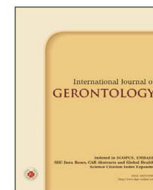




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Original Article

Psychometric Validation of the Novak Caregiver Burden Inventory for Caregivers of People with Dementia

Chi leong Lau^{a,b,c,d,e}, Ya-Chen Lee^f, En-Chi Chiu^{g,*}

^a Dementia Center, Department of Neurology, Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan, ^b Applied Cognitive Neuroscience Group, Institute of Cognitive Neuroscience, University College London, London, UK, ^c Institute of Biophotonics, National Yang Ming Chiao Tung University, Taipei, Taiwan, ^d College of Medicine, Fu-Jen Catholic University, New Taipei City, Taiwan, ^e Department of Medicine, University Hospital, Taipa, Macau, ^f Department of Occupational Therapy, College of Medical and Health Science, Asia University, Taichung, Taiwan, ^g Department of Long-Term Care, National Taipei University of Nursing and Health Sciences, Taipei, Taiwan

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SUMMARY

Background: The Novak Caregiver Burden Inventory (CBI) is commonly used to assess caregiver burden in caregivers of people with dementia. Although the CBI's five-factor structure has been supported in previous studies, the unidimensionality of each individual domain requires further validation, particularly in culturally specific populations and disease contexts. This study aimed to examine the domain-level unidimensionality of the CBI among caregivers of people with dementia in Taiwan. Internal consistency and ceiling and floor effects were also examined.

Methods: A total of 200 caregivers of people with dementia completed the CBI. The mean ages of the caregivers was 55.9 years (standard deviation = 13.4), with the most were female (70.0%), and an average caregiving duration was 5.2 years (standard deviation = 4.2). Confirmatory factor analysis (CFA) and Rasch analysis were performed to examine the unidimensionality of each domain. Cronbach's alpha was applied to examine internal consistency. The percentages of participants with maximum and minimum scores in each domain were used to estimate ceiling and floor effects, respectively.

Results: The four CFA fit indices of the five domains were: comparative fit index = 0.98–1.00, Tucker-Lewis index = 0.95–1.00, root mean square error of approximation = 0.000–0.170, and standardized root mean square residual = 0.023–0.055. Based on Rasch analysis, Infit and outfit mean squares of the five domains were 0.61–1.69 and 0.61–1.43, respectively. The alpha values of the five domains were 0.79–0.92. Ceiling effects ranged from 2.5% to 17.5% and floor effects ranged from 1.0% to 9.5%.

Conclusion: Our results supported the unidimensionality, demonstrated good internal consistency, and showed no notable ceiling or floor effects in the five CBI domains for caregivers of people with dementia. The total score for each domain can be utilized to indicate domain-specific caregiver burden.

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1. Introduction

The world's population is aging rapidly and the number of people suffering from dementia is also increasing rapidly.¹ Because the symptoms of dementia affect functional ability, people with dementia require assistance from their caregivers for performing activities of daily living, which places a heavy burden on caregivers.² Caregivers need to cope with inappropriate behaviors from the care receivers with dementia (e.g., aggression, agitation, wandering, and other disruptive behaviors).³

Moreover, caregivers of people with dementia have to take a leave of absence or quit the jobs in order to provide the necessary care, which results in reducing income.⁴ In Taiwan, caregivers of people with dementia also face substantial psychological and emotional challenge. Studies in Taiwan have reported high prevalence rates of depression (23.7–43.8%) and anxiety (37.4%) among informal caregivers of people with dementia.^{5,6} These mental health issues are

often attribute to neuropsychiatric symptoms of care receivers and the associated caregiving burden. Moreover, affiliate stigma, where caregivers internalize public stigma toward dementia, has been shown to further exacerbate caregiver burden and mental health issues.^{5–7} These findings highlight the importance of culturally validated tools for assessing caregiver burden and designing tailored interventions to support caregivers in Taiwan.

The Novak Caregiver Burden Inventory (CBI) is a widely used measure for assessing caregiver burden.⁸ The CBI contains five domains, including time-dependence burden, developmental burden, physical burden, social burden, and emotional burden. The time-dependent burden domain refers to the challenges that arise from time demands and restraints arising from caregiving responsibilities. The developmental burden domain refers to caregivers' feelings of being off time during their personal development with respect to peers. The physical burden domain describes the strain and demands placed on the caregivers' physical health, energy, and strength. The social domain describes the impact of caregiving on social roles. The emotional burden domain refers to negative emotions that caregivers may experience due to the care receiver's bizarre and unpre-

* Corresponding author. National Taipei University of Nursing and Health Sciences, No. 365, Ming-Te Road, Peitou District, Taipei 112303, Taiwan.
E-mail address: enchichiu@ntunhs.edu.tw (E.-C. Chiu)

dictable behaviors.⁹ The multidimensional domains provide a comprehensive depiction of caregiver burden in the context of caring, which is useful for determining the specific aspects of burden in clinical and research settings.

Construct validity imply whether a measure assesses the underlying construct that is intended to assess. Unidimensionality (i.e., the unidimensional model) is a type of construct validity that verifies whether the items of a domain reflect a singular underlying construct.¹⁰ Evaluation of unidimensionality of the singular CBI domain is essential to ensure that the sum score of a domain represents its specific aspect of caregiver burden.

The CBI has shown satisfactory internal consistency, test-retest reliability, and convergent validity in caregivers of people with dementia.^{11,12} The factor structure has been investigated in caregivers of people with dementia using exploratory factor analysis.^{12,13} While the overall five-factor structure of the CBI has been supported through confirmatory factor analysis (CFA) in previous researches,^{14,15} this evidence primarily comes from studies involving caregivers of people with other diseases, rather than dementia. The unidimensionality of each individual domain also remains insufficiently examined using advanced psychometric methods, such as Rasch analysis, particularly among caregivers of people with dementia in Taiwan. In addition, earlier studies have explored caregiver burden and its impact,^{5–7} yet there is still a lack of psychometric evidence supporting domain-level unidimensionality within the CBI for this specific population. Our study built on this body of work by using both CFA and Rasch analysis to rigorously examine the domain-level unidimensionality of the CBI among caregivers of people with dementia in Taiwan. We also assessed internal consistency as well as ceiling and floor effects to provide comprehensive psychometric evidence.

2. Methods

2.1. Participants

We recruited caregivers of people with dementia from two hospitals in northern Taiwan between April and December 2022. The inclusion criteria were as follows: (1) caring for people with dementia for more than four hours a day; (2) continuously caring for people with dementia for more than one year; (3) over 20 years of age; (4) care receiver with a diagnosis of dementia according to the Diagnostic and Statistical Manual of Mental Disorders, fifth edition; and (5) willingness to sign informed consent to participate in the study. The exclusion criteria were as follows: (1) caring for others with physical or mental illness; (2) receiving psychotherapy within two months; and (3) having conditions to prevent participation in the study (e.g., severe visual impairment).

2.2. Procedures

After obtaining written consent from eligible participants, each completed the CBI. We obtained demographic data (i.e., sex, age, education, marital status, employment, relationship with the care receiver, and care duration) using a questionnaire. This study was approved by the ethics committee at the Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan (approval number: 20211107R). All participants provided written informed consent before enrolment.

2.3. Measures

The Taiwanese version of the CBI was used in this study.^{16,17} The CBI is a self-reported caregiver burden measure that includes 24

items across five domains (Appendix 1). Each item was rated on a five-point scale: 0 = not at all, 1 = a little, 2 = moderately, 3 = much, and 4 = very much. The four domains (i.e., time-dependence burden, development burden, social burden, and emotional burden) had five items with score range is 0–20. The physical burden domain consists of four items, and its score is multiplied by 1.25 to obtain an equivalent score range of 0–20. The total CBI score ranges from 0 to 100, where higher domain scores indicated higher domain-specific caregiver burden.⁹

2.4. Data analysis

CFA was conducted using the LISREL 8.8 software to evaluate the unidimensionality of each domain. The diagonally weighted least squares estimator was used to estimate the CFA parameters.^{18,19} Four indices were applied to examine the data model fit: the comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). The requirements of a good model fit were CFI $\geq$ 0.95, TLI $\geq$ 0.95, RMSEA $\leq$ 0.08, and SRMR $\leq$ 0.08.^{10,20,21} The factor loading of items was estimated to show the correlation between each item and its corresponding domain. The standard of item factor loading was $\geq$ 0.40.¹⁰ Internal consistency was investigated using Cronbach's alpha (α). The values of $\alpha \geq$ 0.70 and $\geq$ 0.90 were good for used in group comparisons and individual comparisons, respectively.²²

Rasch analysis with a rating scale model was performed using the WINSTEPS software. Infit and outfit statistics were used to ascertain whether item responses fit the unidimensional model. An item with infit or outfit mean square (MnSq) between 0.5 and 1.5 demonstrated item fit.²³ Moreover, we performed principal components analysis on the standardized residuals and the criterion of unidimensionality was the eigenvalue of the first contrast $<$ 2.0.²⁴

Ceiling and floor effects were examined for each domain of the CBI. Ceiling and floor effects were evaluated by calculating the percentage of participants with maximum and minimum scores in each domain, respectively. A percentage $\geq$ 20.0% demonstrated notable ceiling and floor effects.²⁵

3. Results

Two hundred caregivers of people with dementia completed the CBI. The mean ages of the caregivers was 55.9 years and most were female (70.0%). Two-thirds of the caregivers were married (66.5%) and more than half had an education level of college or higher. Table 1 provides further characteristics of the caregivers.

Table 2 displays the CFA results for the fit statistics of the five CBI domains. The CFA results for the overall model were: CFI = 0.99, TLI = 0.99, RMSEA = 0.053, and SRMR = 0.064. The Cronbach's α for the overall scale was 0.94. The time-dependence burden domain fulfilled the pre-set requirements of the unidimensional model using four fit indices. The RMSEA index was 0.108–0.119 in the four domains (i.e., development burden, physical burden, social burden, and emotional burden). If not considering the RMSEA index, the other three indices met the requirements of unidimensional model (CFI = 0.98–0.99, TLI = 0.95–0.98, and SRMR = 0.033–0.055) in these four domains. The results of internal consistency of the five domains were α = 0.79–0.92. The item factor loadings for the time-dependence burden, development burden, physical burden, social burden, and emotional burden domains were 0.72–0.85, 0.76–0.86, 0.87–0.97, 0.59–0.84, and 0.69–0.92, respectively (Table 3).

Regarding Rasch analysis, the items of four domains (i.e., time-dependence burden, development burden, physical burden, and

emotional burden) met the unidimensional model (the infit/outfit MnSq were 0.78–1.17, 0.85–1.16, 0.61–1.20, and 0.69–1.34, respectively) (Table 3). Only one item of the social burden domain revealed misfit (item 17 “I’ve had problems with my marriage”) with infit MnSq = 1.69. The other items of the social burden domain fit the unidimensional model (infit MnSq = 0.70–1.23 and outfit MnSq = 0.71–1.19). The eigenvalues of the first contrast were 1.5, 1.8, 1.9, 1.7, and 1.8 in the time-dependence burden, development burden, physical burden, social burden, and emotional burden, respectively.

The percentages of participants with the maximum scores in the respective domains were 3.5% (time-dependence burden), 2.5% (developmental burden), 4.5% (physical burden), 12.5% (social burden), and 17.5% (emotional burden). The percentages of participants with the minimum scores in the respective domains were 1.0% (time-dependence burden), 3.5% (development burden), 9.5% (physical burden), 1.0% (social burden), and 0.5% (emotional burden).

4. Discussion

To our knowledge, the present study is the first to evaluate the construct validity of the CBI using both methods (i.e., CFA and Rasch analysis) in caregivers of people with dementia. The results of the CFA and Rasch analysis demonstrated sufficient unidimensionality for all five domains of the CBI, indicating that the items of each domain assess a unidimensional construct. Hence, the scores for each item were aggregated to represent each distinct construct. In terms of clinical implications, future users can utilize the CBI domain score

to characterize and elucidate the domain-specific caregiver burden in caregivers of people with dementia.

The time-dependence burden domain revealed a good model fit in CFA and Rasch analysis. All the items in five domains had high factor loadings. Four domains (i.e., development burden, physical burden, social burden, and emotional burden) met the requirements of the CFA indices, except for the RMSEA index. A possible reason for the RMSEA index is influenced by the number of items. The RMSEA decreased as the number of items increased.²⁶ The number of items in each of the four domains was limited number of items (i.e., 4–5 items). Future studies could consider increasing the number of items in these domains to decrease the RMSEA statistic.

Regarding the results of the Rasch analysis, the items fit the assumptions of the Rasch unidimensional model, except for one item (item 17, marriage problems) in the social burden domain, showing poor fitting in the infit MnSq (> 1.5). The infit statistic is responsive to the pattern of responses to item that is tailored to the persons.²⁷ Sixty-six percent of caregivers in this study stated not at all descriptive (score = 0) on item 17. Previous studies on factor structure using exploratory factor analysis of 24 items showed 4-factor model for

Table 1
Characteristics of carers (n = 200).

Characteristic	
Age (mean year [SD])	55.9 (13.4)
Gender, n (%)	
Male	60 (30.0)
Female	140 (70.0)
Education, n (%)	
Elementary school and below	20 (10.0)
High school	58 (29.0)
College and above	122 (61.0)
Marital status, n (%)	
Single	52 (26.0)
Married	133 (66.5)
Divorced	15 (7.5)
Employment, n (%)	
No	100 (50.0)
Full time	67 (33.5)
Part time	33 (16.5)
Relationship with care receiver, n (%)	
Spouse	41 (20.5)
Child	126 (63.0)
Others	33 (16.5)
Care duration (mean year [SD])	5.2 (4.2)

SD: standard deviation.

Table 2
Fit indices of confirmatory factor analysis and Cronbach’s α .

Domain	Number of items	CFI	TLI	RMSEA	SRMR	Internal consistency (α)
Time-dependence burden	5	1.00	1.00	0.000	0.023	0.87
Development burden	5	0.98	0.97	0.119	0.044	0.88
Physical burden	4	0.98	0.95	0.170	0.033	0.92
Social burden	5	0.98	0.95	0.115	0.055	0.79
Emotional burden	5	0.99	0.98	0.108	0.055	0.83

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

Table 3
Factor loading and statistics of Rasch analysis.

Domain and item	Factor loading	Difficulty logit	Infit MnSq	Outfit MnSq
Time-dependence burden				
1	0.85	-0.46	0.91	0.84
2	0.78	-0.85	1.12	1.00
3	0.82	-0.74	0.79	0.78
4	0.83	0.20	1.10	1.06
5	0.72	1.85	1.11	1.17
Development burden				
6	0.86	-0.38	0.85	0.85
7	0.80	0.84	1.02	0.98
8	0.82	-0.35	1.10	1.09
9	0.82	-0.18	0.82	0.84
10	0.76	0.08	1.16	1.15
Physical burden				
11	0.87	-0.83	1.18	1.20
12	0.97	0.28	0.61	0.61
13	0.87	1.38	1.17	1.09
14	0.88	-0.83	0.98	0.98
Social burden				
15	0.84	-0.46	0.70	0.71
16	0.77	0.06	0.86	0.87
17	0.59	0.88	1.69	1.43
18	0.80	-0.08	0.74	0.79
19	0.64	-0.28	1.23	1.19
Emotional burden				
20	0.82	-0.65	1.07	1.02
21	0.92	1.01	0.77	0.69
22	0.86	0.64	0.94	0.73
23	0.72	0.40	1.34	1.15
24	0.69	-1.41	1.05	1.04

MnSq: Mean Square.

caregivers of people with dementia (i.e., time-dependence burden, physical burden, social burden, and emotional burden). In these previous studies, five items (items 11, 15, 16, 20, and 24) displayed low factor loadings, and one item (item 18) was deleted.^{12,13} Our findings on misfitting items were not consistent with those of previous studies in Iran and Italy. There are two potential reasons for this discrepancy. First, individuals residing in different countries possess varying perspectives on caregiver burden.²⁸ Second, the characteristics of the samples in this study differed from those in previous studies. The majority of our samples were children of the care receiver, and half of them were currently employed. Moreover, 33.5% of the participants in this study were non-marital, and thus, more than half of the participants did not perceive marital problems while taking care of their care receivers. From the CFA results of this study, item 17 showed sufficient factor loading and the five items of the social burden domain demonstrated a unidimensional model. Therefore, item 17 was retained in this study.

Good internal consistency of each domain in the CBI was confirmed, indicating item homogeneity of each domain. Our reliability results were similar to those of previous studies.^{9,10} Thus, caregivers tended to provide consistent responses to items in each domain. Internal consistency of the physical burden domain ($\alpha > 0.90$) is sufficient for individual comparisons of domain scores and those of the other four domains ($\alpha > 0.70$) are satisfactory for group comparisons of domain scores in caregivers of people with dementia. No ceiling or floor effects were observed in the five domains, demonstrating that these domains can distinguish domain-specific functions of caregivers of people with dementia across the high and low score ranges. Overall, adequate internal consistency and no notable ceiling or floor effects provided additional evidence of the psychometric properties of these five domains.

One limitation of this study was the use of a convenience sample from two hospitals in northern Taiwan, which may limit generalizability due to potential sampling bias related to cultural context and caregiver demographics (e.g., predominantly female, higher education levels). Additionally, we did not collect data on caregivers' personal health condition, which may have influenced their perceived burden. Future studies should include more diverse and representative samples, consider caregivers' health status, and explore caregiver burden longitudinally to further validate the CBI.

5. Conclusions

The unidimensionality of the five CBI domains was supported in this study. Each domain captured the domain-specific burden of caregivers of people with dementia. Moreover, the five domains showed good internal consistency with no noticeable ceiling or floor effects. Therefore, the CBI is a valid and reliable caregiver burden measure for caregivers of people with dementia. The use of each domain in the CBI may assist clinicians and researchers in assessing multidimensional caregiver burden and facilitating appropriate clinical decisions.

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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 <http://www.sgecm.org.tw/ijge/journal/view.asp?id=35>.

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