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Research Article

The Chinese Version of the Work Control Scale for Nurses: Modifying the Translation and Psychometric Testing

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A B S T R A C T

Purpose: The aim of the study was to modify and test the psychometric properties of the Chinese version of the work control scale (C-WCS).
Methods: The translated scale was administered to 840 nurses in Shanghai. Validity was assessed in terms of content validity and construct validity using exploratory factor analysis and confirmatory factor analysis. Internal consistency and test–retest reliability were estimated using Cronbach α and the intraclass correlation coefficient.
Results: Psychometric analyses of the C-WCS indicate high reliability and good content and construct validity.
Conclusion: The C-WCS has good psychometric properties and can be used as a valid tool for measuring work control among nurses in China. The C-WCS will help to further explore the correlations between perceived work control and organizational quality indicators such as nurses' satisfaction, job stress, well-being, or intention to stay. It can also be used in nursing outcome studies of work control strategies.

Introduction

Work control is an essential work characteristic [1] that is generally defined as one's control over one's task, conduct, and performance [2] or the ability to have influence over one's work and work environment to obtain a rewarding work situation [3]. Perceived work control reflects the belief or perception that a person can influence or change situations related to work. Work control is also considered a potential resource enhancer that can help employees compensate for the negative effects of stress and improve work performance [4]. Those who reported low levels of control over work were more likely to suffer from diseases such as cardiovascular disease and depression [5–10]. Regarding nurses, less work control is also closely related to nurses' acute fatigue [6–11], burnout [6,7], work–life imbalance [7–12], lower job satisfaction [7,8], poor performance [10,13], and increased intentions of leaving [2,11,14]. Nursing managers should pay attention to the influence of work control on nurses' work attitude, work quality, and organizational goals. An accurate and valid measuring tool is of great significance for nursing researchers and managers to understand the current situation of nurses' work control and improve their work control level.

Several questionnaires were designed to measure work control, for instance, Jackson's work control questionnaire [15], Karasek's job decision latitude from the job content questionnaire [2,12], and the work control scale (WCS) [16]. Jackson designed a self-report measurement tool that consists of timing control, method control, monitoring demand, problem-solving demand, and production responsibility. The subscales of control include time control (4 items) and method control (10 items). Although the scale has good reliability and validity, it is mainly designed for work at advanced manufacturing technology. The job decision latitude contains 9 items and measures decision authority (3 items) and skill discretion (6 items). And it equates the concept of work control with the work decision latitude. In addition, it usually appears as only one dimension of the job content questionnaire. It has been criticized owing to confounding "control" with "job complexity" [17]. To address this problem, Dwyer and Ganster [16] developed the

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WCS to measure the degree of control over work. It emphasizes covering the most crucial areas of control for a worker, such as the variety of tasks performed, scheduling of breaks, the choice of working methods, the order of execution, and predictability of work activities [16]. This tool has been applied to the nursing population and exhibited adequate reliability in previous studies [7,8,10].

However, because the WCS was rooted and developed in American culture, further adjustment studies for medical contexts in China before it can be applied are warranted. Although the WCS was originally introduced to China by Jia and Li [18], this edition is an incomplete version with only 17 items; the remaining 5 items and its structural validity have not been reported or explained in the existing published literature. Although this version has been used in nursing research in China [8], there were still some problems such as incomplete content, unclear translation revision process, and unclear structure. In addition, the scope of nursing practice and the content of nurses' work in China have changed greatly in the past decade [13]. Last but not least, the original author hopes that the WCS should be remodified and that a psychometric test should be performed to verify its reliability and validity. Therefore, it is necessary to retest the psychometric properties of the Chinese version of the WCS (C-WCS). A valid Chinese version of this work control assessment tool for the medical environment will enable researchers to examine the level of control over work that nurses have. To address this need, this study aims to validate the psychometric properties of the C-WCS.

Methods

Design, setting, and sample

This methodological study, which included translation, expert content validity, and psychometric testing, was undertaken from December 2016 to February 2017 in Shanghai. The multistage mixed sampling method was adopted to invite registered nurses to participate in the survey anonymously. First, researchers used a computer-generated random sequence to select three districts from 16 administrative divisions in Shanghai. Next, one tertiary hospital from each district was randomly selected using the same method. Finally, the convenience sampling method was used to recruit clinical nurses who met the inclusion criteria in each hospital. The inclusion criteria were participants (1) who were registered ward nurses and (2) who had at least 1 year of clinical experience. The exclusion criteria involved nurses who were on maternity or sick leave or who were receiving external training at the time of the investigation.

According to the principle that the sample size for factor analysis is about 10 to 20 times the number of scale items [19,20], 210 to 420 participants would be considered to be the optimal sample size because 21 items would be included in the analysis. Considering that the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were expected to be carried out in this study, the sample size was doubled. Therefore, we finally recruited 840 nurses.

Data collection

Before commencement of the study, the researchers obtained ethical approval from the Ethics Committee of Shanghai Jiao Tong University School of Public Health and Nursing Ethics Committee University (Approval no. 2016001). We explained the purpose and method of this study to nursing directors of each hospital and asked for their cooperation in data collection. After obtaining permission, the researchers or trained research assistants visited the clinical departments to distribute and collect the questionnaires. Each participant was fully informed of the aim of the survey and provided oral informed consent before being investigated. A total of 840 questionnaires were distributed and returned in a sealed envelope directly to the researchers (the return rate was 100%); of which, 122 were excluded because they had missing information on more than three items or had the same answers (e.g., all 4's or all 5's), leaving a sample of 718 (valid response rate = 85.5%), which was deemed a sufficient sample size for conducting EFA and CFA. In addition, after two weeks of the investigation, 30 nurses from the medical wards of the first hospital were invited to participate in the evaluation of test–retest reliability (the response rate was 100%).

Measures

The study questionnaire included demographic information such as age, gender, years of practice, marital status, education, department, and the WCS, which was translated into Chinese in this study.

The WCS is a one-dimensional scale consisting of 22 items, which measures in an employee the control level of tasks, schedules, methods, breaks, interruptions, predictability, and other aspects of work [16]. It used a 5-point Likert-type scale, with higher scores indicating a better work control level. The internal consistency reliability was 0.87 [16]. In line with previous studies [17], this study will exclude the 22nd item from all the following psychometric analyses, which is usually used only as a general control for validity check.

Translation and content validity evaluation

Before testing the psychometric characteristics of the C-WCS, we first completed the translation and content validity evaluation. With the approval from the original WCS developer, the C-WCS was adapted and translated into simplified Chinese. The process included forward and back translations with consensus meetings. The research team consisted of 1 nursing professor (Member A), 3 nursing teachers (Members B, C, and D), 1 senior clinical nurse with more than 15 years of clinical experience (Member E), and 1 nursing graduate student (Member F). All members are fluent in English, and they (excluding Member F) have more than one year of study or work experience in the United States or Australia. First, Members B and F separately translated the original version of the WCS to Mandarin. Second, Member C compared these two copies of the translated C-WCS to merge them into a reconciled forward version. Next, to ensure linguistic and conceptual consistency with the original scale, several discussions were conducted by Members A, B, C, and F. Then, Members D and E, who knew nothing about the original scale, independently completed their own back translation. Finally, the research team compared the two translations with the original English version, identified and discussed several synonyms, and finally obtained the conceptual and semantic equivalent versions of the original English WCS and the C-WCS.

A panel of 9 experts in nursing research, clinical nursing, and nursing management, which included two academic researchers, three nursing managers, three clinical nurses, and an expert on tool development, reviewed the content of the C-WCS. They rated the relevance of each item, with 1 marked as “not relevant,” 2 marked as “somewhat relevant,” 3 marked as “quite relevant,” and 4

marked as "highly relevant" [21]. The content validity index (CVI) was assessed in terms of "item CVI" (I-CVI) and "construct CVI." An average I-CVI of ≥.74 and an average scale level CVI (S-CVI) of ≥.90 were considered acceptable [21,22]. In this study, a modified kappa (κ*) statistic was used to adjust I-CVI for the chance of agreement on relevance. A κ* of ≥.74 was considered excellent [21].

Data analysis

Data analyses were performed using SPSS Statistics 23.0 (IBM Corp., Armonk, NY, USA) and MPlus program (Version 7.4, Muthén & Muthén, Los Angeles, CA, USA) [23]. Content validity was evaluated using the CVI and the κ* statistic. The reliability of the C-WCS was assessed by internal consistency (via Cronbach α coefficients) and test–retest reliability (via intraclass correlation coefficients). EFA and CFA were used to examine the construct validity of the C-WCS, with the total sample randomly split into two groups: Group A ($n = 361$) used for EFA and Group B ($n = 357$) used for CFA by SPSS 23.0. First, EFA was conducted to explore the factor model of the C-WCS using principal component analysis and Promax rotation. The following criteria were used to obtain the best fitting structure and the correct number of factors: (a) eigenvalue higher than 1.0, (b) the percentage of total variance explained, and (c) factor loading cutoff of .45 [24,25]. Next, CFA was used to confirm the prior explored model obtained in EFA. Indices, including the Chi-square test, Chi-square/df ratio, root mean square error of approximation (RMSEA), comparative fit index (CFI), Tucker–Lewis index (TLI), and standardized root mean square residual (SRMR), were commonly used to assess the model fit for CFA [26]. Higher CFI and TLI values (>.90) and lower RMSEA (≤.08) and SRMR (≤.08) values indicate good fit [26]. The square root of average variance extracted (AVE) of each construct should be higher than the correlation coefficient of each paired construct, which means that the constructs have discriminant validity [26]. A composite reliability value which is higher than .6 represents ideal structural reliability [27]. Statistical significance was set at $p < .05$.

Table 1 *Demographic Characteristics of the Ward Nurses (N = 718).*

Variables	Whole sample ($N = 718$) n (%)	Sample 1 ($n = 361$) n (%)	Sample 2 ($n = 357$) n (%)
Age (yrs)			
Mean (SD)	31.08 (6.89)	30.85 (6.87)	31.31 (6.92)
Range	20–54	20–53	21–54
Gender			
Women	704 (98.1)	355 (98.3)	349 (97.8)
Men	14 (1.9)	6 (1.7)	8 (2.2)
Years of employment (yrs)			
Mean (SD)	9.80 (7.87)	9.61 (7.89)	10.00 (7.86)
Range	1–33	1–33	1–33
Education			
Diplomas	18 (2.5)	5 (1.4)	13 (3.6)
Associate's degree	312 (43.5)	161 (44.6)	151 (42.3)
Bachelor's degree	374 (52.1)	187 (51.8)	187 (52.4)
Master's degree or higher	14 (1.9)	8 (2.2)	6 (1.7)
Marital status			
Married	445 (62.0)	221 (61.2)	224 (62.7)
Single, divorced, or separated	273 (38.0)	140 (38.8)	133 (37.3)
Unit/department			
Medicine	249 (34.7)	130 (36.0)	119 (33.4)
Surgery	158 (22.0)	70 (19.4)	88 (24.6)
Pediatric	30 (4.2)	16 (4.4)	14 (3.9)
Obstetrics–gynecology	35 (4.9)	14 (3.9)	21 (5.9)
Emergency	66 (9.2)	40 (11.1)	26 (7.3)
ICU	141 (19.6)	71 (19.7)	70 (19.6)
Other	39 (5.4)	20 (5.5)	19 (5.3)

Note. ICU = intensive care unit; SD = standard deviation; yrs = years.

Results

Demographic characteristics

Regarding the participants, 98.1% were women, and 62.0% were married. Other characteristics of the nurses are shown in Table 1.

Scale modification

Only 1 item was revised because of cultural differences and the occupational milieu. Item 14, "How much can you control the time and frequency with which you interact with others at work?" was modified to "How much can you control the time and frequency with which you interact with others (such as medical personnel, patients and their families) at work?" This modification was made to improve Chinese nurses' understanding of the statement. Item 3 "How much control do you have over your work quality?" was excluded owing to its low corrected item total correlation [25] during the item analysis process. In addition, Item 10 "How much can you predict what the consequences of your decisions about

Table 2 *Content Validity Index (CVI), Means, SD, Corrected Item Total Correlation for the Chinese Version of the Work Control Scale (n = 361).*

Item	I-CVI	κ†	Mean	SD	Critical ratio	Item total correlation	Corrected item total correlation	Cronbach α if the item deleted
Item 1	1	1	3.14	0.86	8.77	.47*	.41	.90
Item 2	.89	.89	2.57	0.98	14.79	.68*	.62	.90
Item 4	1	1	3.40	0.95	9.70	.53*	.45	.90
Item 5	1	1	3.54	0.87	9.25	.54*	.47	.90
Item 6	1	1	3.54	0.83	9.89	.56*	.50	.90
Item 7	.89	.89	2.86	1.03	15.33	.69*	.63	.90
Item 8	.89	.89	3.16	1.09	12.91	.64*	.57	.90
Item 9	.89	.89	2.90	1.00	13.11	.64*	.58	.90
Item 11	.89	.89	2.71	0.99	15.90	.70*	.64	.89
Item 13	1	1	3.26	0.93	15.75	.69*	.64	.90
Item 14	1	1	3.10	0.85	12.37	.63*	.57	.90
Item 15	.89	.89	2.67	0.91	12.77	.64*	.59	.90
Item 16	1	1	3.18	0.76	10.26	.59*	.54	.90
Item 17	1	1	2.94	0.79	11.67	.64*	.59	.90
Item 18	1	1	2.97	0.89	12.20	.62*	.57	.90
Item 19	.78	.76	2.70	0.95	12.16	.61*	.54	.90
Item 20	.78	.76	2.07	1.02	11.68	.56*	.48	.90
Item 21	.78	.76	2.70	0.90	12.07	.63*	.57	.90

$^*p < .001$; †κ = kappa designating agreement on relevance; number of experts = 9.
Note. I-CVI = item content validity index; SD = standard deviation.

work will be?" and Item 12 "How much can you control the physical conditions of your work area (lighting, temperature)?" with a low factor loading (.37 and .35, respectively) were deleted from further analyses.

Descriptive statistics of the items

As shown in Table 2, the mean score of most items of nurses in this investigation was higher than 2.50, indicating at least moderate control over their work. But Item 18, about control with regard to income, had means lower than 2.50.

Content validity

As described in Table 2, all items had satisfactory I-CVI scores and excellent κ*. The average S-CVI for the WCS-C was .94, indicating highly satisfactory content validity.

Construct validity

Exploratory factor analysis

EFA involving principal component extraction and Promax rotation was used to test the constructs of the C-WCS. Factor analysis suitability was verified using the Kaiser–Meyer–Olkin (KMO) test (.92) and Bartlett's test of sphericity (χ^2 = 2911.24, p < .001). Initially, three factors accounting for 53.2% of the variance explained were extracted. Item 10 "How much can you predict what the consequences of your decisions about work will be?" and Item 12 "How much can you control the physical conditions of your work area (lighting, temperature)?" had a low factor loading (<.45). Based on the criterion of loading factors of >.45 [26], these two items were deleted.

Table 3 *Exploratory Factor Analysis Results of the C-WCS (n = 361).*

Factor	1	2	3
Name of the factors	Control of Work Environment	Control of Work Resources	Control of Work Efficiency
Percentage of variance	38.1	9.8	7.2
Cumulative %	38.1	47.9	55.1
Cronbach α	.85	.83	.74
Item 20	**.83**	.07	−.33
Item 7	**.70**	−.21	.39
Item 2	**.69**	−.09	.25
Item 9	**.65**	−.07	.22
Item 21	**.59**	.21	−.06
Item 11	**.53**	.24	.07
Item 19	**.50**	.41	−.23
Item 8	**.46**	−.01	.37
Item 16	−.24	**.83**	.20
Item 17	.11	**.71**	−.02
Item 18	.22	**.65**	−.13
Item 14	−.01	**.63**	.20
Item 13	.01	**.61**	.29
Item 15	.34	**.49**	−.05
Item 5	−.11	.14	**.76**
Item 4	.04	−.03	**.75**
Item 6	−.05	.14	**.73**
Item 1	.15	.02	**.48**

Note. C-WCS = Chinese version of the Work Control Scale; EFA = exploratory factor analysis; KMO = Kaiser–Meyer–Olkin.
EFA involving principal component extraction and Promax rotation was used to test construct validity of the C-WCS. The KMO test value was .91, and the approximate Chi-square value for Bartlett's test of sphericity was 2573.85 (df = 153, p < .001). The figures in bold are factor loadings >.45. Item 22 (In general, how much overall control do you have overwork and work-related affairs?), a general control item, was not used in any analyses.

Ultimately, the C-WCS (18 items) had a three-factor solution, accounting for 55.1% of the variance (Table 3), with a KMO test value of .91 and a significant Bartlett's χ^2 test result (χ^2 = 2573.85, p < .001). The factor loadings of all 18 items ranged from .46 to .83. The percentage variances for the three factors were 38.11, 9.78, and 7.21. The first factor was labeled control of the work environment (Items 2, 7, 8, 9, 11, 19, 20, and 21). The second factor was labeled control of work resources (Items 13, 14, 15, 16, 17, and 18). And the last factor was labeled control of work efficiency (Items 1, 4, 5, and 6), with factor loading ranging from .48 to .76. All factor loadings were higher than .45.

Confirmatory factor analysis

CFA (357 individuals, Group B) with robust maximum likelihood estimation was performed to evaluate the three-factor correlated model that was built according to the EFA (361 individuals, Group A). Initially, the result showed an acceptable fit according to the RMSEA (.08) and SRMR (.07) indices. However, the CFI (.87) and TLI (.85) values did not meet the criteria for an acceptable fit. Based on modification indices [28] and theoretical justifications, four error covariances were set as free parameters. The modified measurement model then got a goodness-of-fit statistics [χ^2 = 335.85, df = 128, p < .001, χ^2/df = 2.62 CFI = .91, TLI = .89, RMSEA = .07 (90% confidence interval = 0.06–0.08), SRMR = .06] (see Table 4). Figure 1 shows all standardized factor loadings. The reasons for correlated errors in this model may be due to similar expressions, with regard to aspects such as item wording and format. The composite reliability values for the control of the work environment, control of work resources, and control of work efficiency factors were .85, .81, and .78, respectively.

Discriminative validity

The AVE method was used to analyze the discriminant validity. We found that the square root of each construct's AVE had a higher value than the correlations with other latent constructs, which indicated good discriminant validity [26]. The relevant data are showed in Appendix A.

Reliability

The reliability estimates for the factors of the C-WCS are listed in Table 3. The Cronbach α coefficients were .90 for the total scale, .85 for control of work environment, .83 for control of work resources, and .74 for control of work efficiency. All values indicated very acceptable internal consistency reliability. Moreover, the intraclass correlation coefficient was .77 (p < .05), indicating acceptable test–retest reliability.

Discussion

This article provides documentation of the translation, modification, and validation of the C-WCS. Our findings demonstrate that the 19-item C-WCS is a valid, reliable assessment tool, with

Table 4 *Summary of Model Fit Indices of the C-WCS from CFA (n = 357).*

Model	χ^2	df	TLI	CFI	SRMR	RMSEA (90% CI)
Model 1	420.68*	132	.85	.87	.07	.08 (0.07–0.09)
Model 2	335.85*	128	.89	.91	.06	.07 (0.06–0.08)

*p < .001.
Note. CFA = confirmatory factor analysis; CFI = comparative fit index; RMSEA (90% CI) = root mean square error of approximation with 90% confidence interval; SRMR = standardized root mean square residual; TLI = Tucker–Lewis index. Estimation = robust maximum likelihood.

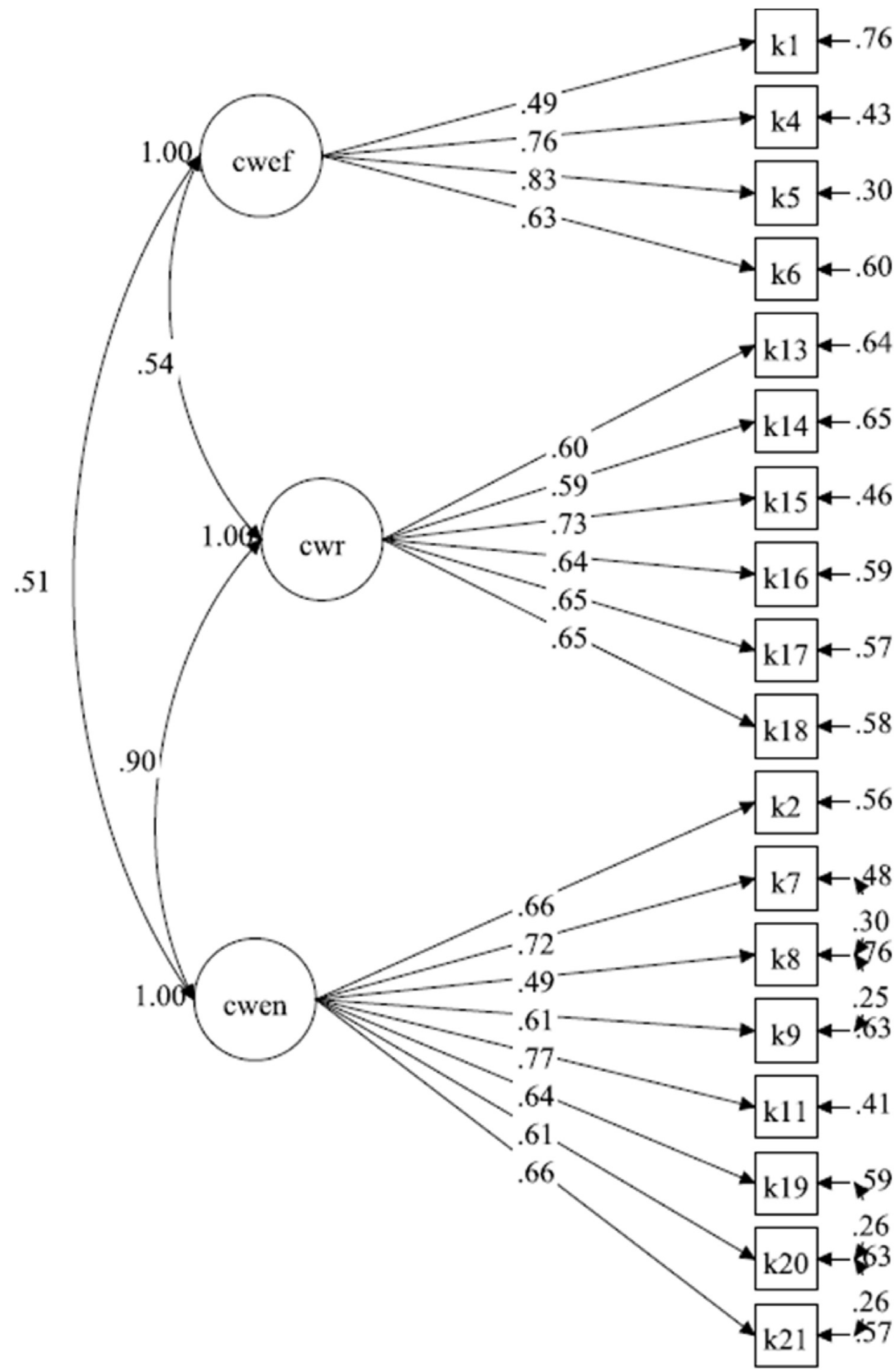

Figure 1. Three-factor model of the work control scale. Note: Analysis was performed using Mplus 7.4. Estimation = robust maximum likelihood (n = 357); (CWEf: control of work efficiency; CWR: control of work resources; CWEn: control of work environment). The 3-factor CFA model fits the data as follows: χ^2 = 335.85, p < .001, df = 128, χ^2/df = 2.62, CFI = .91, TLI = .89, RMSEA = .07 (90% CI .06–.08), SRMR = .06. CFA = confirmatory factor analysis; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; TLI = Tucker–Lewis index.

satisfactory content validity, acceptable internal consistency, and desirable construct validity. The C-WCS can be used to measure nurses' perceived work control in the Chinese medical context.

This study has applied various criteria and methods to test the psychometric characteristics of the C-WCS. Content validity indices, such as the I-CVI scores (>.78), the average S-CVI (.94), and the item κ* value (>.76), signified that the C-WCS has good content validity. When it comes to reliability, the internal consistency reliability (.90) and test–retest reliability (.77) showed good reliability of the C-WCS. The discriminant validity was also analyzed using the AVE method. And the data indicated accepted discriminant validity.

In addition, construct validity was analyzed using EFA and CFA. Based on the EFA and CFA results, three factors from the C-WCS emerged, indicating that nurses are aware that they maintain authority over the job in the wards through environmental planning and management, resource regulation, and efficiency management. EFA showed that the three factors explained 55.1% of the total variance of the 18-item C-WCS. Among Chinese nurses, control of work environment was the strongest factor, which accounted for 38.1% of the total variance. The control of work environment (8 items) factor refers to the perception that the individual's control of the working environment, such as decoration of the work area, protects the working environment from interference. The control of work resources (6 items) factor involves the perception of authority in regard to job-related information, procedures, or materials for meeting the demands of the job. The control of work efficiency (4 items) factor refers to the perception of discretion over work elements, including the method, amount, and speed for increasing efficiency.

However, this correlated three-factor structure for work control is different from the original unidimensional version of the WCS. The reason may be that the original version of the WCS was purportedly developed to widely assess multiple domains of work control rather than to define its subscales [16]. But we verify the original author's assumption of the original multidimensional scale. In addition, Smith et al. [17] found a two-dimensional pattern of the WCS, the general control dimension (9 items) and predictability dimension (3 items) [17]. Differences in the number of constructs and items may be related to the different types of occupations of the two study participants. The study of Smith et al. [17] was based on samples of American male production workers and traditional white-collar women, while this study consisted of Chinese hospital nurses as participants. Moreover, the WCS originated in the West. To some extent, different cultures may affect the factorial structure of the instrument [28]. Ongoing health-care reforms and the accelerated aging of the population have changed the Chinese clinical environment [28]. At present, nurses encounter not only the threat of a fragile nurse–patient relationship [29,30] but also balance between insufficient staff, inadequate resources, and quality of care [8,31,32]. These factors may make Chinese hospital nurses more aware of the practice environment, work resources, and work efficiency. Some studies in China have found that nurses who perceived insufficient work control felt less job satisfaction, lower self-efficacy, and more work–family conflict [31]. What is missing of nurses' control of their work should be investigated in future. Therefore, this study on the dimensionality of the WCS will help clarify the specific difficulties in nurses' control over their daily work.

There are several limitations to this study that need to be acknowledged. This study was carried out in Shanghai, a municipality of China, and most of the participants were women, which may limit the universality of the findings. Therefore, further studies in other settings and with male populations should be encouraged to explore gender difference, geographical difference, and culture sensitivity of the C-WCS. Furthermore, additional psychometric evaluation that may be needed, such as measurement invariance or predictive validity, was not discussed in this study.

Conclusion

The C-WCS demonstrated acceptable validity and reliability and can be suggested for application in China, especially in female nurses. The C-WCS provides the opportunity for health-care organizations or clinical care managers to adopt various methods to improve nurses' control over work and to explore the associations between work control, sociodemographic characteristics, satisfaction, and intention to stay. In the future, the C-WCS can play a role in exploring the influencing factors and intervention strategies of work control. The instrument may help assess the effectiveness of training programs and determine which ones are the best suited for better work control. For further exploration of the culture sensitivity of the C-WCS, it is necessary to conduct replication studies with diverse samples including more male nurses or community nurses.

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Conflict of interest

No conflicts of interest.

Appendix A. The square root of the average variance extracted (AVE) (in bold) and correlations between constructs

	Control of work efficiency	Control of work resources	Control of work environment
Control of work efficiency	**0.691**		
Control of work resources	0.368	**0.647**	
Control of work environment	0.356	0.527	**0.648**
The C-WCS	0.677	0.799	0.857

Note: The boldface value of the diagonal line is the square root of AVE.

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