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Original Article

Psychometric Properties of the Core-Competency Institutional Nurse Aide Scale among Institutional Nurse Aides

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SUMMARY

Background: The Core-competency Institutional Nurse Aide scale (CINA) is a job competency measure for institutional nurse aides that includes eight domains: physical care, daily care, emergency management, psychological support, interpersonal communication, activity facilitation, teamwork cooperation, and occupational ethics. This study aimed to examine the construct validity (i.e., 8-factor structure of the CINA, unidimensionality of each domain, and convergent validity) and internal consistency of the CINA among institutional nurse aides.

Methods: Totally, 238 institutional nurse aides completed the CINA. Confirmatory factor analysis (CFA) was conducted to examine the 8-factor structure of the CINA and unidimensionality of each domain. Pearson's *r* and Cronbach's alpha (α) were performed to examine convergent validity and internal consistency, respectively.

Results: The CFA goodness-of-fit indices of the 8-factor structure of unidimensionality were comparative fit index = 0.97–1.00, Tucker-Lewis index = 0.95–1.00, standardized root mean square residual = 0.037–0.100, and root mean square error of approximation = 0.026–0.170. Moderate to strong correlations were observed among the eight domains (r = 0.33–0.78). Cronbach's α for the eight domains ranged from 0.89 to 0.94.

Conclusion: The CINA has shown sufficient construct validity and internal consistency for use among institutional nursing aides. Each domain assesses a specific dimension of job competency pertinent to institutional nursing aides. This multidimensional job competency measure has potential applications in workforce development, performance evaluation, and quality improvement of institutional nurse aides.

1. Introduction

As Taiwan's aging population intensifies, the country faces unprecedented challenges, especially the increasing need for long-term care services. A 2022 national survey reported that 4.043 million individuals in Taiwan were aged 65 years and older, among whom approximately 28.16% experienced difficulty in activities of daily living, reflecting a broad spectrum of functional limitations.[1,2] While this statistic indicates a considerable need for long-term care services, it does not distinguish the severity of disability. Disability severity is typically classified as mild, moderate, or severe, based on the extent of functional impairment.[3] As chronic illness and age-related decline progress, older adults are more likely to develop moderate to severe disabilities or become bedridden, thereby contributing to increased demands for professional long-term care.[4] This growing need places a substantial burden on family caregivers, often prompting them to seek support from institutional long-term care facilities.[5]

In institutional long-term care facilities, registered nurses have traditionally served as the primary caregivers, overseeing medical care and coordinating health services. However, due to a persistent shortage of nursing staff and the increasing demands of an aging population, nurse aids have become indispensable in providing daily care.[6] Nurse aids now delivering approximately 70–90% of direct care to residents,[7,8] including assistance with daily activities, monitoring residents' conditions, and offering emotional support.[9] Their frequent and sustained interactions with residents make them vital contributors to the continuity and responsiveness of care in long-term care settings. Therefore, evaluating the job competencies of institutional nurse aides is critical to identify their training needs and guide workforce development, which, in turn, can help improve the overall quality of institutional care.

The Core-competency Institutional Nurse Aide scale (CINA) is a newly developed instrument designed to assess the job competencies of institutional nurse aids in Taiwan.[10] The scale comprises eight domains: physical care, daily care, emergency management, psychological support, interpersonal communication, activity facilitation, teamwork cooperation, and occupational ethics. Each domain includes items reflecting the specific duties and challenges encountered by nurse aides in long-term care settings. Developed based on Taiwan's long-term care system and workforce characteris-

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tics, the CINA has the potential to identify strengths and deficiencies in job competencies, providing a structured basis for workforce development, targeted training, and quality improvement in long-term care facilities.

The CINA has shown good content validity and face validity, the former of which was established through expert review during its development for institutional nurse aides.[10] However, construct validity (e.g., 8-factor structure of the CINA, unidimensionality of each domain, and convergent validity) and internal consistency have not been examined in institutional nurse aides. Establishing an 8-factor structure is critical to confirm that each domain represents a distinct and coherent construct of job competency for nurse aide. Evaluating unidimensionality ensures that the items within each domain collectively measure a single underlying construct.[11] Internal consistency is used to verify whether items within a domain produce consistent results.[12] Therefore, the purpose of this study was to examine the construct validity (i.e., 8-factor structure of the CINA and unidimensionality of each domain) and internal consistency of the CINA among institutional nurse aides.

2. Methods

2.1. Participants

We recruited nurse aides from institutional long-term care facilities in northern Taiwan between June and December 2023. The inclusion criteria were as follows: (1) aged ≥ 20 years; (2) having completed nurse aide training or having passed a nurse aide certification exam; (3) currently working in an institutional long-term care facility; (4) able to read and understand Chinese; and (5) willing to provide informed consent to participate in the study. The exclusion criteria were nurse aides who did not provide care for institutional residents or those who were unable to read and understand Chinese. A minimum sample size of 200 was calculated based on widely accepted recommendations for confirmatory factor analysis (CFA).[13–15] To account for potentially incomplete responses and enhance the robustness and stability of model estimates, an attribution buffer of 15–20% was applied.[16,17] Informed consent was obtained from all participants prior to their enrollment in the study. This study was approved by the Taipei City Hospital Research Ethics Committee (TCHIRB-11201007-E).

2.2. Procedures

After obtaining written consent, participants were informed about the purpose and procedures of the study. They then self-administered the CINA in a quiet environment within their institutional workplace. Demographic data, including age, sex, seniority in the institutional long-term care facility, education level, and marital status, were also collected. The estimated time required to complete the questionnaire was approximately 20–30 minutes.

2.3. Measures

The CINA is a self-report measure originally developed and written in Chinese by the first author to assess job competencies of institutional nurse aides. It contains of 74 items across eight domains. The physical care domain (17 items) assesses the nurse aides' ability to perform personal hygiene and physical health maintenance tasks for residents. The daily care domain (20 items) evaluates their competencies related to supporting residents in routine daily living activities. The emergency management domain (6 items) measures nurse aides' preparedness and capacity to respond effectively to emergencies. The psychological support domain (7 items) captures their ability to provide empathetic, respectful, and emotionally supportive care to residents. The interpersonal communication domain (5 items) evaluates communication effectiveness with residents and team members. The activity facilitation domain (6 items) assesses their ability to support residents' engagement in therapeutic and recreational activities. The teamwork cooperation domain (6 items) evaluates collaborative behaviors within the care team. The occupational ethics domain (7 items) assesses adherence to professional standards and ethical principles in caregiving. Appendix 1 displays the CINA items.

Items were rated on a five-point scale: 1 = unable to do anything, 2 = able to do small things, 3 = able to do some things partially, 4 = able to do most things, and 5 = able to do all things completely. The raw score for each domain was calculated by summing the item scores within that domain. Then, the transformed score was calculated using the following formula:

$$\text{Transformed score} = (\text{raw score} / \text{maximum possible score for the domain}) * 100$$

The resulting transformed scores for each domain ranged from 20 to 100 (see Appendix 1). The possible raw score ranges for each domain are as follows: physical care: 17–85; daily care: 20– 100; emergency management: 6–30; psychological support: 7–35; interpersonal communication: 5–25; activity facilitation: 6–30; teamwork cooperation: 6–30; occupational ethics: 7–35. The total CINA score was calculated by averaging the eight transformed domain scores. Higher scores in each domain denoted a stronger degree of job competency. The CINA has been reported to have good content validity and face validity.[10]

2.4. Data analysis

Descriptive statistics were used to analyze participants' demographic characteristics. Means and standard deviations were calculated for continuous variables (e.g., age, seniority), while frequencies and percentages were reported for categorical variables (e.g., gender, education level, and marital status).

The 8-factor structure of the CINA and the unidimensionality of each domain were evaluated through CFA conducted using LISREL 8.8 software. The CFA parameters were estimated using the diagonally weighted least squares (DWLS) technique, which is suitable for ordinal data.[18,19] To evaluate the adequacy of the model fit, four goodness-of-fit indices were employed: the comparative fit index (CFI), Tucker-Lewis index (TLI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). A satisfactory model fit was determined based on the following thresholds: CFI ≥ 0.95, TLI ≥ 0.95, SRMR ≤ 0.08, and RMSEA ≤ 0.10.[20–22] The RMSEA was reported with a 95% confidence interval to provide a more conventional and rigorous estimate of model fit precision.[23] Item factor loadings were estimated to assess the degree of association between each item and its respective latent construct, with a loading of ≥ 0.40 considered acceptable.[21]

To further confirm the 8-factor structure of the CINA, Pearson's *r* was calculated to assess the correlations between the eight domains. Correlations were interpreted as when $r > 0.75$, moderate when $0.40 \leq r \leq 0.74$, and low when $r < 0.40$.[24]

Cronbach's alpha (α) was employed to evaluate internal consistency, with α values ≥ 0.70 deemed sufficient for group comparisons, and α values ≥ 0.90 regarded as excellent for individual comparisons.[25]

3. Results

In total, 238 institutional nurse aides were recruited. This sample size was adequate to obtain stable estimates from the CFA model. Their average age was 49.7 years, and most were women (77.7%). The mean seniority in the institutional long-term care facilities was 7.0 years. Further details on participants' demographics are presented in Table 1.

The CFA results for the 8-factor structure were as follows: CFI = 0.97, TLI = 0.97, SRMR = 0.110, and RMSEA (95% CI) = 0.084 (0.081, 0.087). Table 2 shows the CFA results for the goodness-of-fit indices of the eight CINA domains. Four domains (i.e., emergency management, psychological support, teamwork cooperation, and occupational ethics) met the predefined criteria for unidimensionality, as confirmed by the four fit indices (CFI = 0.99–1.00, TLI = 0.98–1.00, SRMR = 0.037–0.051, and RMSEA = 0.026–0.099). The other four domains satisfied the requirements of the two indices (CFI = 0.97–0.99 and TLI = 0.95–0.97). These four domains did not meet the required criteria for SRMR (0.097–0.100 for the physical care and daily care domains) and/or RMSEA (0.110–0.170 for the physical care, interpersonal communication, and activity facilitation domains). The item factor loadings of the physical care, daily care, emergency management, psychological support, interpersonal communication, activity facilitation, teamwork cooperation, and occupational ethics domains were 0.66–0.84, 0.58–0.89, 0.79–0.92, 0.80–0.95, 0.83–0.93, 0.79–0.97, 0.76–0.93, and 0.70–0.94, respectively (Appendix 1). As for the interrelationship among the eight domains of the CINA, moderate to strong correlations were observed (r = 0.33–0.78; Table 3).

Cronbach's α of the occupational ethics domain was 0.89 (Table 2). The other seven domains exhibited an α exceeding or equal to the criterion of 0.90.

Table 1
Characteristics of participants (n = 238).

Characteristic	
Age (mean year [SD])	49.7 (11.9)
Sex, n (%)	
Male	53 (77.7)
Female	185 (22.3)
Seniority (mean year [SD])	7.0 (5.9)
Education, n (%)	
Elementary school	13 (5.5)
Middle school	47 (19.7)
High school	106 (44.5)
College and above	72 (30.3)
Marital status, n (%)	
Single	60 (25.2)
Married	136 (57.1)
Divorced	24 (10.1)
Widow	18 (7.6)

SD = standard deviation.

4. Discussion

This study examined the construct validity and internal consistency of the new measure (i.e., the CINA) which assesses the job competency of institutional nurse aides. The novelty of this measure lies in identifying the job competencies of nurse aides working in institutional long-term care facilities and assessing multidimensional job competencies. The model fit of the 8-factor structure and the unidimensionality of each domain in the CINA were supported. That is, each domain captures a distinct aspect of the competency of nurse aides, and the cumulative item scores within a domain can be used to assess proficiency in the corresponding job competency. Furthermore, the substantial item factor loadings of each domain indicated the appropriateness of the items as indicators of their respective job competencies.[21] The CINA can serve as a valid tool for assessing the multidimensional job competencies of nurse aides in institutional long-term care settings, with potential applications in workforce development, performance assessment, and quality improvement initiatives.

While the CFI and TLI values demonstrated a satisfactory model fit, the SRMR and/or RMSEA values exceeded the recommended thresholds for the 8-factor structure and four domains (i.e., physical care, daily care, interpersonal communication, and activity facilitation). The elevated SRMR values may be attributed to the model size (i.e., number of variables).[26] The 8-factor structure model included

Table 2
Confirmatory factor analysis fit indices and internal consistency.

Domain	CFI	TLI	SRMR	RMSEA (95% CI)	Cronbach's α
Physical care	0.97	0.97	0.097	0.110 (0.093, 0.123)	0.93
Daily care	0.98	0.97	0.100	0.100 (0.091, 0.112)	0.94
Emergency management	0.99	0.99	0.038	0.091 (0.044, 0.138)	0.92
Psychological support	0.99	0.98	0.051	0.099 (0.062, 0.136)	0.92
Interpersonal communication	0.99	0.97	0.049	0.130 (0.076, 0.190)	0.90
Activity facilitation	0.97	0.95	0.064	0.170 (0.123, 0.207)	0.92
Teamwork cooperation	0.99	0.98	0.046	0.097 (0.051, 0.148)	0.92
Occupational ethics	1.00	1.00	0.037	0.026 (0.000, 0.077)	0.89

CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; TLI = Tucker-Lewis index.

Table 3
Correlations between eight domains of the CINA.

Domain	Physical care	Daily care	Emergency management	Psychological support	Interpersonal communication	Activity facilitation	Teamwork cooperation
Daily care	0.72	-	-	-	-	-	-
Emergency management	0.51	0.57	-	-	-	-	-
Psychological support	0.33	0.43	0.66	-	-	-	-
Interpersonal communication	0.41	0.45	0.67	0.78	-	-	-
Activity facilitation	0.56	0.56	0.78	0.77	0.78	-	-
Teamwork cooperation	0.44	0.42	0.67	0.64	0.63	0.77	-
Occupational ethics	0.33	0.52	0.54	0.71	0.63	0.62	0.55

74 items, and the physical care and daily care domains contained 17 and 20 items, respectively, which potentially contributed to inflated SRMR values.

The RMSEA is known to be sensitive to models with low degrees of freedom, which may lead to an overestimation of poor fit.[27] The marginal model fit observed in two domains (i.e., interpersonal communication and activity facilitation) may be partly attributed to the limited number of items, which reduces degrees of freedom and inflates RMSEA values.[28] However, the suboptimal fit observed in domains such as physical care, which includes 17 items, suggests that other factors may be at play. These may include item redundancy, a lack of unidimensionality, or weaker content coherence within the domains. Such issues could lead to model misspecification even when the item count is sufficient.[29,30] These findings highlight the need for cautious interpretation and suggest that refinement of item content and reduction of redundancy may help improve the measurement model.

To further confirm that the eight domains are interrelated and collectively assess the job competencies of institutional nurse aides, a Pearson correlation analysis was conducted. The results revealed mostly moderate correlations among domains, ranging from 0.41 to 0.78, indicating that the domains were conceptually related but not redundant. For instance, data from the current study showed that daily care was strongly correlated with physical care (r = 0.72), reflecting the overlapping skill sets required to support residents' physical and daily activities.[31] Similarly, psychological support and occupational ethics were moderately correlated (r = 0.71), both requiring emotional sensitivity and facilitating ethical care.[31,32] Activity facilitation demonstrated moderate to high correlations with multiple domains (r = 0.56–0.78), suggesting that this function frequently intersects with communication, emotional support, emergency management, and teamwork. Similar patterns have been observed in previous studies on institutional care competencies in Taiwan, where domains such as physical care, psychological support, and interpersonal communication were found to be closely connected within a broader competency framework.[33,34] These patterns support the interpretation that the eight domains collectively contribute to institutional nurse aides' overall job competencies.

The CINA domains displayed good internal consistency among institutional nurse aides. Cronbach's α of the occupational ethics domain was > 0.70, indicating sufficient internal consistency for group comparison of test scores in research studies. The other seven domains revealed high reliability ($\alpha \geq 0.90$), demonstrating suitability for individual comparisons of test scores in clinical settings.

Our study has two limitations. First, we only recruited institutional nurse aides from northern Taiwan, which may have limited the generalizability of our findings. Further studies should compare our results with samples from other regions of Taiwan or different cultural contexts. Second, the CINA contains a relatively large number of items, which may increase the response burden and restrict its practicality for routine use in busy long-term care settings. In the future, a shortened version can be considered by selecting items with high factor loadings from each domain to reduce the scale length while maintaining accuracy. This approach can help reduce the burden and time required for respondents. Further studies are needed to develop and validate the shortened version, examining its construct validity, internal consistency, and ensuring that its psychometric properties remain comparable to those of the original scale.

5. Conclusions

The findings of this study provide empirical evidence for the construct validity (i.e., 8-factor structure of the CINA, unidimensionality of each domain, and convergent validity) and internal consistency of the CINA. Each domain measures a distinct competency aspect relevant to institutional nurse aides. Moreover, the seven domains showed excellent internal consistency in individual comparisons. Therefore, the CINA is a psychometrically sound measure for assessing the job competencies of nurse aides in institutional long-term care settings. By understanding nurse aides' competency performance, institutional administrators can identify areas of insufficiency and develop advanced in-service training programs, thereby enhancing the overall quality of care in long-term care facilities. Future research should consider developing a shortened version of the CINA by selecting key items from each domain to enhance its practicality and reduce response burden in busy long-term care settings.

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Conflicts of interest

The authors declare that they have no conflict of interest.

Supplementary materials

Supplementary materials for this article can be found at https://www.sgecm.org.tw/ijge/journal/view.asp?id=37.

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