An Exploratory Factor Analysis for Developing and Validating a Scale of Long-Term Care Competencies among Care Managers in Long-Term Care System

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Background: Care managers (CMs) play a crucial role in delivering long-term care (LTC) services for dependent older adults in the district health system (DHS). However, there are limitations of the instrument for assessing LTC competency of CMs in the DHS.

Objective: To develop and validate an LTC competency instrument for CMs in the DHS in Thailand.

Materials and Methods: An exploratory mixed methods study was conducted. In the qualitative phase, eight participants took part in in-depth interviews and 26 participants took part in focus group discussions, all of them were stakeholders in LTC. The participants included policymakers, practitioners, and academics covering the national, regional, provincial, and district levels. They were invited to determine the LTC competency of CMs. Data were analyzed by content analysis. Trustworthiness was confirmed by triangulation. From the qualitative data, an item pool of 109 items was developed. In the quantitative phase, the validity and reliability of the instrument were assessed with exploratory factor analysis and internal consistency. The content validity index was examined. A pilot test of 30 CMs confirmed the reliability. The exploratory factor analysis was conducted with 378 CMs, and the internal consistency of Cronbach's alpha and corrected item-to-total correlation was investigated.

Results: The LTC competency instrument comprised of four dimensions with 24 items. The four dimensions included 1) management, 2) caring for dependent older persons, 3) intersectoral collaboration, and 4) resilience. They explained 34.217%, 16.803%, 13.229%, and 9.035% of the total variance, respectively. Therefore, these four dimensions together explained 73.284% of the total variance. All subscales showed a Cronbach's alpha ranging from 0.912 to 0.944, with an overall value of 0.917.

Conclusion: The developed LTC competencies scale for CMs in providing LTC services in the DHS is a valid and reliable instrument and can be applicable as a tool to tailor a training program to promote the LTC competency of CMs.

Keywords: Long-term care competencies; Care manager; Older adult; Long-term Care System; Exploratory mixed methods

With the increasing number of older adults, Thailand has become an ageing society, with 18.31% of the population aged 60 or older in 2022. The ageing population will reach 22.4% in 2026, making Thailand an aged society, and it will reach 30.4% in 2038, making the country a superaged society[1]. This increase in the older population and age-related

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chronic diseases also leads to an increase in the proportion of homebound people who stay at home, are bedridden[2,3], and have various care needs.

The Thai Ministry of Public Health (MOPH) classifies older adults into three groups, namely, active, homebound, and bedridden, based on health status as measured by the Barthel Index of Activities of Daily Living (ADL), which is used to assess patient function based on 10 activities (0 to 20 points). Zero points means the patient cannot perform the function by themselves, and higher points indicate a greater likelihood of being able to live at home with a degree of independence. Following assessment, each patient's score is categorized as bedridden (0 to 4 points), homebound (5 to 11 points), and active or independent (12 to 20 points)[2,4]. The group of independent patients promote health and participation via the older adult club in the community, while the homebound and bedridden patients need more

support for routine activities and other social services care.

The study of Tantirat et al.[5] projected that by 2030, the number of older adults in the active, homebound, and bedridden groups will be 15,593,054, 321,511, and 152,749, respectively. In addition, the number of older adults living in rural areas will be 7,156,700 or 27% of the projected rural population. Of this, 20.3% will be homebound, 1.1% will be bedridden, and 1.6% will need rehabilitation[4]. Older people are mostly provided care by their life partners, family members, and relatives, but social changes and increased mobility due to economic reasons for working in urban areas often result in older adults living alone. A 2020 report found that out of 21.9 million households, there were 1.3 million households (6%), with older adults living alone and another 1.4 million households (6.2%), with older adults living together without people of other ages living in the house. This means that more than 12% of older adults live alone[6]. Older adults living alone, compared to those not living alone, have significantly low socioeconomic conditions and a high level of unmet needs[7].

Long-term care (LTC) refers to the health, social, and residential services provided to people with disabilities or chronic care needs. The need for LTC services is determined by the incidence of chronic disease and disability. Older persons have a substantial risk of both chronic disease and disability and are thus the primary recipients of LTC[8]. This is true in Thailand, where most of the people who need LTC are senior citizens. In 2016, the Thai government implemented a LTC policy to support independent older persons in their homes with a focus on community-based and home care services. Institutionalized care or private/public ageing homes are not yet popular. Thai older adults stay at home and share the same house with their children, who take care of their parents within the concept of generalized reciprocity[9,10]. The National Health Security office (NHSO) is responsible for the community based LTC program for older people and works with the local administrative organization (LAO), which is the key organization responsible for managing the system, with the support of the district health system (DHS). The DHS is a network of services of subdistrict health promotion hospitals, which previously was called health centers, and community hospitals in all districts of the country, serving as a firm basis for achieving universal health coverage[11]. Care managers (CMs) and care givers (CGs) are trained individuals. CMs are specially trained nurses, physiotherapists, or social workers who are trained in a 70-hour period. Srithamrongsawat et al.[12] reported that 95.0% of CMs are nurses, physiotherapists, or public health professionals, while only 5.0% of them are social workers. These individuals assess the eligibility of older persons and prepare a care plan (CP). CPs are developed and then communicated to the CGs to implement and supervise under their responsibility. CGs are non-professionals who live in the community being paid monthly according to the NHSO and The Ministry of Interior guidelines through local administrations.

In addition, CGs are recruited from communities and trained by the multidisciplinary team of the DHS for 70 hours[3,4,13,14]. Older persons who have ADL scores below 11, who are defined as homebound and bedridden persons, are registered to receive community LTC services. LTC services are provided by the family carers of older adults and supplemented by assistance from a paid community CG through a CP that was designed and supervised by a CM[14]. If an older person registered for the LTC fund has a complex health problem, the referral system for any professional service or consultation according to the national guidelines is implemented. This concept is linked to community based LTC due to the services provided at the older adult's home, and the stakeholders of the services include family, trained CGs (people living in community), LAO (social workers), trained CMs (health care providers at the primary care level), and multidisciplinary teams at secondary care and tertiary care institutions.

Community based LTC differs in different countries. The management of LTC in developed countries such as Germany[15], the United States[16], Japan[17], and the Netherlands[18] is financed through a combination of government support and co-payments from beneficiaries, while the LTC system in Thailand is fully funded through public financing schemes and focuses on community-based services because the strength of the social capital of rural communities is capable of supporting care. The different model of LTC practice contributes to the development of LTC services in each context. In Thailand, CMs conduct assessments to determine the eligibility of beneficiaries and identify their care needs. CMs play a critical role in preparing individual care plans through a multidisciplinary team meeting and the development of weekly plans, which are regularly reviewed. They determine the capacity of the team and manage and monitor the

performance of five to ten caregivers per subdistrict health promotion hospital[3,14]. In addition, CMs require the skill and management for communication and monitoring, reimbursement schemes, interaction with other professionals, collaboration with the LAO, and collaboration with community members and family caregivers. Therefore, CMs provide guidance that combines health and social care with multidisciplinary work in the health sector, local sector, and population sector[13,19].

The competency of health professionals is needed in preparing LTC services. Competency refers to a person's capacity to apply or use a set of related knowledge, skills, and abilities to successfully perform critical job functions or tasks. Competencies are the foundation of important human resource management[20]. A previous study indicated the need to investigate that the competence level available in each senior care community is sufficient to meet complex patient needs[21]. There are existing studies relevant to the LTC competencies of physicians, nurses, social workers and mental health professionals, pharmacists, direct care workers[20], community-based nursing staff working with older patients[21], and the competencies of nurses and nurse managers who work in LTC institutions[22,23]. The study of Pagaiya et al.[4] suggested that with the increasing community based LTC services, in the future, appropriate teamwork between the multidisciplinary health team and the CG will need to be prepared. This suggestion is in line with Ikeda-Sonoda et al.[19], who argued that CMs play a crucial role in reducing service fragmentation and increasing the level of communication between the care provider team and the recipients such as older adults, to ensure that the services provided meet their needs. However, there are limitations of the instrument that investigate the competencies of CMs in LTC system in Thailand. The present study aimed to develop and validate a questionnaire to measure LTC competencies among CMs in LTC system. Knowledge about the CM's competence level is necessary to design interventions or programs that aim to improve the LTC competency of CMs to better provide LTC services to older persons according to their health care needs.

Materials and Methods
Study design
Exploratory mixed methods (qual → QUAN)[24] and scale development[25] were applied in two phases aimed at developing and ensuring the validity and reliability of a questionnaire to measure LTC

competencies among CMs in LTC system. The present study was designed to have two phases with nine steps (Figure 1). The exploratory sequential design was characterized by a primary qualitative phase that built into a quantitative phase. Phase 1 consisted of the qualitative approach, which aimed to identify the variables and their definitions related to the LTC competency of CMs in the DHS. Phase 2 conducted the quantitative approach, which aimed to develop and test the psychometric properties of the instrument[26]. In addition, the process of scale development was applied during the quantitative phase[25]. Health region 1 comprises of eight provinces, namely, Chaing Mai, Chaing Rai, Lamphun, Lampang, Phare, Nan, Phayao, and Maehongson, which were purposively selected. This approach was used because in 2020, older adults accounted for 19.87% of the population in the northern regions, which was the highest percentage in the country[1]. The study was approved by the Human Research Ethics Committee. Naresuan University IRB COA No. 657/2019 IRB No. 0763/62.

Phase 1: Qualitative approach to identify the variables and their definitions related to the LTC competency of CMs in LTC system

Step 1. Identify the concept and definition of the competencies of CMs in LTC system

In the qualitative approach, eight volunteers participated in in-depth interviews held with policymakers, nurses, public health practitioners, and academics. For the focus groups, 26 volunteers were divided into four groups, namely CMs, CGs, the LTC fund committee, and the head of the older adult club. The aim was to identify the concepts and definitions of the competencies of CMs in LTC system. The pilot test of the semi-structured interview guideline was conducted, resulting in minor revisions to clarify the questions. Semi-structured interviews were used (Table 1). Data collection was performed until no new issues emerged. To minimize data transcription bias, the authors listened to the interviews three or four times each to ensure that the transcriptions were as accurate as possible[27]. Verbatim transcription was applied. The first author initially coded all the included transcripts, and the second author reviewed them. Each author conducted a more detailed evaluation of the codes in their set and produced a summary of each theme, subtheme, and definition of CM competencies using content analysis. These summaries were reviewed and amended by the research team until a consensus was reached.
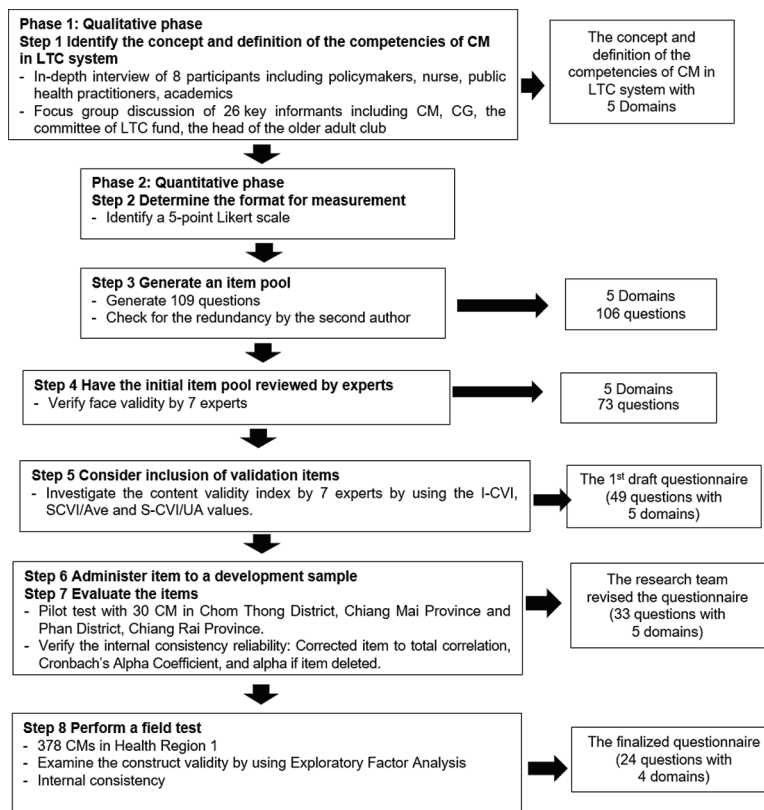
Figure 1. Summary of steps in the development of assessing long-term care competencies among care managers in long-term care system.

Table 1. Semi structure interview guideline

Key questions
1. What is the definition of competency?
2. What is the meaning of long-term care competency?
3. What are the roles and responsibilities of care managers administering the competency of long-term care within the district health system?
4. What is the essential knowledge, skills, and attitudes that are necessary for a care manager in providing long-term care services?
5. What traits (or characteristics) are essential for a care worker in providing long-term care services?
6. What are the factors that motivate care managers to pursue careers in offering long-term care services?
7. What are the appreciations of delivering long-term care services? In your opinion, what are the factors that contribute to your success in this role?
8. Are there any issues or additional matters that you would like to address regarding long-term care services?

Triangulation was carried out using data from in-depth interviews and focus group discussions to gain multiple perspectives and to validate the data[28].

Phase 2: Quantitative approach to develop and test the psychometric properties of the instrument

Step 2. Determine the format for measurement

A five-point Likert scale with all the response categories was designed. A scale with fewer than four categories was too small, and one with more than six was difficult to distinguish[29]. The Likert scale was used as a response scale for each item referring to how they performed the competence for their current job. The researcher defined five responses ranging from 1 as "novice" meaning I have little or no knowledge/ability or no previous experience of the competency described to 5 as "expert" meaning I have high competence in practice, with neutral responses in the middle. A higher score indicates higher overall competence.

Step 3. Generate an item pool

The initial item pool was larger than the final

scale set. As a rule, it could be three to four times larger[25,30], or if the construct was rather narrow, it could be two times larger. Content redundancy was an asset during pool construction because it boosted the internal consistency reliability, which, in turn, supported the validity[25].

Step 4. Have the initial item pool reviewed by experts

For face validity, a panel of experts, including two academic experts, two researchers relevant to instrument development, one policymaker responsible for older adult policy at the Department of Health of the MOPH, and two practitioners involved in providing LTC services in the DHS, examined the initial questionnaire. The experts were asked to review the questionnaire by looking at the items in the questionnaire and agreeing that on its face, the test was a valid measure of the concept being measured[31].

Step 5. Consider the inclusion of validation items

The measurement of content validity was used to ensure that the items in the questionnaire fully represented the domain of attitudes towards the LTC competency of CMs. Seven experts, including two policymakers at the national and provincial levels, two practitioners at the provincial and district levels, two academics, and one local administrator, were invited to rate the constructs of interest. The experts in this step were not the same group as in step 4 to ensure the content validity of the new scale. The experts reviewed all the items for readability, clarity, and comprehensiveness and came to some level of agreement as to which items should be included in the final questionnaire. Each rater used a 4-point rating scale consisting of 1 for not relevant, 2 for somewhat relevant, 3 for quite relevant, and 4 for highly relevant. The item-level content validity index (I-CVI), the average of the I-CVI for each subconstruct, which was referred to as S-CVI/Ave, and a scale-level content validity index obtained through the universal agreement (S-CVI/UA) score were calculated[28,31].

Step 6. Administer item to a development sample and Step 7. Evaluate the items

A pilot test held with 30 CMs in Chom Thong District, Chiang Mai Province, and Phan District, Chiang Rai Province, was conducted. The Cronbach's alpha coefficient was examined to determine the internal consistency of the scale, which indicates how well the items fit together conceptually, with an acceptable value of 0.70 or greater. For item analysis, the corrected item-to-total correlation coefficient, and the value of alpha if the item deleted were analyzed.

The correlation coefficient values of 0.20 or greater were considered satisfactory[25]. In the pilot test, the Cronbach's alpha coefficients for these scales were 0.886 to 0.942, and the item-total correlation was 0.362 to 0.792. Finally, the LTC competency scale of CMs with five dimensions and 33 items was developed.

Step 8. Perform a field test

The field test was conducted to examine the construct validity. Exploratory factor analysis (EFA) was used to simplify a set of complex variables or items using statistical procedures to explore the underlying dimensions that explain the relationships between the multiple items[32]. The questionnaire had 33 items. Comrey and Lee[33] proposed a guide for rating adequate sample sizes as 100 for poor, 200 for fair, 300 for good, 500 for very good, and 1,000 or more for excellent. The ratio of cases per indicator variable was determined to be 15:1, and 495 samples were obtained. Four hundred ninety-five questionnaires were distributed to CMs in health region 1 between August and October 2021. Three hundred seventy-eight CMs completed the questionnaire, thus a response rate of 76.36%. Simple random sampling was used to select CMs from the LTC fund of every district. Permission from the provincial health office, community hospital, district health office, and LAO were obtained prior to data collection. A participant information sheet was given to, and a consent form was obtained from each respondent. Data analysis for construct validity was carried out.

EFA was undertaken to explore the underlying factor structure. In the present study, principal component analysis (PCA) with varimax rotation was used for EFA. Additionally, EFA was performed separately for the main dimensions, with checking communalities and factor loading to confirm as a theoretical construct[32]. The factor loading was the correlation between the item and the factor. A factor loading of more than 0.30 usually indicated a moderate correlation between the item and the factor. The number of factors were determined by evaluating four criteria, eigenvalue greater than 1[34], a percentage of cumulative variance of 60 or more, a scree plot[35], and the interpretability criteria of the same component had corresponding meanings.

Reliability was the degree of consistency of the measurement tool. In the present study, internal consistency reliability was used. Internal consistency meant the extent to which items within an instrument measured the same concept, which could be assessed

with the Cronbach's alpha coefficient and corrected item-total correlation[25].

Statistical analysis

EFA was used to test the psychometric properties. PCA was employed as the extraction method for EFA using SPSS Statistics for Windows, version 17.0 (SPSS Inc., Chicago, IL, USA). The EFA was conducted as follows: assessment of the factorality of the data, factor extraction, factor rotation, and interpretation. The Kaiser Meyer-Olkin (KMO) test was performed, with values ranging between 0.80 and 0.89, which was considered commendable. Bartlett's test of sphericity and total variance explained were used for the evaluation of factor analysis. An orthogonal rotation of the factor axis by the varimax method extraction was used in the EFA. The criteria for item selection from the factor analysis included 1) factor loadings greater than 0.3, 2) the absence of items cross-loaded onto other factors by considering both the highest and second-highest factor loadings, ensuring a difference of less than 0.2 between the two loadings to indicate a substantial correlation within each factor, and 3) all retained items sharing the same conceptual meaning[36,37]. Access to the field was obtained with permission from the provincial health office, community hospital, district health office, and LAO prior to data collection. Written informed consent was obtained from the participants.

Results

Phase 1: Qualitative approach to identify the variables and their definitions related to the LTC competency of CMs in LTC system

Step 1. Identify the concepts and definitions of the competencies of CMs in LTC system

The results of the qualitative approach identified the meanings and domains of LTC competencies for the 20 subdomains of the five CM components (Table 2).

Phase 2: Quantitative approach to develop and test the psychometric properties of the instrument

Step 2. Determine the format for measurement

A 5-point Likert scale ranging from 1 for novice meaning that I have little, or no knowledge/ability or no previous experience of the competency described to 5 for expert meaning that I have high competence in practice, with neutral in the middle, was determined.

Step 3. Generate an item pool

The result from phase one was used to generate the items, and a pool of 109 items with five domains was established. Then, the second author checked for redundancy, after which three items were deleted. A 106-item questionnaire remained to assess the face validity by experts in the next step.

Step 4. Have the initial item pool reviewed by experts

The expert reviewed the initial pool of items

Table 2. The dimensions and sub-dimensions of LTC competencies of CMs in LTC system

Dimensions	Sub-dimensions	
1. Management	1.	Mobilizing resources
	2.	Financial management
	3.	Human resources development
	4.	Data and information and communications technology
2. Caring for the older person	1.	Knowledge and evaluation of older person
	2.	Create individual care plan
	3.	Monitoring care plan
	4.	Evaluation care plan
3. Inter-sectoral collaboration	1.	Communication with other sectors
	2.	Dealing with personal safety
	3.	Problem solving
	4.	Conflict management
	5.	Developing supportive peer relations through supervision
	6.	Relationship with local organization, community, and population
4. Quality improvement for caring older people	1.	Critical thinking
	2.	Creativity
5. Resilience	1.	Understanding things happened with reason
	2.	Adaptability
	3.	Coping
	4.	Recognition and regulation of own emotion

regarding their relevance to the content domain, accuracy, and completeness. The expert reviewers judged the completeness of the content. Such subjective judgement contributes to whether each of the measuring items matches any given conceptual domain of the concept[31]. The review eliminated 33 items. Therefore, 73 items with five domains remained.

Step 5. Consider the inclusion of validation items

Findings regarding the content validity index were confirmed. The I-CVI range was 0.86 to 1.00, the S-CVI/Ave was 0.95 and the S-CVI/UA was 0.81, which were acceptable. The first draft of the questionnaire contained 49 questions with five domains.

Step 6. Administer item to a development sample and Step 7. Evaluate the items

In the pilot test, the Cronbach's alpha coefficients for these scales ranged from 0.886 to 0.942, and the item-total correlation ranged from 0.362 to 0.792. The LTC competency scale of CMs with five dimensions and 33 items was developed.

Step 8. Perform a field test

Of the sample of 378 respondents, 90.21% were female. The respondents were aged 23 to 60 years, with a mean of 42.12 (SD 8.803). Within the group, 46.03% were registered nurses at a professional level, and 36.77% had a maximum period of work of 10 years or less, with a mean of 14.96 (SD 8.884), and a range of 6 to 45 years. The length of working experience of the CMs ranged from three to six years, with an average of 3.73 years (SD 1.783). Most of them (87.34%) had graduated with a bachelor's degree in nursing.

The results of investigating the construct validity found that r was equal or greater than +0.30, chi-square was equal or smaller than 0.001 and KMO was 0.890 (p<0.05). Furthermore, Bartlett's test confirmed that EFA was appropriate (χ^2=10,382.56, df=351, and p<0.001), and the results of the factor extraction analysis showed that the four dimensions of management, caring for dependent older persons, intersectoral collaboration, and resilience explained 34.217%, 16.803%, 13.229%, and 9.035% of total variance, respectively. Together, these four dimensions explained 73.284% of the total variance (Figure 2). The domain, consistent with the theoretical hypotheses, included four domains with 24 items.

The internal consistency and Cronbach's alpha coefficient of the whole scale was 0.917, with each

Rotated Component Matrix[a]

items	Dimension			
	Management (MA)	Caring for the older person (CA)	Intersectoral collaboration (CO)	Resilience (RE)
RE5: Be able …	.194	.053	.093	.852
RE4: Build …	.324	.084	.091	.808
RE3: Establish …	.279	.055	.101	.802
RE2: Develop …	.171	.103	.156	.790
RE1: Design …	.122	.015	.108	.819
CO5: Develop …	.126	.116	.884	.085
CO4: Collaborate …	.149	.128	.837	.088
CO3: Empower …	.153	.087	.891	.125
CO2: Care …	.131	.122	.885	.121
CO1: Communicate …	.141	.082	.873	.138
CA6: Create …	.027	.911	.046	.086
CA5: Evaluate …	.025	.924	.025	.092
CA4: Resolve …	.081	.696	.256	.015
CA3: Supervise …	.037	.887	.069	.045
CA2: Provide …	.076	.868	.043	.055
CA1: Create …	.145	.795	.127	.029
MA8. Adopt …	.787	.072	.145	.291
MA7. Choose …	.818	.105	.131	.295
MA6. Encourage …	.830	.078	.090	.150
MA5. Manage …	.591	-.013	.097	-.047
MA4. Assess …	.885	.091	.114	.199
MA3. Prepare …	.867	.065	.073	.191
MA2. Create …	.857	.077	.127	.195
MA1. Organizing …	.783	.067	.097	.213

Extraction Method: Principal Component Analysis.

a. Rotation converged in 5 iterations.

Figure 2. Factor loading of items in each dimension

dimension ranging between 0.912 and 0.944. The item-total correlation with each dimension ranged between 0.385 and 0.706 (Table 3).

Discussion

The findings showed that the LTC competency scale of CMs in LTC system is valid and reliable for measuring LTC competency. This instrument is the first attempt to develop an instrument to measure LTC competency that is community based and uses mixed methods. Several instruments have been developed for health professionals, according to the literature review[20], namely, gerontological nursing in China by a two-phase need analysis and a two-round Delphi study[38], nurses in LTC institutions for older persons in Thailand by the Delphi technique[39], and relevant professionals in Korea by a scoping review and the Delphi method[40]. Due to the specific context of LTC funds in Thailand that work with interprofessional such as nurses, physiotherapists, public health practitioners, and social workers who work together in community based LTC, a qualitative approach to understanding their competencies is required to provide an in-depth understanding of both the operational situation and the contextual situations of the LTC competency of CMs in the DHS. An explanatory sequential mixed methods design started with a phase that focused on qualitative methods, and then the data were connected to quantitative methods in phase two[41]. This methodology is in line with the study regarding the development of the clinical nurse specialist core competencies scale and the behavioral and psychological symptoms of dementia competency scale for care teams at long-term geriatric care facilities[42] and the ability of caregivers to recognize behavioral and psychological symptoms of dementia in long-term geriatric care facilities[43]. The complex nature of community based LTC tool was designed by an exploratory mixed methods design, which led to the cultural adaptation of the questionnaire.

The results of the KMO measure of sampling adequacy showed an appropriate level of inter-correlation for the 24 items to explore the underlying structure. The PCA revealed a 4-dimensional structure, reducing the domains from 5 to 4 and the items from 30 to 24. In addition, the Cronbach's alpha ranged between 0.912 and 0.944, with an overall scale of 0.917, and the item-total correlation with each dimension ranged between 0.385 and 0.706, leading to reliable measurement of LTC competency. Cronbach's alpha was consistent with Nunnally[44] who suggested that reliability coefficients of 0.9 to 0.95 should be used for applied research, and George and Mallery[45] indicated that Cronbach's alpha of 0.9 or better was excellent. The construct validity and reliability values were also considered acceptable.

Table 3. Cronbach's alpha coefficient after the exploratory factor analysis for the LTC competency of CM in DHS

Dimension	Number of items	Cronbach's alpha coefficient	Range of item-total correlation
1. Management	8	0.932	0.390 to 0.887
1.1 Mobilizing resources	3		
1.2 Financial management	2		
1.3 Human resources development	1		
1.4 Data and information and communications technology	2		
2. Caring for the dependent older person	6	0.930	0.648 to 0.899
2.1 Create individual care plan	1		
2.2 Monitoring and conflict management	3		
2.3 Evaluation care plan	1		
2.4 Creativity services	1		
3. Intersectoral collaboration	5	0.944	0.811 to 0.875
3.1 Communication with other sectors	1		
3.2 Team empowerment	2		
3.3 Coordination with the team	1		
3.4 Building relationships with collaborative support	1		
4. Resilience	5	0.912	0.733 to 0.831
4.1 Adaptability	1		
4.2 Coping	4		
Overall scale	24	0.917	0.385 to 0.706

The first dimension, management, contains eight items, with a Cronbach's alpha of 0.932 and a corrected item-to-total correlation value ranging between 0.390 and 0.887. This dimension is relevant to mobilizing resources, managing finances, developing human resources, and managing data and technology, which are the management abilities of managers. This domain is consistent with the context of community based LTC and the DHS in Thailand. The role of a CM is to provide a functional assessment using the Barthel Index of ADL for all older adults in the subdistrict, to create an individual care plan for a dependent older person, and to submit to the local governments for financial support, which is provided by the LAO and the NHSO, with focus on managing data, technology, and finances. Before the ADLs survey is conducted, the CGs need to be trained and then provide home visits according to the CP, under the supervision of the CM[3]. This activity is relevant to human resource development. Moreover, the subdomain of mobilizing resources reflects the health care system of Thailand in that PHC is the fundamental service delivered through the concept of the DHS. If the rural community encountered constrained resources, then the full engagement of all sectors, including the population, community leader, local government, and other public sectors in the district, would be supported[13,46,47].

The dimension of caring for a dependent older person includes six items, with a Cronbach's alpha of 0.930 and a corrected item-to-total correlation ranging between 0.648 and 0.899. This dimension is related to creating individual care plans, monitoring and conflict management, evaluation, and creativity services. All of these subdimension comprise the ability of a CM to make an individual care plan and then supervise, monitor, and evaluate the care plan. This dimension can be explained by a CM's need for creative ideas to solve upcoming challenges in an innovative manner, as the established ways may not work for handling certain situations. For creativity, CMs must create new services to serve older adults according to their health needs. This is in line with Mulgan et al.[48], which indicated that social innovations are innovative ideas such as products, services, and models, that simultaneously meet social needs more effectively than alternatives, and create new social relationships or collaborations.

The dimension of intersectoral collaboration includes five items, with a Cronbach's alpha of 0.944 and a corrected item-to-total correlation ranging between 0.811 and 0.875. This dimension is connected to communication with other sectors, team empowerment, coordination with the team, and building relationships with all sectors. Community based LTC needs to work together with various sectors, including local organizations, community hospitals, community leaders, CGs, and dependent older persons and their families[3]. This concept is consonant with the framework on integrated people-centered health services[49], which indicates that intersectoral collaboration is one of the key strategies for achieving people-centered health. The people-centered provision is the concept that consciously adopts the perspectives of individuals, families, and communities and sees them not only as participants but also as beneficiaries of trusted health systems that respond to their needs and preferences in humane and holistic ways. At the sub-district level, CMs are at the forefront of delivering individual care plans to older adults at home within the LTC system. Community hospitals at the district level offer secondary care, while primary care is provided by sub-district health promoting hospitals. Every sub-district that implements community LTC carried out the survey for the older adults and assess their ADL by using the assessment form based on the Barthel Index standard and classify the older adults into three groups to serve as baseline data for LTC planning that was relevant to the services in DHS[3,11,13].

The dimension of resilience contains five items, with a Cronbach's alpha of 0.912 and a corrected item-to-total correlation ranging between 0.733 and 0.831. This dimension is related to adaptability and coping. McKenna et al.[50] indicated that resilience was an important concept for explaining protection strategies and referred to the ability to adapt to physical and psychological requirements in demanding situations. CMs work in various sectors, encounter the complex health needs of dependent older persons, and have recently faced a pandemic, all of which can lead to negative experiences. The findings of the present study were consistent with the study of Chang and Kim[51], which found that coping with demanding situations using internal resources and external support is a unique trait revealed in the resilience of the nursing staff members of nursing homes. In addition, nursing home and home care leaders in Norway implemented innovative solutions to ensure resilient performance during the first six to nine months of the pandemic in approximately March 2020[52]. This was in line with Cooper et al.[53], who indicated that resilience was a crucial factor in reducing the burnout and psychological burden of

nurses and promoting their mental health. Therefore, the ability of CMs to continue functions during a crisis is necessary.

The strength of the present study is that the LTC competency measurement of CMs was developed and validated based on a mixed method design that was specific to the community based LTC context. However, the present study has limitations. First, in the quantitative phase, the study was undertaken in one health region. However, this limitation was minimized during the conceptual qualitative approach, under which the present study aimed to cover all national, regional, provincial, and district levels with a comprehensive understanding of the concept of the LTC competency of CMs from the perspectives of all stakeholders, including policymakers, practitioners, and academics. Second, the instrument described herein is the first development of such an instrument. Therefore, the steps of confirmatory factor analysis and replicability are required for scale development. The results of this study have a significant impact on the improvement of care managers' competencies in providing LTC services in the DHS. An evaluation of achieved CMs competency bridges the competency gap, and a tailor-made training program will be designed to maintain the quality of services provided to recipients in LTC services.

Conclusion

The present study showed the acceptable validity and reliability of the developed instrument to measure the LTC competency of CMs in LTC system. The four chosen domains and 24 items provide a solid empirical and theoretical basis for future research on self-ability evaluated LTC competencies and the intervention mixed methods design before experiment, which will motivate the future CMs and policymakers to recognize that improving the competency of CMs and their careers' path is necessary to achieve the intention of LTC services to meet a person's health or personal care needs.

What is already known on this topic?

Studies have examined LTC competencies in healthcare managers at LTC institutions.

Few studies have defined LTC competencies for CMs in community-based settings.

Limitation of the instrument demonstrates sound psychometric properties for assessing LTC competencies amongst CM in community-based settings.

What does this study add?

This study provides the concept and definition of a community-based long-term amongst CM.

This study suggests an instrument for assessing the competency of CM in community-based setting with sound psychometric properties.

Conflicts of interest

The authors declare no conflict of interests.

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