988 (>0.9), indicating acceptable content validity.

Criterion validity

(1) Concurrent validity Pearson correlation analysis examined the associations between CRSS-OA scores, ASKAS, and the HIV/AIDS stigma scale. In Table 5, results showed that the aging sexual attitude was significantly associated with the first ($r=-0.227$, $p<0.05$) and second domains ($r=-0.508$, $p<0.05$) of CRSS-OA; the HIV/AIDS stigma scale was positively correlated with all three

Table 2 Summary of item analysis for the test version of CRSS-OA

Item	Extreme Group Comparison	Correlation between Individual Items Score and the Total Score		Homogeneity Test			Number of Sub-standard Indicators	Notes
		CR	Initial Items	Corrected Items	Cronbach's α after Item Deletion	Communality		
b1	25.482***	0.774**	0.734	0.897	0.673	0.820	0	Retained
b2	18.777***	0.689**	0.637	0.900	0.543	0.737	0	Retained
b3	20.073***	0.748**	0.704	0.898	0.608	0.780	0	Retained
b4	23.245***	0.748**	0.701	0.898	0.633	0.796	0	Retained
b5	20.365***	0.739**	0.697	0.898	0.607	0.779	0	Retained
b6	17.910***	0.629**	0.567	0.902	0.463	0.680	0	Retained
b7	20.016***	0.745**	0.703	0.898	0.601	0.776	0	Retained
b8	10.487***	0.628**	0.572	0.902	0.383	0.619	0	Retained
b9	9.864***	0.632**	0.580	0.902	0.359	0.600	0	Retained
b10	5.343***	0.436**	#0.365	0.907	#0.140	#0.374	3	Deleted
b11	5.923***	0.455**	#0.387	0.906	#0.152	#0.390	3	Deleted
b12	9.183***	0.585**	0.528	0.903	0.289	0.538	0	Retained
b13	9.058***	0.562**	0.504	0.903	0.267	0.517	0	Retained
b14	11.170***	0.600**	0.542	0.902	0.346	0.588	0	Retained
b15	11.101***	0.526**	0.461	0.905	0.270	0.520	0	Retained
b16	9.610***	0.498**	0.429	0.905	0.233	0.483	0	Retained
b17	11.129***	0.553**	0.490	0.904	0.293	0.541	0	Retained
b18	7.456***	0.453**	#0.378	0.907	#0.148	#0.385	3	Deleted
b19	11.499***	0.571**	0.511	0.903	0.306	0.554	0	Retained
Criteria	≥ 3.000	≥ 0.400	≥ 0.400	$\leq 0.907^*$	≥ 0.200	≥ 0.450	-	-

*0.907 is the Cronbach's α of the test version of CRSS-OA; # means not reaching the criteria; *** means $p < 0.001$ (two-tailed), ** means $p < 0.01$ (two-tailed)

Table 3 The results of the principal component analysis and direct oblimin rotation

Component	Initial Eigenvalues			Extraction Sums of Squared Loading			Rotation Sums of Squared Loading ^a
	Total	% of Variance	Cumulative%	Total	% of Variance	Cumulative %	Total
1	7.017	43.855	43.855	7.017	43.855	43.855	4.988
2	2.494	15.587	59.441	2.494	15.587	59.441	3.304
3	1.793	11.205	70.646	1.793	11.205	70.646	3.011
4	0.734	4.591	75.237				
.....				
16	0.130	0.815	100.000				

Extraction method: principal component analysis (PCA)

a: When the components are correlated, the sums of squared loadings cannot be added to obtain the total variance

domains of CRSS-OA (r values of 0.311, 0.286, and 0.310 respectively, $p < 0.05$).

(2) Predictive validity Since condom-related stigma towards condom use was a stable variable, while consistent condom use behavior was a situational variable, we examined the predictive validity of the CRSS-OA for consistent condom use behaviors among older adults. The results of consistent condom use over the past six months and the most recent sexual behaviors with different types of sexual partners (regular, commercial, and casual) among older adults are presented in Additional file 4. The results of the multiple logistic regression analysis showed that a

higher level of condom-related stigma predicted eightfold increase in the odds of inconsistent condom use behavior with regular partners over the past six months (OR = 8.319, $p = 0.000$, 95%CI: 3.177–21.783) and a sixfold increase in the most recent instance of sexual behavior with regular partners (OR = 5.863, $p = 0.001$, 95%CI: 2.125–16.179). The predictive power of these behaviors in the regression model was 88.1% and 65.2%, respectively (see Additional file 5). However, condom-related stigma did not predict consistent condom use behaviors with commercial partners or casual partners among older adults.

Table 4 Factor loadings of the first exploratory factor analysis (n = 498)

Items*	Components			Communality
	Factor 1	Factor 2	Factor 3	
b1	0.909	0.346	0.414	0.827
b4	0.900	0.310	0.404	0.810
b2	0.872	0.177	0.413	0.779
b5	0.854	0.358	0.363	0.735
b6	0.830	0.142	0.402	0.714
b3	0.806	0.411	0.393	0.672
b7	0.775	0.456	0.412	0.647
b12	0.252	0.862	0.120	0.746
b13	0.223	0.861	0.153	0.751
b9	0.359	0.826	0.172	0.688
b8	0.484	0.737	0.119	0.615
b16	0.322	0.046	0.885	0.795
b17	0.396	0.063	0.885	0.789
b15	0.399	0.063	0.828	0.693
b14	0.408	0.246	0.788	0.638
b19	0.384	0.357	0.570	0.403

Extraction method: principal component analysis (PCA). *The analysis was performed on 16 items

Discussion

This study adapted and validated an instrument to assess condom-related stigma among older adults in the Chinese cultural context, filling the gap of existing scales lacking strong validity and reliability for this purpose. The adaptation and validation process was rigorous, involving qualitative interviews to fully understand the original scale's appropriateness, adherence to strict scale development procedures, and comprehensive psychometric evaluations. Overall, the scale demonstrates good psychometric properties in terms of model fit, reliability, and validity.

The CRSS-OA was adapted from a previously culture-sensitive scale (CRSS) developed for the MSM population. However, the CRSS was developed to address "condom-related stigma" among the MSM population from individual, interpersonal, or social levels [47]. Based on qualitative interview results [50], this study adapted the scale for older adults by assessing individual perception, interactive stereotypes, and stigmatized social norms related to condom use. Insights from these interviews informed adjustments to the scale, particularly to capture older adults' stigmatizing attitudes towards condom use within the context of ageism in Chinese culture. The modified scale includes items reflecting the perception that condom use is unnecessary for older adults due to their lack of reproductive needs. Additionally, it addresses the societal stereotype that older individuals engaging in sexual activity are viewed as exhibiting immoral ("Lao Bu Zheng Jing") behaviors, leading to feelings of shame among older adults who purchase or use condoms. Therefore, the adapted scale takes a

perspective of collectivism and social norms, reflecting the deeper influence of traditional Chinese culture on the older population [66].

Factor 1, "labeling condom use", refers to the stigmatizing belief that using condoms during sexual activity among older adults is often interpreted as a sign of distrust in their partners' moral integrity, sexual health, and sexual partners' intimacy. For older adults, using condoms is often associated with notions of sexual promiscuity, moral decay, and impropriety [67], as validated in our developed scale. Traditionally, sex is viewed as meant for procreation and continuing the family line; only sexual activities with this purpose are considered moral [68]. Older individuals typically adhere to the belief that sexual activity within marriage aligns with social norms, and they believe the use of condoms is deemed unnecessary and feel less motivated, especially for people who have undergone menopause or sterilization/vasectomy [69]. Therefore, the use of condoms by older adults is perceived as being associated with extramarital or unstable relationships, which is deemed as a violation of moral standards [70]. Moreover, traditional social beliefs often make older individuals feel they should be more restrained in terms of sexuality, leading them to feel psychologically aged before they do physically [71]. This societal perception of the connection between traditional culture, social morality, and sexuality can create a sense of taboo or negativity around the sexual desires of older adults, effectively "hijacking" the sexual desires of older adults. Buchtel et al. [72] revealed that cultural differences between Eastern and Western countries lead to varying perceptions of immoral behavior. While individualistic culture in Western societies prioritize harmful behaviors as immoral, Eastern countries like China view even uncivilized behavior as unethical due to the emphasis on harmony, group cohesion, and the preservation of social norms in their predominant collectivist culture [72]. Within this context, older adults are generally expected to be stabilizing forces and role models within their families and communities, entrusted with the responsibility of upholding traditional values and moral standards [73, 74]. Society traditionally considers abstinence or suppression of sexual desire as a virtue for older adults [67]. This notion leads to behaviors related to sex, such as engaging in frequent sexual activity and using condoms, which may be deemed inappropriate and immoral among older adults [50].

Factor 2, which is named "shaming condom purchase", refers to the embarrassment older adults feel toward purchasing or receiving condoms, because it is usually viewed as indecent or disreputable, and may even be seen as evidence of excessive sexual desire. Older adults may feel ashamed or embarrassed when obtaining condoms due to societal judgment and age-related stereotypes

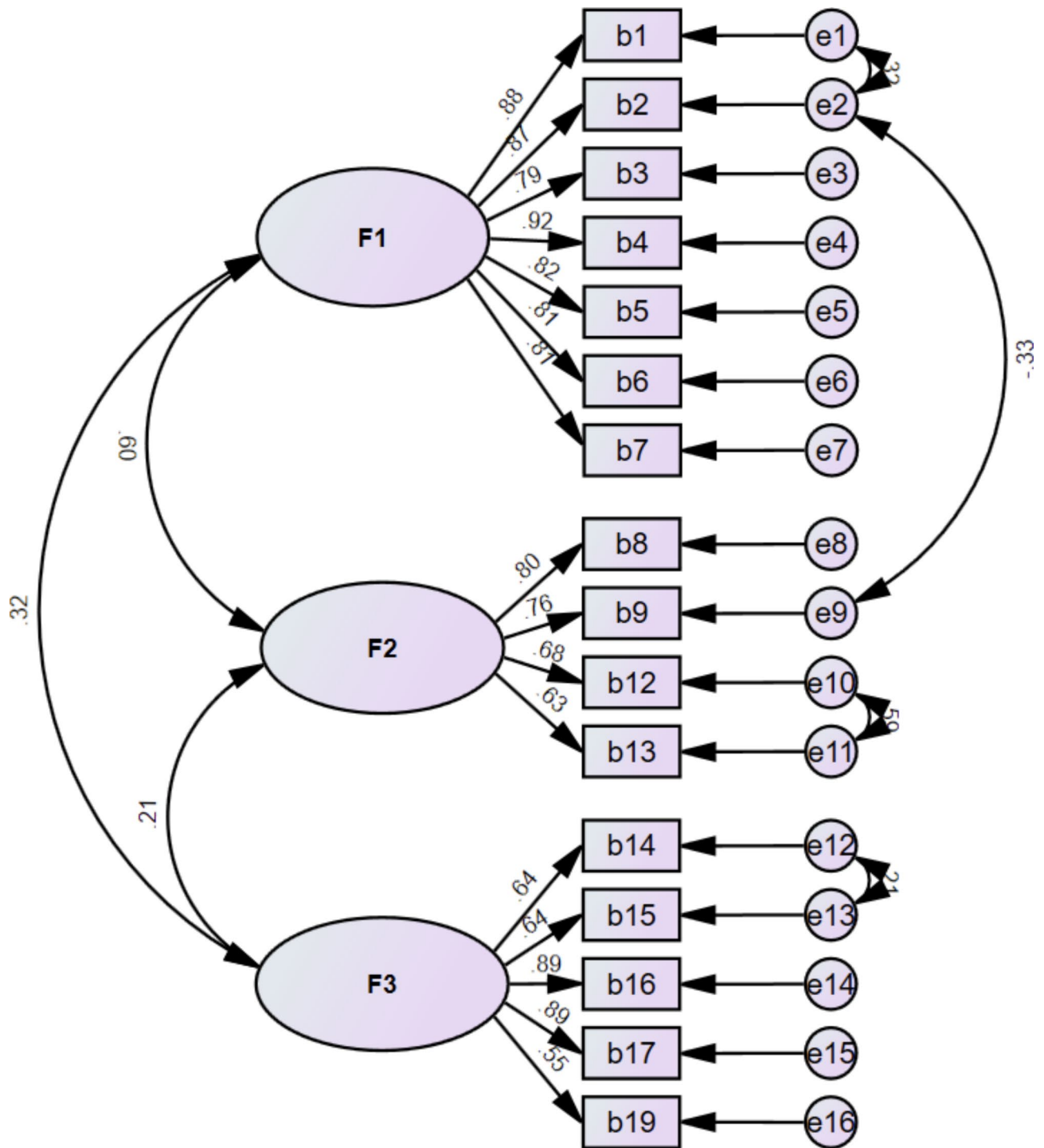


Fig. 1 CFA first-order model of 16-items CRSS-OA

[75], which culturally portray them as asexual even though older adults are sexually sexually active in China [76]. Before the 1960s, Eastern societies represented by China suppressed sexual desires under the influence of Confucianism, Buddhism, Taoism, and traditional Chinese medicine concepts [68]. At that time, any sexual activities unrelated to procreation were considered

taboo. Therefore, many Chinese older adults view discussions about sex or purchasing condoms as very private matters that should not be noticed by others, which will impact their self-image and bring societal and familial criticism [77, 78]. Even, older adults are reluctant to discuss sexual issues with healthcare providers or to obtain condoms from local clinics due to fears of judgment [79].

Table 5 Correlation of domains/subscales with the aging sexual attitudes and HIV/AIDS stigma (Pearson correlation coefficient)

	Factor 1	Factor 2	Factor 3
The aging sexual attitudes			
Attitudinal orientation groups (the dividing line was 104)	-0.188**	-0.473**	-0.022
Total score	-0.227**	-0.508**	0.025
HIV/AIDS stigma			
Fear of transmission and disease	0.157**	0.339**	0.172**
Association with shame, blame and judgment	0.243**	0.069	0.235**
Personal support of discriminatory actions or policies	0.280**	0.260**	0.281**
Perceived community support of discriminatory actions or policies	0.347**	0.278**	0.334**
Total score	0.311**	0.286**	0.310**

** : At the 0.01 level (two-tailed), the correlation was statistically significant; * : At the 0.05 level (two-tailed), the correlation was statistically significant

The shame associated with purchasing condoms has been confirmed as a significant barrier to behavioral interventions for older adults [19]. This attitude has been illustrated by items 8–11 of the adapted CRSS-OA.

Factor 3 describes traditional beliefs about sex, emphasizing that condom use violates the true meaning of sex, which involves direct physical contact, ejaculation into the vagina, and emotional and psychological enjoyment, as illustrated by items 12–15. Traditionally, sex is viewed as a profound emotional connection that demands sincerity and closeness through the exchange of bodily fluids [67], suggesting a belief that intimacy should not be hindered by condom use. Even older adults, when they engage in sexual activities, desire to maintain a sense of vitality, youthfulness, good self-conception, and spontaneity in their intimate relationships by having condomless sex [80]. Additionally, Factor 3 highlights the gender dynamics involved in decision-making regarding condom use during sexual activity. In the Chinese cultural context, where traditional gender norms persist among older generations [81], men may prioritize avoiding condoms to demonstrate their masculinity or assert control, and they are more likely to value sexual experiences, while women may feel pressured to passively acquiesce to these decisions [82, 83]. Item 16 illustrates this perspective.

It is important to acknowledge the limitations of this study. First, this study was conducted in only one province using convenience sampling, thus the sample may not fully represent the broader population of older adults due to potential biases in participant selection and regional differences. Future studies should validate the instrument in diverse regions across China to assess its external validity. Second, due to the sensitive topic of this questionnaire, we did not retain the participants' contact

information, which prevented us from performing test-retest reliability analysis.

Despite those limitations, the development of CRSS-OA has significant implications for community-based behavioral interventions, as knowledge of safe sex activities and condom use is often not addressed among older adults [84]. The CRSS-OA can serve as a sensitive indicator for promoting interventions aimed at enhancing safe sexual behaviors among older populations by reducing their stigma toward condom use. Future community-based programs could design targeted interventions to change their attitudes and beliefs about condom use, taking culturally-rooted factors into account. Additionally, using CRSS-OA can enhance health education initiatives for older adults, emphasizing the importance of safe sex practices. By integrating culture-specific considerations and establishing support systems, these efforts can help older adults overcome stigma-related barriers to condom use and empower them to prioritize their sexual health.

Conclusions

We adapted and validated a condom-related stigma scale for older adults in China, which was a 16-item self-reported scale with three factors (labeling condom use, shaming condom purchase, and violating traditional sex beliefs). This scale serves as a valuable tool for researchers and policymakers to design culture-sensitive preventive programs aimed at reducing stigmatizing attitudes toward condom use, thereby promoting safer sexual activities among older adults.

Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
HIV	Human Immunodeficiency Virus
CDC	Center for Disease Control and Prevention
HCPs	healthcare providers
CRSS-OA	Condom-Related Stigma Scale for Older Adults
CRSS	Condom-Related Stigma Scale
MSM	Men who have sex with men
ASKAS	Aging Sexual Knowledge and Attitudes Scale
CR	Critical ratio
EFA	Exploratory factor analysis
CFA	Confirmatory factor analysis
PCA	Principal component analysis
KMO	Kaiser-Meyer-Olkin
RFI	Relative fitting index
GFI	Goodness-of-fit index
NFI	Normed fit index
IFI	Incremental fit index
TLI	Tucker lewis index
RMSEA	Root mean square error of approximation

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Supplementary Material 4

Supplementary Material 5

Supplementary Material 6

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Author contributions

WWP: Research, Methodology, Writing original draft, Data organizing and Validation. BW and JC: Study supervision, Data organizing and Manuscript revision. JC and YS: Data collection and Data analysis. XHL and QJD: Conceptualization, Methodology, Audit, Project Management, Data Editing, Validation, Formal Analysis. All authors have read and approved the final manuscript.

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Data availability

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

Declarations

Ethics approval and consent to participate

The project was conducted in accordance with the Declaration of Helsinki Declaration. This study was approved by the Institutional Review Board for Behavioral and Nursing Research of Central South University, Xiangya School of Nursing (Approval No. E202275) before data collection commenced. Informed consent was obtained from all participants, ensuring their confidentiality, privacy, and voluntary participation throughout the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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