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METHODOLOGY

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Psychometric testing of the Thai version of Caregiver Contribution to Self-Care of Chronic Illness Inventory version 2

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Abstract

Aim: To assess the psychometric properties of the Thai version of Caregiver Contribution to Self-Care of Chronic Illness Inventory version 2 (CC-SC-CII-v2) among primary caregivers of individuals with any single or multiple chronic illnesses.

Background: The instrument encompasses three scales that evaluate Caregiver Contribution to Self-Care (CC-SC) Maintenance, Monitoring and Management.

Methods: The English version CC-SC-CII-v2 was translated and adapted for Thai context, and a cross-sectional multicenter study involved 430 caregivers from 16 primary care centres in Thailand. Structural validity, internal consistency reliability and test–retest reliability were examined.

Results: The original two-factor CC-SC Maintenance scale required a re-specified model for good fit, while the CC-SC Monitoring and CC-SC Management scales fit well. The simultaneous model of three scales demonstrated satisfactory fit. The CC-SC Maintenance and CC-SC Management scales both had a composite reliability

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index of 0.85, with omega coefficients of 0.86 and 0.83, respectively. CC-SC Monitoring had an alpha coefficient of 0.89. The intraclass correlation coefficients ranging from 0.84 to 0.91, indicating good test–retest reliability.

Conclusion: The Thai CC-SC-CII-v2 is a valid and reliable instrument that can provide clinicians and investigators with an evaluation of the contributions of caregivers to the self-care of patients with chronic illnesses.

KEYWORDS
caregivers, caregiving, chronic illness, psychometrics, reliability, self-care, validity

Summary statement

What is already known about this topic?

- The Caregiver Contribution to Self-Care of Chronic Illness Inventory (CC-SC-CII) is a theoretical-based instrument initially created in the Western context.
- This inventory consists of three separate but interconnected scales for assessing caregiver involvement in patient self-care maintenance, monitoring and management.
- Rigorous psychometric assessments conducted in Western contexts have affirmed the validity, reliability and effectiveness of the CC-SC-CII.

What this paper adds?

- The introduction of the updated version, CC-SC-CII-v2, likely presents challenges linked to cultural adaptation when applying it within the Thai context.
- This research constitutes a novel contribution to the field of caregiving studies in Thailand and the broader Asian region.
- The study offers new insights into the validity and reliability of the CC-SC-CII-v2 within the context of Thai caregiving.

The implications of this paper:

- The CC-SC-CII-v2 proves to be a valid and reliable instrument for evaluating caregiver involvement in the self-care of patients with chronic illnesses.
- Its applicability extends to various culture, including Thai context, and it may be considered suitable for application in other Asian backgrounds as well.

1 | INTRODUCTION

Chronic illnesses globally impact individual health, families and healthcare systems (GBD 2019 Diseases and Injuries Collaborators, 2020). Non-communicable diseases including hypertension, diabetes, heart disease, stroke, chronic respiratory disease, chronic kidney disease and cancer are prevalent in Thai adults and worldwide (GBD 2019 Diseases and Injuries Collaborators, 2020; United Nations Thailand, WHO, 2021). Often coexisting, these conditions share risk factors, treatment regimens and self-care (da Rocha et al., 2020; Jaarsma et al., 2021). Self-care is crucial for patients with all types and states of chronic illnesses, involving appropriate behaviours to enhance health status, maintain stability, prevent recurrence and manage worsening conditions (Riegel et al., 2012). The lifelong management of chronic illnesses often requires daily care from both patients and caregivers.

Informal caregivers, especially family members, play a pivotal role in the self-care of individuals with chronic conditions, engaging in activities that parallel the self-care efforts of care recipients (CRs) (Vellone et al., 2019). This dynamic interaction is critical for meeting self-care requirements during illness episodes, with caregivers participating in maintaining, monitoring and managing CR's self-care. The concept of caregiver contribution to self-care (CC-SC) delineates the involvement of caregivers in patients self-care. Originating from the Caregiver Contributions to Heart Failure Self-Care (Vellone et al., 2019) and the Heart Failure Self-Care (Riegel & Dickson, 2008), they integrated with the broader theory of self-care of chronic illness (Riegel et al., 2012). CC-SC involves the degree to which caregivers assist patients in self-care, encompassing recommendations for or substitution of the CR in performing behaviours contributing to the maintenance of stability and management of worsening conditions (Vellone et al., 2019; Vellone, Lorini, et al., 2020).

The three fundamental processes of CC-SC are maintenance, monitoring and management (Vellone et al., 2019). Maintenance supports CRs' health-promoting behaviours (e.g. sleep, physical activity) and encourages illness-related behaviours (e.g. avoiding sickness, ensuring medication adherence) to maintain physical, emotional and cognitive stability and prevent exacerbations (Vellone, Lorini, et al., 2020). Monitoring entails caregivers vigilantly observing changes in CRs' conditions, signs and symptoms, medication side effects and treatment complications (Vellone, Lorini, et al., 2020). Subsequently, caregivers respond to these changes, constituting the management process. During this phase, caregivers comprehend the significance of the changes in CRs' conditions, interpret symptoms, consider options and decide on appropriate responses (Buck et al., 2015; Vellone, Lorini, et al., 2020). Responses can be autonomous (e.g. modifying diet and activity levels, using medication) or involve consulting healthcare providers (e.g. communicating with healthcare providers, seeking guidance) (Vellone, Lorini, et al., 2020).

Improving CC-SC enhances not only CRs' self-care but also overall health status and health-related quality of life for both CRs and caregivers (Vellone et al., 2019; Vellone, Lorini, et al., 2020). Conversely, inadequate CC-SC may result in hospitalization and mortality for CRs, along with psychological distress and burden for caregivers (Vellone et al., 2019). Factors facilitating or hindering CC-SC include caregiver-related (e.g. self-efficacy, health status), patient-related (e.g. care needed, problems) and dyad-related (e.g. mutuality, nature of the relationship) (Vellone et al., 2019).

Nursing, deeply rooted in self-care science and caregiver roles, is involved in supporting self-care for patients and their caregivers (Currie et al., 2015; Vellone et al., 2019). Clinicians and researchers bear the responsibility of identifying appropriate metrics to assess CC-SC and improve chronic care outcomes. Measuring CC-SC provides valuable insights into caregiver roles in managing chronic illnesses for their CRs, pinpointing intervention opportunities to enhance patient and caregiver outcomes. There are two typical forms of CC-SC instruments: disease-specific and generic or non-disease-specific. They assess three fundamental processes of CC-SC, aligning with relevant theories (Riegel et al., 2012, 2016; Vellone et al., 2019). The Caregiver Contribution to Self-Care of Heart Failure Index (Vellone et al., 2013; Vellone, Barbaranelli, et al., 2020) is a well-established disease-specific measure, culturally validated in various contexts, including Thailand (Antonio-Oriola et al., 2022; Ávila et al., 2020; Lopes Grisante et al., 2021; Srisuk et al., 2021). Simultaneously developed with the Self-Care of Chronic Illness Inventory (SC-CII) (Riegel et al., 2018), the Caregiver Contribution to Self-Care of Chronic Illness Inventory (CC-SC-CII) (Vellone, Lorini, et al., 2020) serves as a generic measure. It addresses the complex nature of chronic illness, including multiple chronic conditions, integrated behaviour changes and multiple treatment approaches, particularly for adult and older adult CRs (Vellone, Lorini, et al., 2020).

The CC-SC-CII demonstrated a robust theoretical construct and internal consistent reliability (Vellone, Lorini, et al., 2020). Notably, each scale's structural validity was confirmed with a partially second-order factor for the CC-SC Maintenance and CC-SC Management scales and a one-factor for the CC-SC Monitoring scale. Additionally, the simultaneous model exhibited a partially second-order structure (Vellone, Lorini, et al., 2020). Despite these achievements, there is limited research into its cross-cultural validity across different populations, languages or contexts. While prior studies established robust methods, validity and reliability, most participants were parents of chronically ill children and adolescents with a single chronic condition, primarily during hospitalization. Moreover, there is no mention of test–retest reliability in any earlier studies (Chen et al., 2021; Vellone, Lorini, et al., 2020). As of now, no publications reporting the psychometric testing for version 2 (Caregiver Contribution to Self-Care of Chronic Illness Inventory version 2 [CC-SC-CII-v2]) in the general chronic conditions context. A recent publication in the Thai context has specifically addressed the needs of stroke caregivers (Klinjun et al., 2023), potentially limiting the comprehensive understanding to caregiving of various generic conditions. Utilizing this instrument will not only enable a comprehensive assessment of caregivers' contribution to self-care of individuals with chronic illnesses in the Thai context but also facilitate the comparison of results across Asia and other parts of the world.

Therefore, we evaluated the psychometric properties of the cross-culturally adapted Thai CC-SC-CII-v2 among Thai family caregivers. Given the significant prevalence of multiple chronic conditions in adults and the ageing population (Dans et al., 2011; United Nations Thailand, WHO, 2021), along with the caregivers role in providing long-term care, our study focused on this population and their residential care context. To ensure the validity and reliability of the instrument, several aspects were tested, including structural validity, concurrent validity, internal consistency reliability and test–retest reliability. As noted earlier, CC-SC encompasses multiple factors, including self-efficacy (Vellone, Lorini, et al., 2020; Wilson et al., 2022). Therefore, the Caregiver Self-Efficacy in Contributing to Patient Self-Care (CES-CSC) scale (De Maria et al., 2021) was used to test the concurrent validity.

2 | METHODS

2.1 | Aim

In this study, we evaluated the psychometric properties of the Thai CC-SC-CII-v2 in caregivers of individuals with non-specific chronic illnesses. Our research group conducted a psychometric study of both the patient and caregiver versions of the generic self-care measures in the Thai context. To provide baseline information, we conducted the study in a population of patients with non-disease-specific conditions (Bunsuk et al., 2023), concurrently with their caregivers in this report. Subsequently, we extended the study to the population with specific conditions, including stroke (manuscript under revision) and their caregivers (Klinjun et al., 2023).

2.2 | Design

This cross-sectional, multicentre study was collected data between July and November 2022. Our study followed the COSMIN (COnsensus-based Standards for the Selection of Health Measurement INstruments) Reporting Guideline for studies on measurement properties (Gagnier et al., 2021).

2.3 | Participants and settings

The psychometric study focused on primary caregivers of individuals with chronic illnesses. The sample size for psychometric testing can ranges from 150 to 1000, with a minimum of 200 considered fair (Anthoine et al., 2014). Our target was to include up to 400 caregivers, ensuring cross-validation and robust analysis, consistent with the original study (Vellone, Lorini, et al., 2020), and meeting the subject-to-item ratio of 20 (Anthoine et al., 2014).

We employed convenience sampling to enrol family caregivers, such as grandparents, parents, spouses or partners, children or grandchildren and other relatives. The primary caregiver, recognized by the patient as having direct self-care involvement routinely (Antonio-Oriola et al., 2022), was selected. We acknowledge that caregiving is typically carried out by adult family members, demands significant time and effort and provides constant care at home, while patients' self-care requirements may be uncertain shortly after hospital discharge (Antonio-Oriola et al., 2022; Riegel et al., 2009; Vellone et al., 2013). To ensure relevance, we excluded caregivers under 18 years old, with less than 3 months of caregiving experience, during hospitalization, or within 3 months post-hospital discharge. Professional or paid caregivers were also excluded.

Patient sampling involved identifying common chronic illnesses from community-based healthcare centres. These conditions including hypertension, diabetes, heart diseases (heart failure, myocardial infarction, valvular heart disease, cardiac arrhythmia), stroke (ischaemic stroke, haemorrhagic stroke, transient ischaemic attack), chronic respiratory disease (asthma, chronic obstructive pulmonary disease) chronic kidney disease (CKD stage 3–5, dialysis), cancer and others (chronic liver diseases, autoimmune diseases, haemophilia, thalassaemia and systemic lupus erythematosus). Patients were selected from 16 healthcare centres in six provinces of Thailand. Patients with each of the above common chronic conditions were listed; 5–10 individuals were invited to research participants. Each centre contributed approximately 20–30 caregivers, totalling 430 participants who completed the survey package. Notably, 102 stroke caregivers from this study were also included in the separate study focused on stroke caregiving (Klinjun et al., 2023). Test–retest reliability involved 60 caregivers from four centres, all included in the total sample analysis.

2.4 | Measurements

2.4.1 | Translation of instruments

The correspondence author received permission from the developer (B. Riegel) to translate the English version of CC-SC-CII-v2 and its CSE-CSC segment into Thai. Our research group followed the ISPOR Task Force for Translation and Cultural Adaptation Process for Patient-Reported Outcome Measure (Wild et al., 2005) in a multi-step approach. The final Thai instruments, approved by the developer, were made available online (https://self-care-measures.com). A detailed step-by-step approach is available in the Supporting Information (Appendix A1) and previously reported (Klinjun et al., 2023). Briefly, the process involved seven expert panels, comprising two forward translators, two back translators, two synthesizers and one Thai–English comparator. A pilot test was not conducted, but the cognitive debriefing was integrated to ensure face validity and practicality for the target sample (Wild et al., 2005).

Nine independent committee members, unrelated to the translation processes, evaluated translational validity based on four content validity criteria: relevance, clarity, simplicity and ambiguity, using scores from 1 to 4 (Yaghmaie, 2003). Item-level content validity index (I-CVI) was determined with kappa coefficients (Polit et al., 2007). Item values of I-CVI of 0.78 or higher, agreed upon by three or more experts, indicated good content validity (Polit et al., 2007). All items had kappa values of 1.00, except three items with 0.89. Scale-level content validity index (S-CVI) averages for each scale and entire CC-SC-CII-v2 were 0.99. The Thai CSE-CSC demonstrated kappa coefficients of 1.00 for both I-CVI and S-CVI.

2.4.2 | CC-SC-CII-v2

The 19-item SC-CII-v2 categorized into three scales: CC-SC Maintenance (items 1–7), CC-SC Monitoring (items 8–12) and CC-SC Management (items 13–19) scales. All items use a 5-point ordinal response scale (Vellone, Lorini, et al., 2020). For CC-SC Maintenance and CC-SC Monitoring, respondents rate how often they recommend specific actions, ranging from never to always. CC-SC Management assesses the likelihood of using strategies when the cared-for person has symptoms, with responses from not likely to very likely. Two items in CC-SC Management include a 0 option (item 13 'The person I care for had a symptom, but I did not recognize it as a symptom of his/her health condition'; item 19 'I did not do anything'). Higher scores across scales and the overall CC-SC-CII-v2 indicate better self-care contribution. The score can be interpreted similarly to the patient version of self-care instrument (Riegel et al., 2018). In this interpretation, item scores ≥ 4.00 or the scale's standardized scores ≥ 70 indicate adequate CC-SC.

2.4.3 | CES-CSC scale

The 10-item CSE-CSC is a self-rating form using 5-point ordinal scales, gauging caregivers' confidence in self-care contribution (De Maria et al., 2021). Response options include not confident, somewhat confident, moderately confident, confident and very confident. Higher CSE-CSC scores signify better self-efficacy in self-care contribution (De Maria et al., 2021). Anticipated is a positive correlation between CSE-CSC scores and scales, dimensions and overall CC-SC-CII-v2.

2.4.4 | Characteristics of the caregivers and CRs

The caregivers were asked to complete a structured questionnaire regarding their sociodemographic data, as well as data on the CRs (e.g. age, gender, education, household income) and caregiving situation (e.g. duration of caregiving, secondary caregiver). They also provided information about the illness characteristics of their CRs, including the type of chronic disease and any other chronic conditions (e.g. dyslipidaemia, visual problems). All chronic diseases and other chronic conditions were counted and classified as total chronic comorbidities.

2.5 | Data collection

The director of each healthcare centre complied lists of eligible patients and contacted them to identify their primary caregivers. Invitations were extended to these caregivers, providing study details. Trained research-assistant nurses at each setting collected data, all 16 of whom having been instructed by the principal investigator following research protocols. Prior to data collection, caregivers were informed and consented to participate. The data collection, conducted through face-to-face interactions using a paper-and-pencil survey package, took place either at the healthcare centre or the participant's home. Typically, participants completed all forms within 30–45 min. For test–retest reliability, caregivers were asked to complete the CC-SC-CII-v2 twice, with a 10–14 days' interval.

2.6 | Ethical considerations

Approval was obtained from the Ethics Board Committee of Walailak University (approval no. WUEC-22-168-01) prior to the data collection. This study adhered to the standards outlined in the Declaration of Helsinki. All the participants provided informed consent. The analysed data were anonymized and treated as strictly confidential.

2.7 | Data analysis

Data analysis utilized SPSS IBM 28.0 and AMOS 24.0. Descriptive statistics, including means and standard deviations ($M \pm SD$) or median and interquartile range (*IQR*), were initial generated for participant characteristics and item descriptions. Assumptions regarding data normality were examined, and a Mahalanobis distance test (Tabachnick & Fidell, 2013) suggested excluding 13 outliers from the initial 430 samples, remaining 417 for analysis. Among these, 78% ($n = 327$) reported that their CRs experienced symptoms. Several items (4, 5, 6, 9, 10, 11, 13, 17, 18 and 19) displayed skewness or kurtosis values exceeding ±1.00, indicating a non-normally distributed data (Vellone, Lorini, et al., 2020). Also, the Kolmogorov–Smirnov results indicated a significant departure from normality for all items.

Structural validity was tested through confirmatory factor analysis (CFA), adhering to the two-factor CC-SC Maintenance, one-factor CC-SC Monitoring and two-factor CC-SC Management established by the original models (Vellone, Lorini, et al., 2020). A second-order factor was conducted for scales with multidimensional structures, while a first-order factor was used for unidimensional structures (Vellone, Lorini, et al., 2020). Robust maximum likelihood estimation was used due to the violation of the multivariate normality assumption, with bootstrapping as an approach method (Novara et al., 2019). Factor loadings were evaluated, with ≥|0.30|considered minimally acceptable, ≥|0.40|adequate and ≥|0.70|highly commendable (Tabachnick & Fidell, 2013). We employed comparative fit index (CFI), Tucker and Lewis index (TLI), root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR) to confirm model fit (Meade et al., 2008). Adequacy was assessed against minimum criteria of CFI ≥ 0.90, TLI ≥ 0.90, RMSEA ≤ 0.08 and SRMR ≤ 0.08 (Hu & Bentler, 1999; Vellone, Lorini, et al., 2020). Specifically, CFI and TLI values >0.95 indicating good fit (Hu & Bentler, 1999). RMSEA values ≤0.05 denote a well-fitting model, 0.05–0.08 suggest moderate fit, and ≥0.10 signify poor fit (Hu & Bentler, 1999). RMSEA with 90% confidence intervals (lower bound ≤0.05, upper bound ≤0.08) establishes a good fit (MacCallum et al., 1996). Close-fit tests examined the probability of low approximation error, with insignificant $p > 0.05$ indicating a good fit. Due to the chi-square likelihood ratio test's sensitivity to sample size, we reported chi-square statistics without interpretation in assessing model fit (Riegel et al., 2018).

A hypothesis test, in line with COSMIN recommendations (Mokkink et al., 2016), was performed to assess concurrent validity. The focus was on examining the associations between scores of CC-SC-CII-v2 and CSE-CSC (Vellone et al., 2019). Positive Pearson's *r* correlation coefficients (Krabbe, 2016) between caregivers' contribution to self-care and their self-efficacy would support concurrent validity.

Internal consistency reliability was assessed after dimensionality testing on the final specified models, as recommended (Vellone, Lorini, et al., 2020). Cronbach's alpha coefficient, suitable for a unidimensional scale (Taber, 2018), and the global reliability index, appropriate for multidimensional scales (Raykov, 2012), were considered. We estimated both the composite reliability (Fornell & Larcker, 1981) and McDonald's omega coefficient (McDonald, 1999) for the multidimensionality scales. Values ≥0.70 were acceptable across all methods (Bagozzi & Yi, 2012). Test–retest reliability was estimated using intraclass correlation coefficients, with values of ≥0.70 considered adequate (Koo & Li, 2016).

3 | RESULTS

3.1 | Participant characteristics

Table 1 details the characteristics of 417 caregivers and their CRs. Caregivers were predominantly middle-aged adults (mean = 48.06, SD = 13.01), women, with completed secondary school education, married, residing in large families and having sufficient income. In the caregiving context, the majority were providing care for adult and older adult, with an average duration of 6 years. The CRs, on average, had two chronic diseases, one other chronic condition and three overall chronic comorbidities.

3.2 | Item descriptive analysis

Table 2 shows descriptive of items. Mean scores for six items (items 1, 7, 8, 14, 16 and 18) were approximately 4.00, while the other nine items (items 2, 4, 5, 6, 9, 10, 11, 12 and 17) had scores above 4.00, indicating adequate self-care contribution behaviours. Items 5 and 13 had the highest and lowest scores, respectively. Two items had a high standard deviation of greater than 1.00 (items 13 and 18).

3.3 | Structural validity

Table 2 presents the factor loadings for each scale and outlines the simultaneous model. Fit indices are reported in Table 3 (models A1–D2), and the structural models are elaborated in Figure 1, along with the Supporting Information (Appendices A2–A5).

3.3.1 | Caregiver Contribution to Self-Care Maintenance scale

CFA for the two-factor model of CC to Health-Promoting Behaviour and CC to Illness-Related Behaviour revealed inadequate fit (model A1). The specified model, allowing residual covariances between items 5 and 6, resulted in a good fit (model A2). All factor loadings (Table 2) were adequate at medium to high (0.64–0.78). Given the high correlation between the two dimensions ($r = 0.97$), we specified the second-order model, yielding consistent fit indices and factor loadings (model A3). However, the standardized estimate of the CC to Health-Promoting Behaviour dimension exceeded 1.00, indicating potential overfit. Therefore, a multidimensional model of CC-SC Maintenance as the second-order factor was partially supported as of the original model (Vellone, Lorini, et al., 2020).

3.3.2 | Caregiver Contribution to Self-Care Monitoring scale

CFA of the one-factor CC-SC Monitoring scale (Vellone, Lorini, et al., 2020) produced almost perfect fit indices (model B). All factor loadings (Table 2) were significant and considered high (0.75–0.82).

3.3.3 | Caregiver Contribution to Self-Care Management scale

CFA for the two-factor model of CC to Autonomous Behaviour and CC to Consulting Behaviour revealed a good fit (model C1). The Thai model, though not allowing for item pairs covariances, displayed clear results. All factor loadings (Table 2) were adequate at medium to high (0.47–0.77). Given the high correlation ($r = 0.79$) between the two dimensions, we specified the second-order model, yielding unchanged fit indices and factor loadings (model C2). However, the standardized error residual estimated for the Autonomous Behaviour dimension exceeded 1.00, indicating potential overfit. Therefore, a second-order model of this scale was partially supported, aligning with the original model (Vellone, Lorini, et al., 2020).

3.3.4 | Simultaneous model of Thai CC-SC-CII-v2

A simultaneous CFA was performed to test the general model, encompassing a total of 19 items and multidimensional scales, without permitting residual covariances. The second-order model revealed acceptable fit indices (model D1). However, allowing residual covariances between two pairs items (items 3 and 15 and 4 and 14) resulted in an improved goodness of fit values (model D2 and Figure 1). All factor loadings were significant and considered medium to high (0.48–0.81). The Thai CC-SC-CII-v2 model was simple and showed that the factors underlying the scales clearly emerged. Also, a multidimensional model of Thai CC-SC-CII-v2 as the second-order factor was supported.

3.4 | Concurrent validity

The concurrent validity of the instrument was established (Table 4). All self-care dimensions ($r = 0.48$–0.62; all $p < 0.001$), scales ($r = 0.53$–0.63; all $p < 0.001$), and overall CC-SC-CII-v2 ($r = 0.64$, $p < 0.001$) were positively correlated with CSE-CSC.

TABLE 1 Characteristics of the caregiver sample and care recipient.

Characteristics	Caregiver ($n = 417$)	Care recipient ($n = 417$)
Sociodemographic characteristics		
Gender		
Women	311 (74.6)	237 (56.8)
Men	106 (25.4)	180 (43.2)
Age, years	48.06 (13.01)	67.23 (13.16)
Adults, age <60 years	341 (81.8)	110 (26.4)
Older adults, age ≥60 years	76 (18.2)	307 (73.6)
Education		
Below primary school graduate	19 (4.7)	58 (13.9)
Primary school graduate	121 (29.0)	249 (59.7)
Secondary or high school graduate	132 (31.7)	67 (16.1)
College-educated or higher	145 (34.6)	43 (10.3)
Marital status		
Single, never married	30 (7.2)	17 (4.1)
Married or partnered	323 (77.5)	288 (69.1)
Divorced, separated or widowed	64 (15.3)	112 (26.8)
Living arrangement		
Alone	11 (2.6)	33 (7.9)
With a couple	111 (26.6)	108 (25.9)
With large family	295 (70.7)	276 (66.2)
Work status		
Not working, or unemployed; no income	22 (5.3)	129 (30.9)
Retired; had pension income	11 (2.6)	14 (3.4)
Working; with irregular income	46 (11.0)	89 (21.3)
Working, or employed; with a regular income	338 (81.1)	185 (44.4)
Household income		
Comfortable; have more than enough to make ends meet	112 (26.9)	99 (23.7)
Sufficient; have enough to make ends meet	215 (51.6)	207 (49.7)
Insufficient; do not have enough to make ends meet	90 (21.5)	111 (26.6)
Caregiving context		
Relation of the caregiver to the care receiver		
Caregiver's grandparent	25 (6.0)	
Caregiver's parent	221 (53.0)	
Caregiver's spouse or partner	129 (30.9)	
Caregiver's children or grandchildren	11 (2.6)	
Caregiver's relative	31 (7.5)	
Duration of caregiving in year (ranging 0.3–30)	6 (3, 10)	
Had secondary caregiver	315 (75.5)	
Number of secondary caregivers (ranging 0–5)	2 (1, 2)	
Illness characteristics of the care recipient		
Total number of chronic diseases (ranging 1–5)	___	2 (1, 3)
Type of chronic diseases		
Hypertension	___	314 (75.3)
Diabetes	___	176 (42.2)
Heart diseases	___	58 (13.9)

(Continues)

TABLE 1 (Continued)

Characteristics	Caregiver ($n = 417$)	Care recipient ($n = 417$)
Stroke	___	102 (24.4)
Chronic kidney disease stage 3–5, or dialysis	___	59 (14.1)
Chronic lung diseases	___	36 (8.6)
Chronic joint problems	___	55 (13.2)
Cancer	___	23 (5.5)
Other	___	26 (6.3)
Total number of other chronic conditions (ranging 0–5)	___	1 (0, 2)
Type of other chronic conditions		
Dyslipidaemia	___	196 (47.0)
Visual problem	___	101 (24.2)
Hearing problem	___	68 (16.3)
Walk difficulty	___	131 (31.4)
Wheelchairs	___	32 (7.7)
Bedridden	___	20 (4.8)
Total number of all chronic comorbidities (ranging 1–10)	___	3 (2, 4)

Note: Data are frequency (%) or mean (±standard deviation) or median (interquartile range).

3.5 | Scale internal consistency reliability and item analysis

CC-SC Maintenance scale ($n = 417$) demonstrated good reliability (composite reliability = 0.85, McDonald's omega = 0.86 and Cronbach's alpha = 0.85). Alpha coefficients remained consistency high (0.82–0.84) even with item deletion, and no item substantially affected the coefficient if deleted. All items presented adequate discrimination, with medium to high item-to-total corrected correlations (0.56–0.69).

CC-SC Monitoring scale ($n = 417$) demonstrated good reliability with Cronbach's alpha of 0.89. Alpha coefficients remained consistency high (0.86–0.88) even with item deletion, and no item substantially affected the coefficient if deleted. All items presented high item-to-total corrected correlations (0.70–0.76).

CC-SC Management scale ($n = 327$) demonstrated good reliability (composite reliability = 0.85, McDonald's omega = 0.83 and Cronbach's alpha = 0.82). Alpha coefficients remained consistency high (0.79–0.83) even with item deletion, and no item substantially affected the coefficient if deleted. All items presented adequate discrimination, with medium to high item-to-total corrected correlations (0.42–0.64).

Simultaneous Thai SC-CII-v2 ($n = 327$) demonstrated excellent reliability (composite reliability = 0.95, McDonald's omega = 0.93 and Cronbach's alpha = 0.93). Alpha coefficients remained consistency high (0.92–0.93) even with item deletion, and no item substantially affected the coefficient if deleted. All items presented adequate discrimination, with medium to high item-to-total corrected correlations (0.45–0.76).

3.6 | Test–retest reliability

The ICCs were 0.84 (95% CI = 0.78–0.89) for CC-SC Maintenance scale, 0.91 (95% CI = 0.88–0.94) for CC-SC Monitoring scale and 0.85 (95% CI = 0.79–0.90) for CC-SC Management scale. Overall, good-to-excellent stability reliability (Koo & Li, 2016) of the Thai CC-SC-CII-v2 was established.

3.7 | Sensitivity analysis

To verify, we re-analysed the data without 102 stroke caregivers ($n = 315$), and the results remained similar (Supporting Information). Participant characteristics, structural validity, concurrent validity and internal consistent reliability all showed comparable findings with the full sample. One potential explanation for the consistent results across this study in the caregiving contexts of non-specific chronic conditions, whether with or without stroke caregivers, and the relevant publication specifically focused on stroke caregivers (Klinjun et al., 2023) could be the robustness of the instrument itself. Notably, the results in both Thai caregiver studies were aligned with those originally reported in the Italian caregivers.

4 | DISCUSSION

The psychometric properties of the Thai CC-SC-CII-v2 were evaluated in this study. Our findings confirm its validity and reliability for assessing the contribution of Thai caregivers to the self-care of individuals

TABLE 2 Descriptive statistics of the Thai CC-SC-CII-v2 items, item-total corrected correlation, and factor loadings of each Thai CC-SC-CII-v2 scale.

	M ± *SD*	Skewness	Kurtosis	ITC	Loadings
CC-SC Maintenance scale (*n* = 417)					
During the last month, how often did you recommend the person you care for the following behaviours? Or, how often did you do these activities because the person you care for is not able to do them?					
CC to Health-Promoting Behaviour dimension					
1. Make sure to get enough sleep	3.99 ± 0.87	−0.83	0.66	0.60	0.68
3. Exert energy on daily activities or exercise (e.g. take a brisk walk, use the stairs, do housework, labour, gardening, sport, physical rehabilitation)	3.79 ± 0.98	−0.64	−0.05	0.56	0.64
7. Mindful relaxation, being aware of stress or overthinking (e.g. meditation, yoga, music, recreational activities, doing good things, praying, religious ceremony, consulting others, accepting things as they are)	3.90 ± 0.91	−0.63	0.13	0.58	0.65
CC to Illness-Related Behaviour dimension					
2. Try to avoid getting sick (e.g. get vaccinated, wash your hands, wear a mask, maintain distance from sick people, practise social distancing)	4.19 ± 0.79	−0.70	−0.14	0.64	0.71
4. Eat healthy foods, disease-specific diet or avoid certain foods (e.g. vegetables, fruits, sugar and eating low salt and low-fat food)	4.13 ± 0.86	−1.08	1.43	0.68	0.78
5. Keep appointments for routine or regular healthcare	4.53 ± 0.78	−1.95	4.19	0.58	0.60
6. Take prescribed medicines without missing a dose and follow time schedules (for oral, injection, inhaler, or external usage)	4.44 ± 0.86	−2.02	4.73	0.69	0.70
CC-SC Monitoring scale (*n* = 417)					
How often do you recommend to the person you care for to do the following things? Or, do the following things because the person you care for is not able to do them.					
8. Monitor whether physical, emotional or cognitive conditions are out of the ordinary	4.05 ± 0.80	−0.65	0.39	0.70	0.79
9. Monitor for medication side effects (all of the oral, injection, inhaler or external used)	4.14 ± 0.88	−1.16	1.68	0.76	0.81
10. Pay attention to changes in how the person you care for feels about physical, emotional and cognitive conditions	4.26 ± 0.81	−1.10	1.35	0.67	0.81
11. Monitor whether the person you care for tires more than usual doing normal activities	4.19 ± 0.76	−0.92	1.21	0.65	0.75
12. Monitor for symptoms of the person you care for	4.30 ± 0.71	−0.82	0.71	0.70	0.82
CC-SC Management scale (*n* = 327)					
CC to Autonomous Behaviour dimension					
13. The last time the person you care for had symptoms. How quickly did you recognize them as symptoms related to the illness, complication as well as treatment side effects your person suffers from?	3.09 ± 1.07	−0.65	1.36	0.45	0.47
When the person you care for has symptoms, how likely are you to recommend performing the following behaviours (or you perform these behaviours if the person you care for is unable to do so?)					
14. Change what the person you care for eats or drinks to make the symptom decrease or go away (e.g. reduced salt, restricted fluid)	4.00 ± 0.87	−0.81	0.62	0.70	0.75
15. Recommended the person you care for to change the activity level or do appropriate activities with condition (e.g. slow down, rest)	3.83 ± 0.86	−0.59	0.25	0.63	0.72

(Continues)

TABLE 2 (Continued)

	M ± *SD*	Skewness	Kurtosis	ITC	Loadings
16. Recommend the person you care for to take medicine to make the symptom decrease or go away	3.91 ± 0.99	−0.84	0.36	0.51	0.65
19. Think of a treatment you used the last time the person you care for had symptoms. Did the treatment you used to make the person you care for better or symptom relief?	3.61 ± 0.77	−0.66	2.46	0.50	0.57
CC to Consulting Behaviour dimension					
17. Talk about the symptom to the doctor/nurse of the person you care for at the next office visit	4.27 ± 0.88	−1.40	2.10	0.63	0.77
18. Contact the healthcare provider for guidance (e.g. call, message, emergency visit if needed)	4.01 ± 1.08	−1.12	0.75	0.57	0.75

Abbreviations: CC-SC, Caregiver Contribution to Self-Care; ITC, corrected item to total correlation; M, mean; SD, standard deviation.

with chronic illnesses. The instrument demonstrated its applicability in the caregiver of CR with non-specific conditions, similar to the stroke caregivers (Klinjun et al., 2023). These findings are consistent with the original results (Vellone, Lorini, et al., 2020), reflecting the generalizability of the instrument across diverse illness conditions and contexts.

This theoretically derived instrument, tested in Thai context, closely aligns with the original Italian model (Vellone, Lorini, et al., 2020). It maintains a fundamental structure, featuring two scales with two dimensions each (CC-SC Maintenance and CC-SC Management) employing partially second-order factor and one scale with a single dimension (CC-SC Monitoring). Additionally, the simultaneous CC-SC-CII-v2 exhibits a multi-structure in accordance with the originally proposed second-order model (Vellone, Lorini, et al., 2020). Overall, the Thai CC-SC Maintenance, CC-SC Monitoring and CC-SC Management models closely resemble the original models. Interestingly, variations in concurrent behaviours were observed among Thai, Italian (Vellone, Lorini, et al., 2020) and Chinese (Chen et al., 2021) caregivers. Notably, the Thai models seem simplified compared to the original models, and all three scales exhibit good reliability.

In the Thai CC-SC Maintenance model, a partially second-order structure emerged, featuring CC to Health-Promoting Behaviour and CC to Illness-Related Behaviour dimensions. The factor loadings aligned moderately with the original model (Vellone, Lorini, et al., 2020). In contrast, the Chinese model showed different item allocation to the dimensions (Chen et al., 2021). Despite these variations, improved fit indices were observed in all CC-SC Maintenance models when considering item correlations. However, the Thai model exhibited dissimilar correlation matrices, with the highest residual covariances between routine healthcare visits (item 5) and prescribed medicines (item 6), differing from previous models that considered physical activity (item 3) and adherence to a special diet (item 4) (Chen et al., 2021; Vellone, Lorini, et al., 2020). Overall, the theoretical construct of the CC-SC Maintenance fits well with Thai caregivers, reflecting diverse self-care contribution behaviours in a cultural context.

The Thai CC-SC Monitoring model exhibited an almost perfect fit with high factor loadings (Tabachnick & Fidell, 2013), comparable to the original model (Vellone, Lorini, et al., 2020). Notably, it presented a simpler and more satisfactory structure, deviating from previous models that required different approaches for residual covariances (Chen et al., 2021; Vellone, Lorini, et al., 2020). Despite these distinctions, the theoretically foundation of the Thai CC-SC Monitoring scale showed similarities with previous studies while reflecting cultural variations (Chen et al., 2021; Vellone, Lorini, et al., 2020). This simplified model captures caregivers engaging in five straightforward behaviours to observe worsening conditions in their CRs' physical, emotional and cognitive states.

The CC-SC Management model fits well in the Thai context, displaying a partially second-order structure with dimensions of CC to Autonomous Behaviour and CC to Consulting Behaviour, featuring moderate to high factor loadings, likewise the original model (Vellone, Lorini, et al., 2020). However, the Thai model is satisfactory without requiring additional specifications. In contrast, the original model (Vellone, Lorini, et al., 2020) achieved a good fit with correlations established within two item pairs. These pairs included the caregivers role in recognizing symptoms (item 13) and consequence of symptom management (item 19) and changing diet or drinks (item 14) and adjusting activity level (item 15). The Thai CC-SC Management model is succinctly represented by five items of Autonomous Behaviour and two items of Consulting Behaviour. It captures cultural variations in self-management and healthcare-seeking behaviours while also reflecting universal aspects of caregiver contribution to self-care management.

We also assessed the comprehensive model of the Thai CC-SC-CII-v2, incorporating all three scales. The theoretical retained analogous item allocation, maintaining the original model's scales and dimensions (Vellone, Lorini, et al., 2020). Evaluated through second-order structure, the general model demonstrated a satisfactory fit, enhancing caregiver contributions to maintenance, monitoring and management behaviours. The model comprised five constructs, covering two dimensions of the CC-SC Maintenance scale (Health-Promoting Behaviour and Illness-Related Behaviour), one dimension of the CC-SC Monitoring scale and two dimensions of the CC-SC Management scale (Autonomous Behaviour and Consulting Behaviour), mirroring the structure of the original model (Vellone, Lorini, et al., 2020). Cultural distinctions emerged, with variations in correlated CC-SC behaviours between the Thai and the original models,

TABLE 3 Fit index values for the Thai CC-SC-CII-v2 in caregivers of patients with chronic illnesses.

		χ2 test goodness of fit									
Thai SC-CII-v2	Model	χ2	df	p	CMIN/df	CFI	TLI	RMSEA	90% CI	p	SRMR
CC-SC Maintenance (n = 417)	Model A1. Unspecified first-order model	136.47	13	<0.001	10.49	0.89	0.83	0.15	0.12–0.17	<0.001	0.04
	Model A2. Final specified first-order model	40.59	12	<0.001	3.38	0.97	0.97	0.07	0.05–0.10	0.045	0.02
	Model A3. Final specified second-order model	40.59	12	<0.001	3.38	0.97	0.97	0.07	0.05–0.10	0.045	0.02
CC-SC Monitoring (n = 417)	Model B. Final unspecified model	14.49	5	0.013	2.89	0.99	0.98	0.06	0.02–0.10	0.199	0.01
CC-SC Management (n = 327)	Model C1. Final unspecified first-order model	41.50	13	0.001	3.19	0.96	0.94	0.07	0.04–0.09	0.060	0.03
	Model C2. Final specified second-order model	41.50	13	0.001	3.19	0.96	0.94	0.07	0.04–0.09	0.060	0.03
CC-SC-CII-v2 (n = 327)	Model D1. Unspecified second-order model	518.86	149	<0.001	3.48	0.91	0.89	0.07	0.07–0.08	<0.001	0.04
	Model D2. Final specified second-order model	455.34	150	<0.001	3.03	0.92	0.91	0.07	0.06–0.07	<0.001	0.04

Abbreviations: CC-SC-CII-v2, Caregiver Contribution to Self-Care of Chronic Illness Inventory version 2; CFI, comparative fit index; CI, confidence interval; CMIN/df, the minimum discrepancy per degree of freedom; RMSEA, root mean square error of approximation; SRMR, standardized root means square residual; TLI, Tucker–Lewis index.

particularly within-scale correlated items. The Thai model clarified associations between caregiver involvement in physical activities (item 3) and adjustments in activity level (item 15), as well as routine dietary care (item 4) and changes in diet or drinks (item 14). These findings extend the theoretical link between caregiver behaviours in self-care maintenance and self-care management (Vellone et al., 2019). The original model fit well when considering simultaneous behaviours of the CC-SC Maintenance scale related to physical activity (item 3) and diet (item 4), within the CC-SC Monitoring scale related to monitoring the condition (item 8) and paying attention to changes (item 9) and within the CC-SC Management scale related to recognizing symptoms (item 13) and the consequence of symptom management (item 19), as well as changing diet or drinks (item 14) and adjusting activity level (item 15). In summary, the general Thai CC-SC-CII model demonstrated good structural validity, supported by a theoretical construct. Compared to the original model, the Thai model was characterized as less complex, reflecting both commonalities and differences in CC-SC across diverse cultures.

The concurrent validity of the Thai CC-SC-CII-v2 has been established. As hypothesized, all three scales, along with the four dimensions and overall CC-SC-CII-v2, showed positive and significant correlations with CSE-CSC. Our findings confirmed the theoretical proposition that caregiver self-efficacy is linked to caregivers' contribution to patient's self-care (Vellone, Lorini, et al., 2020). Our findings supported the theoretical proposition and previous findings (Vellone et al., 2019; Wilson et al., 2022) that caregivers who engaged in better self-care contributions were associated with better self-efficacy, and vice versa.

As in the original study (Vellone, Lorini, et al., 2020), the methods employed for internal consistency reliability in this study were based on the characterized structure of the scales. These methods demonstrated satisfactory reliability for all three scales, irrespective of the hierarchical measurement models and statistical methods approached. Moreover, this study extended the state of knowledge by establishing that all three scales exhibited good-to-excellent test–retest reliability. Overall, our study provides further confirmation and broadening of the reliability of this instrument in diverse contexts, including Thailand.

Overall, this study demonstrated that the CC-SC-CII-v2 is valid and reliable in Thai context, indicating that it can be used effectively in different cultures.

4.1 | Implication for practice

The CC-SC-CII-v2 is acknowledge as a valid and reliable instrument for assessing CC-SC in patients with multiple chronic conditions. It allows flexible in assessment of CC-SC, enabling clinicians to evaluate item by

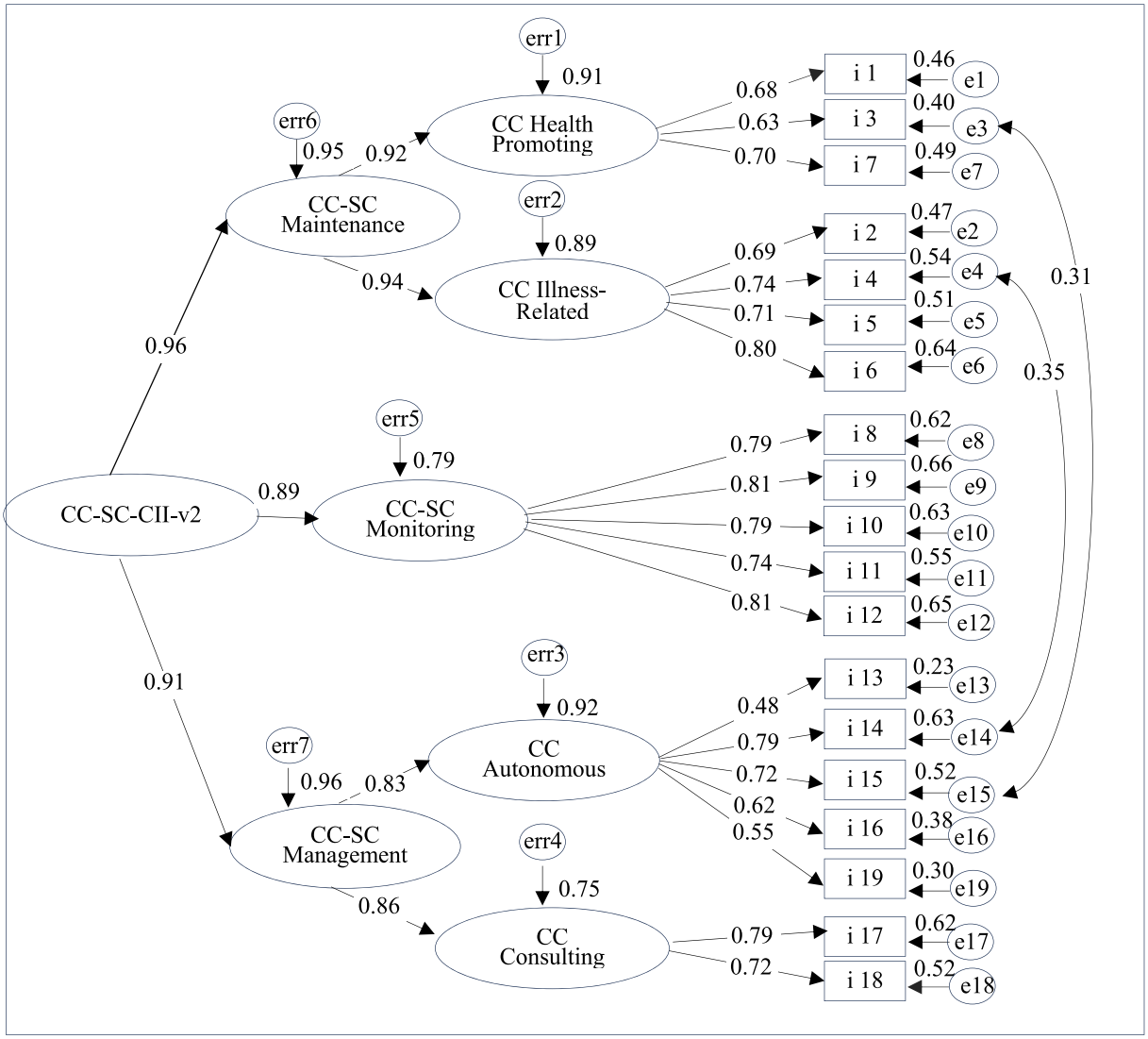

FIGURE 1 A second-order factor analysis of the final simultaneous model of Thai Caregiver Contribution to Self-Care of Chronic Illness Inventory version 2. CC, caregiver contribution; i, item numbers 1–19.

TABLE 4 Pearson's correlation coefficients for assessing the concurrent validity of the Thai CC-SC-CII-v2.

Thai CC-SC-CII-v2	CSE-CSC	*p*
CC-SC Maintenance scale ($n = 417$)	0.55	<0.001
CC to Health-Promoting Behaviour dimension	0.53	<0.001
CC to Illness-Related Behaviour dimension	0.49	<0.001
CC-SC Monitoring scale ($n = 417$)	0.53	<0.001
CC-SC management scale ($n = 327$)	0.63	<0.001
CC to Autonomous Behaviour dimension	0.62	<0.001
CC to Consulting Behaviour dimension	0.48	<0.001
Overall CC-SC-CII-v2 ($n = 327$)	0.64	<0.001

Abbreviations: CC-SC, Caregiver Contribution to Self-Care; CC-SC-CII-v2, Caregiver Contribution to Self-Care of Chronic Illness Inventory version 2; CSE-CSC, Caregiver Self-Efficacy in Contributing to Patient Self-Care.

item, scale by scale or comprehensively based on caregiver and patient needs. Addressing varying self-care requirements in different illness stages, CC-SC should focus on health-promoting behaviours, illness management regimens, symptom monitoring, symptom management strategies and modes of self-care contribution (Vellone, Lorini, et al., 2020). Tailoring information for caregivers based on their experience is emphasized, with newly diagnosed patients and caregivers needing detailed guidance, while experienced caregivers benefit from advanced strategies to reinforce long-term contribution. Emphasizing quick response and symptom recognition is vital, given our finding that this behaviour scored the lowest. Clarifying specific symptoms, medication side effects and treatment complications heightens awareness of potential changes in CRs' conditions. Ongoing support and follow-up are emphasized to help caregivers maintain long-term self-care contributions, including regular checking and strategies to bolster self-efficacy.

4.2 | Implication for research

The initial caregiver contribution to the self-care instrument, developed and tested in heart failure caregivers, was later extended to a non-disease-specific measure, the generic CC-SC-CII-v2. This version underscores the caregiver's role in promoting self-care across various chronic conditions. Future research could explore its applicability in specific diseases such as heart disease, chronic respiratory diseases, chronic kidney disease and cancer. This approach would address the limitations linked to the relatively small sample sizes of caregivers for these conditions in both previous and current studies. Comparing CC-SC using unique measures like CC-SC-CII-v2 across different chronic conditions could provide insights into caregiving antecedences, processes and outcomes. We suggest international collaborative research across Asian countries or the southeast region, sharing socio-cultural relevance in self-care despite different languages.

4.3 | Strengths and limitations

This study exhibits notable strengths. Firstly, participants closely mirror the general characteristics of the Thai population with chronic illnesses (United Nations Thailand, WHO, 2021) and caregiver characteristics offering a robust foundation for comparison with the original study (Vellone, Lorini, et al., 2020). The extension of knowledge to caregivers of older adults with multiple chronic conditions and community-dwelling patients is emphasized, addressing a gap left by the original study that primarily focused on parent caregivers and hospitalized children (Vellone, Lorini, et al., 2020). Secondly, the psychometric testing is robust, employing a moderate sample size and recruiting from multi-settings, effectively reducing selection bias through cross-validated samples. Additionally, the cultural equivalence of Thai CC-SC-CII-v2 is underscore, encompassing translational validity, structural validity and internal consistent reliability. Lastly, the study enhances existing knowledge by providing insights into the test–retest reliability of the instrument.

Acknowledged limitations include unequal recruitment across different chronic diseases, potentially affecting generalizability. The study encourages future testing with a more equitable representation of heart disease, stroke, chronic lung disease, chronic kidney disease, cancer and chronic joint problems. Due to the unavailability of instruments in Thai context, this study was unable to conduct hypothesis testing for the CC-SC-v2 with health outcomes. The lack of a pilot test could limit understanding of feasibility and appropriateness for the target population.

5 | CONCLUSION

The Thai CC-SC-CII-v2 demonstrated robust psychometric properties and maintained faithfully to the theoretical structure of the original scale. Our study extended the existing knowledge by evaluating the psychometric properties of the CC-SC-CII-v2, thereby facilitating future research on caregiving within Thai context. To ensure generalizability, it is recommended that forthcoming studies include caregiver samples with comparable numbers and types of chronic conditions, explore cross-country comparisons or encompass various Asian countries.

AUTHORSHIP STATEMENT

Wanna Kumanchan: Conceptualization; methodology; validation; investigation; data curation; funding acquisition; writing—original draft; writing—review editing. **Jom Suwanno**: Conceptualization; methodology; validation; formal analysis; investigation; data curation; funding acquisition; writing—original draft; writing—review editing; supervision; project administration. **Naruebeth Koson:** Conceptualization; methodology; validation; investigation; funding acquisition; writing—review editing. **Chonchanok Bunsuk**: Conceptualization; methodology; validation; investigation; writing—review editing. **Nuntaporn Klinjun**: Conceptualization; methodology; validation; investigation; writing—review editing. **Kannika Srisomthrong:** Conceptualization; methodology; validation; investigation; writing—review and editing. **Chennet Phonphet:** Conceptualization; methodology; validation; investigation; writing—review and editing. **Chidchanog Mayurapak:** Conceptualization; methodology; validation; investigation; writing—review and editing. **Chutiporn Dansuwan:** Conceptualization; methodology; validation; investigation; writing—review and editing. **Juk Suwanno:** Conceptualization; methodology; validation; investigation; writing—review and editing. **Punnaphat Chramnanpho:** Conceptualization; methodology; validation; investigation; writing—review and editing. **Umaporn Kamlungdee:** Conceptualization; methodology; validation; investigation; writing—review and editing. **Wichai Arab:** Conceptualization; methodology; validation; investigation; writing—review and editing. **Putrada Ninla-aesong:** Conceptualization; methodology; validation; writing—review and editing. **Sadee Saithong Hamilton:** Conceptualization; methodology; validation; writing—review and editing. **Ladda Thiamwong:** Conceptualization; methodology; validation; formal analysis; funding acquisition; writing—review and editing; supervision.

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CONFLICT OF INTEREST STATEMENT

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

DATA AVAILABILITY STATEMENT

The datasets used and analysed during the current study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

Approval was obtained from the University Ethics Board Committee of Walailak University (approval no. WUEC-22-168-01) prior to the data collection. This study adhered to the standards outlined in the Declaration of Helsinki. All the participants provided informed consent. The analysed data were anonymized and treated as strictly confidential.

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