

Testing the psychometric properties of a Chinese version of Dementia Management Strategies Scale

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Abstract: Caregiving stress and burden are universal phenomena among family caregivers of people with dementia. Family caregivers who adopted adaptive management strategies in dementia care could alleviate their own distress and the progression of neuropsychiatric symptoms in people with dementia. An understanding about the management strategies used by these caregivers in caring for their relatives with dementia would be crucial to family services in dementia care. This study aimed to validate a Chinese version of Dementia Management Strategies Scale (DMSS) in family caregivers of Hong Kong Chinese people with dementia. Face and content validity, semantic equivalence, and test–retest reliability of the translated Chinese version of 34-item DMSS were examined. A random sample of 211 family caregivers and their relatives with dementia were then recruited to identify the factor structure of the Chinese version by exploratory factor analysis followed by varimax rotation and assess its internal consistency. Reproducibility and responsiveness of the scale to changes in neuropsychiatric symptoms were also examined over a 6-month interval. Results indicated that the Chinese version of DMSS indicated very satisfactory content validity, semantic equivalence with the original English version, and test–retest reliability. Factor analysis showed that 32 items of the Chinese version had substantial loadings on one of the three identified factors (“Criticism toward older relative”, “Showing encouragement”, and “Active management strategies”), explaining 72.4% of the total variance. The three-factor Chinese version also indicated good internal consistency of its three subscales (Cronbach’s $\alpha=0.86–0.90$) and satisfactory reproducibility over 6 months (intraclass correlation coefficients =0.85–0.89). Furthermore, the Chinese version demonstrated moderate effect sizes for detecting changes in symptom severity of dementia (Cohen’s $d=0.50–0.60$). This study provides evidence on the sound psychometric properties of the Chinese version of DMSS to measure the levels of management strategies in family caregivers of people with dementia.

Keywords: family caregivers, instrument validation, psychometric properties, responsiveness, reproducibility

Introduction

Dementia is a neurodegenerative disorder typically in old age characterized by cognitive impairment and behavioral and psychological symptoms such as agitation, apathy, and disorientation. Its prevalence is age related, varying from 0.8% at aged between 60 years and 64 years to 19.1% at aged ≥ 85 years.¹ About 65%–75% of people with dementia are taken care by family members at home.² While caregiving stress and burden are universal phenomena in families having a relative with dementia, recent research suggested that family education on dementia management strategies could reduce the functional decline of people with dementia and familial burden of care and enhance family caregivers’ self-efficacy in handling challenging behaviors of their demented relatives.^{2–4} An enhancement of these caregivers’ dementia management strategies can potentially reduce the likelihood of institutionalization of their dementia

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relatives into aged care facilities and/or seeking community mental health services that may pose significant health care burden to society.

As suggested by de Vugt et al⁵ there should be a need for better understanding about the effectiveness of different strategies used by family caregivers in managing their relatives with dementia and other chronic illnesses. However, there is a paucity of research instruments that are relevant to assessment of attitude, skills, and practices of the family caregivers in handling the behavioral and psychological symptoms of their relatives with dementia. While identifying conventional coping items has inadequate situational specificity to capture family caregivers' cognitive and behavioral patterns of interactions with the dementia relatives and management of their stressful life situations, Hinrichsen and Niederehe⁶ generated 34 items based on interview data with these caregivers and their dementia relatives and literature on these families' coping behaviors. An early study using the 34-item Dementia Management Strategies Scale (DMSS) condensed the item pools into three subscales of caregiving strategies, namely, criticism (eleven items), encouragement/support (eight items), and active management (nine items), as well as six items not included in any factors (due to very weak factor loading). Criticism refers to caregivers' efforts to manage the dementia relative by blaming, criticizing, threatening, and/or other related behaviors. Encouragement refers to their efforts to praise the older relative, getting him/her to discuss feelings and maintaining all family members' emotional regulation, whereas active management involves activities to safeguard, engage, and modify the home care environment and daily routine that these caregivers have adopted to stimulate better independent and self-care behaviors of their dementia relative. Both criticism and other passive (or inappropriate) management strategies are found positively correlated with caregiving distress and burden, while giving encouragement to and active management activities for dementia relatives could alleviate (negatively correlated with) familial burden of care and decrease families' intention to institutionalize their dementia relative.^{5,6}

A cross-sectional survey study in Singapore using the original English version of DMSS also found that the active management strategies in dementia care could predict the intra- and interpersonal growths of English-speaking Chinese family caregivers.⁷ The researchers also suggested that modification of dementia management strategies could possibly lead to a better sense of competence and more rewarding experience among caregivers, which might then contribute to a more sustainable, constructive home care

environment for their dementia relatives. This was indeed supported by a 12-month prospective cohort study,⁵ reporting that caregivers who accepted their caregiving role and used supportive caregiving strategies would indicate a higher level of competence in managing the behavioral problems of their dementia relatives. Another recent research in 134 Chinese family caregivers also recommended that by improving these caregivers' self-efficacy and their adopting effective strategies in taking care of those disturbing behaviors in dementia, their abilities in controlling their own negative thoughts and emotions and successfully coping with the demands for caregiving would be enhanced.⁸ This might potentially lower the caregivers' psychological distress, feelings of guilt and burden, social withdrawal and isolation, and other mental health problems, such as depression and anxiety.

Conversely, studies showed that family members who were lacking such adaptive strategies to caregiving as such in DMSS were associated with and characterized by not only ineffective coping ability but also frequent criticism of their relatives with dementia, or emotional over involvement in caring for their relatives with dementia.^{9,10} TARRIER et al¹⁰ suggested that dementia management strategies used in coping with the demands for caregiving could strongly affect the psychosocial health conditions of both the caregivers themselves and their dementia relatives. The items of DMSS included a wide range of adaptive and nonadaptive strategies in dementia care, and thus would be useful for health care professionals to assess and identify those family caregivers who lack appropriate or effective strategies in coping with the challenges in caregiving for dementia.

There is another recently used instrument in dementia care research termed Task Management Strategy Index (TMSI), that can measure caregivers' frequency of using task simplification strategies (eg, using pictures or labels to identify objects and placing items in front of the relative) to assist the daily activities and care for people with dementia, and thus reveal the levels of their self-efficacy and problem-focused coping.⁸ Nevertheless, the unidimensionality of TMSI (with positive coping tasks only) could not reveal the caregivers' negative and passive management strategies and relationships between all of their management strategies and familial distress, burden, and expressed emotion in relation to caregiving. Therefore, it is important and useful to translate and validate the DMSS in different populations, such as the Chinese population in this study, in order to examine its potential usefulness to assess the management strategies being used by these caregivers in dementia care. Assessing the caregivers with this validated DMSS, educational

interventions can be developed in terms of the needs for both strengthening their adaptive strategies and minimizing those nonadaptive ones.

Aims and objectives

This study was to test the reliability and validity of a Chinese version of DMSS in family caregivers of a relative with dementia at two elderly service centers in Hong Kong. The study objectives were:

1. to examine the content validity of the translated Chinese version of DMSS and its semantic equivalence with the original English version;
2. to assess the test–retest reliability, internal consistency, and construct validity of the Chinese version; and
3. to test the responsiveness and reproducibility of the Chinese version to changes in the levels of caregiving distress and dementia relatives' neuropsychiatric symptoms over a 6-month interval.

Methods

This was a two-phased instrument validation study to test the psychometric properties of the translated Chinese version of DMSS, and the two phases of instrument testing are described below.

Participants in two study phases

In Phase I of this study, an expert panel comprising six mental health professionals (two advanced practice nurses, two psychiatrists in psychogeriatric specialty, one occupational therapist, and one medical social worker) and two family caregivers of people with dementia with at least 6 months experience of caregiving were recruited to rate the relevance of the items of DMSS in assessing caregivers' dementia management strategies at home. After testing its content validity, a convenience sample of 30 Chinese–English bilingual speaking family caregivers of dementia in one of the two elderly service centers who met the study criteria (listed below for Phase II) were approached and invited individually by a research assistant during their visit to the center to participate in this study. They were asked to complete both the original English and translated Chinese versions of DMSS for assessing semantic equivalence between the two versions. Similarly, another convenience sample of 30 family caregivers were recruited from the other center under study to complete the Chinese version twice over a 2-week interval to assess its test–retest reliability.¹¹

In Phase II (and Phase I), both the family caregivers and their older relatives with dementia were recruited from the

two elderly service centers providing day and residential dementia care for over 1,000 families in two of the three main geographical regions in Hong Kong (ie, Kowloon and Hong Kong Island). The inclusion criteria of the family caregivers were those who were: 1) aged 18 or above, Hong Kong Chinese residents; 2) main caregivers for a dementia relative for at least 3 months; 3) currently providing home care to the dementia relatives for their activities of daily living and instrumental assistance (eg, feeding, walking, and personal hygiene) for at least 2 hours per day; and 4) able to understand and/or read Cantonese/Mandarin. The inclusion criteria for their dementia relatives were those who were: 1) aged ≥ 60 years; 2) in mild-to-moderate stage of dementia measured with Structured Clinical Assessment using the criteria of *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (DSM-IV),¹² and/or the Clinical Dementia Rating,³ by a psychiatrist; and 3) able to understand Cantonese/Mandarin.

Those family caregivers presenting with acute psychiatric symptoms or cognitive impairments were excluded. The dementia relatives presenting with very acute and serious physical or mental health problems, or planning to stay at a long-term aged care facility in the upcoming 6 months, were also excluded.

In Phase II, the caregivers who met the above inclusion criteria were randomly selected from a list of dementia relatives sequenced in terms of alphabetical order of their surnames, using the computer-generated random numbers issued by an independent statistician. During their visit to the elderly care centers, the research assistant obtained informed written consent from the selected caregivers individually with clear explanation of the purpose and procedure of this study. After obtaining their written consent, the research assistant asked the caregivers to complete the study questionnaires.

By using the rule of a minimum of five subjects per item for factor analysis¹¹ and estimating about 20% of potential attritions at 6-month follow-up, 211 pairs of family caregivers and their dementia relatives were recruited to complete the 34-item Chinese version of DMSS and other relevant measures. This sample size could be adequate for achieving a 95% confidence interval of mean values and margin of errors of the three DMSS subscales between 2.43 ± 1.54 (for "Criticism") and 4.05 ± 1.06 (for "Active management") from the population mean, as suggested by Lim et al.¹³

Instruments

The family caregivers completed two study measures in Chinese language, namely, DMSS and Neuropsychiatric

Inventory (NPI), whereas the cognitive and memory functions of their dementia relatives were screened with the Mini-Mental State Examination (MMSE) for their eligibility of study participation. The stage (from 0.5= very mild, 2= moderate, to 3= severe) of dementia was assessed by a psychiatrist using an informant-based global assessment scale, Clinical Dementia Rating,³ in terms of six cognitive and behavioral domains (ie, memory, orientation, judgment and problem solving, community affairs, home and hobbies, and personal care). The recent clinical records of the dementia relatives were also examined to countercheck with the severity of neuropsychiatric symptoms reported by the caregivers in the NPI and the results of MMSE.

The 34-item DMSS⁶ was developed at Texas Research Institute of Mental Sciences, and its items were rated on a 5-point scale (1= never to 5= most of the time), measuring the extents of each strategy used by family caregivers in taking care of their dementia relative over the previous month. The scale and its three subscales (ie, "Criticism", "Encouragement/support", and "Active management") demonstrated satisfactory internal consistency (Cronbach's $\alpha=0.77-0.85$) and good linkage to the theories or concepts of stress-appraisal and coping with dementia caregiving.^{9,14} The subscale "Active management" also indicated moderate correlation and predictive power ($\beta=0.30$) to the caregivers' perceived personal gains in Singaporean Chinese and other ethnic groups (eg, Malaysians and Indians) using its validated English version.⁷

The 12-item NPI could provide a reliable assessment of both the neuropsychiatric symptoms of dementia such as agitation, apathy, and behavioral disturbance over the past 2 weeks and level of caregiving distress.¹⁵ Each symptom item was rated on a 4-point frequency scale (1= occasionally to 4= very frequently) and a 3-point severity scale (1= mild to 3= severe), and multiplying both scores would obtain a total score (ie, possible score range of 12-144). The same items for caregiving distress score were rated on a 5-point scale (0= not at all to 5= very severely), with a total score between 0 and 60. The Chinese version used in this study has demonstrated good internal consistency (Cronbach's $\alpha=0.86$) and test-retest reliability (Pearson's $r=0.79-0.86$) in Chinese dementia populations.¹⁵

In addition, demographic characteristics of the caregivers such as their age, sex, education, employment, household income, average weekly hours of care provided, and current general health condition were collected. The dementia relatives' age, sex, psychiatric diagnosis, duration of illness,

and comorbidities of other mental or physical diseases were collected from the client records in the two centers.

Data collection procedure

Permission for access to the family caregivers and their dementia relatives (and their health records) and ethics approval of the study were obtained from the Management Committee of the two dementia care centers and Human Subjects Research Ethics Committee of The University, respectively. After informed written consent was obtained from the randomly selected caregivers (and/or their dementia relatives), the research assistant who had a master degree in nursing and was experienced in instrument validation administered the study questionnaires to these participants.

In Phase I, face and content validity, semantic equivalence, and test-retest reliability of the Chinese version of DMSS were tested. A standard linguistic validation process of the Mapi Research Institute was adopted and consisted of four stages, including conceptual definition (face validity), forward and backward translation, cognitive debriefing or pilot testing, and proofreading.¹⁶ For conceptual definition, the researcher and two other nurse consultants in dementia care reviewed all the items of the questionnaire to clarify the concepts involved, and all agreed that the items were appropriate to the local dementia care system and services. For forward and backward translations, the original DMSS was translated into Chinese language by two bilingual mental health research nurses independently and reconciled the two translations into a consensus version, and then the consensus version was back-translated into English by a Chinese-English translator, independently. The item equivalence (percentage of agreement) was determined by the researcher and three translators in which a 97% of agreement was achieved. A few disagreements on the meaning of wordings in three of the 34 items (ie, "prompt better behavior" in item 15, "a fighting attitude" in item 16, and "tended to indulge" in item 17) between the two translators were found. The researcher asked the translators to clarify and make consensus on each of the three statements and their meaning and suggested minor amendments to resolve the differences. Furthermore, cognitive debriefing was conducted, in which the amended Chinese version was tested with five family caregivers with more than 6 months caregiving experience and two mental health nurses in dementia care to assess its relevance, clarity, and intelligibility. All reviewers were able to understand and complete the questionnaire and found all items easy to answer. With no required revision on the items, the Chinese version was proofread by one translator

and researcher to ensure it to be free of formatting, typing, spelling, and grammatical errors.

After the proofreading was made, the expert panel rated on the relevance of each of the 34 items of the Chinese version to assess the caregivers' dementia management strategies used on a 4-point Likert scale (1= not relevant' to 4= highly relevant). Content validity index (CVI) was calculated at both item and scale levels based on the percentage of agreement between panel members on the relevance of each item (with a rating of 3 or 4).

After a few minor amendments were made on the translated items, the Chinese version was tested for semantic equivalence with the original English version, and then test-retest reliability over 2 weeks by each of the two convenience samples of 30 caregivers, respectively. For semantic equivalence testing, the two versions of DMSS were administered using cross-over design to reduce subjective/recall bias.¹¹ That is, half of the 30 caregivers were given the Chinese version first and then the English version; another half was given the two versions in the reverse order. For test-retest reliability testing, the split-half technique was adopted to reduce the recall bias in which the first half and the second half of the Chinese version were completed in reverse order at the two measurements.

In Phase II, the research assistant screened the dementia relatives for intractable cognitive and memory functions using the MMSE developed by Folstein et al (ie, total score >8)^{17,18} and checked the results against their clinical records. The research assistant then assisted the selected caregivers to complete the study questionnaires and demographic data sheet individually (about 20–30 minutes) in a quiet interview room of the centers. Six months later, the caregivers completed a similar set of questionnaires again at home or the centers as preferred.

Data analysis

All quantitative data in this study were analyzed using IBM's SPSS for Windows, version 20.0. Level of significance of all statistical tests was set at 0.05. Item equivalence between the Chinese and English version of DMSS was evaluated by using weighted kappa (ie, >0.6, indicating a satisfactory agreement on translated items).¹⁹ The equivalences between the subscale and total scores of the two versions were assessed by intraclass correlation coefficient (ICC), using one-way ANOVA test. CVIs of the Chinese version were calculated at both item and scale levels based on percentage of agreement between panel members on the relevance of each item to dementia management strategies (ie, ≥ 0.80

with a rating of 3 or 4 considered acceptable).²⁰ Its test-retest reliability at 2-week interval was evaluated using ICC that could take into account both the degree of correspondence (covariance) and agreement between two measurements. For assessing both the equivalence between the two versions of DMSS and test-retest reliability of the Chinese version, ICC values >0.75 were considered an acceptable reliability.¹¹

Construct validity of the Chinese version was established by exploratory factor analysis, similar to the testing of the original DMSS by Hinrichsen and Niederehe⁶ and a few previous studies.^{5,7} After confirming the factorability of the data by using Bartlett's test of sphericity ($P < 0.05$) and Kaiser-Meyer-Olkin measure of sampling adequacy (>0.8), an exploratory factor analysis with eigenvalue (>1.0) and Cattell's scree test followed by varimax rotation was adopted to determine appropriate number of interpretable factor solutions.¹¹ Varimax rotation was used because the factors identified from the original DMSS were slightly correlated or uncorrelated, and each identified factor tended to be loaded high on a few items and low or very low on the other items. Item-scale and item-subscale correlations were then calculated to examine the level of associations between items, subscales (factors), and total scale of the Chinese version. Internal consistency (Cronbach's α coefficients) of the subscales of the Chinese version was also calculated.

Previous research suggested that family members' coping abilities or strategies in caring for their relatives with dementia, and other serious mental disorders, were significantly predicted by or correlated with the levels of their caregiving distress or burden and patients' psychiatric and behavioral symptoms.^{2,5,14,19} For assessing the level of reproducibility of the Chinese version, data from those reported little or no change (ie, score change <2) in both levels of caregiving distress and neuropsychiatric symptoms (ie, total sum of the frequency of each symptom multiplied by its severity) between the two measurements over 6 months were used.²¹ This criterion was based on the pooled standard deviations of the average change in NPI score of people with dementia over 3–6 months in a few controlled trials.⁴ ICCs using random-effects ANOVA test were calculated, and ICC of ≥ 0.7 would represent a satisfactory reproducibility of the scale between the two measurements.¹⁹

To assess its responsiveness to the changes in neuropsychiatric symptoms, the observed changes in the subscale mean scores of the Chinese version were assessed every 6 months among those caregivers whose dementia relatives reported a substantial change of both the NPI total and distress scores >10.⁴ Effect sizes of detecting these observed

negative changes (deterioration) in neuropsychiatric symptoms at 6-month interval were calculated (ie, Cohen's $d > 0.8$ for large effect, 0.5–0.8 for moderate effect, and 0.2–0.5 for small effect).¹¹

Results

Results of Phase I of the study

Characteristics of participants

Two convenience samples of 30 family caregivers were recruited; one group for testing semantic equivalence and another one for test–retest reliability. Refusal rates were 5% and 7%, respectively, mainly due to time constraint, lack of interest, and unwillingness to discuss their family issues. Mean values and ranges of age of the two groups of caregivers were similar ($M=37.85$, $SD=16.19$, range 25–60; and $M=38.28$ years, $SD=14.78$, range 22–59, respectively). Less than half of them were male ($n=13$ and $n=14$), and two-thirds had secondary school or above education ($n=20$ and $n=21$). Average duration of dementia was 1.6 years ($SD=0.8$) and 1.8 years ($SD=0.9$; both ranged between 0.3 and 2.8). Their relationships with the dementia relative were mainly child (both $n=9$) and spouse ($n=9$ and $n=10$).

Content validity and equivalence of the Chinese and English versions of DMSS

The 34-item Chinese version of DMSS indicated substantial agreement, thus having good semantic equivalence with the original English version, in terms of both the items and overall scale. Thirty items had high kappa values of 0.87–0.94, and the remaining 4 items had kappa values of 0.80–0.84 (ie, items 10, 20, 24, and 28), being slightly below the acceptable value of 0.85.^{11,19} The ICCs between the two versions were 0.89 ($P=0.01$) for the overall scale and from 0.82 to 0.93 for the three subscales (suggested by the original authors⁶). Very minor amendments on the wordings of a few items were made (eg, “undesirable [嚴重的不良]” in item 3 changed to “非常差/壞的”; “problems/trouble [困擾]” in item 20 to “麻煩”; and “mentally [心理]” in item 24 to “精神狀況”). The Chinese version also showed satisfactory content validity, having the item-level CVIs between 0.90 and 1.00 and scale-level CVI of 0.96.

Test–retest reliability of the Chinese version

ICCs for assessing the test–retest reliability of the Chinese version over 2-week interval were $ICC=0.89$ for the overall scale ($P=0.01$) and from 0.88 to 0.92 for the three subscales ($P=0.01–0.005$). This result revealed that all the items of the

Chinese version had high stability of responses over 2 weeks (ie, high test–retest reliability).^{11,19}

Results of Phase II of the study

Characteristics of participants

Two hundred and eighty-five family caregivers were randomly selected from the list of dementia relatives; 215 of them who were invited during their visits to the elderly service centers agreed to participate in this study. The response rate was 75.4%. Seventy refused to participate mainly due to lack of interest in participating ($n=32$), being too busy ($n=8$), and/or time inconvenience in completing the measurements ($n=30$). Finally, 211 participants were used for data analysis, while the data of four participants were discarded due to their not completing of >4 items of the two scales in the study questionnaires. The sociodemographic and clinical characteristics of 211 pairs of family caregivers and their dementia relatives (and those refusals) are summarized in Tables 1 and 2, respectively. The results of chi-square test or independent sample t (two-tailed)-test indicated that there were no significant differences in all of these characteristics between the respondents and those refused to participate (P -values >0.10).

Exploratory factor analysis

Exploratory factor analysis was conducted to identify the plausible underlying structure of the Chinese version of DMSS. All corrected item-total correlations were positive with 32 out of 34 items ranging between 0.30 and 0.75. Only two items fell below the 0.30 criterion of adequate correlation with the total scale, which were “I was kept busy just cleaning up or repairing things after the damage my older relative had done” (item 29, $r=0.23$) and “I tended to indulge my older relative” (item 32, $r=0.24$). Cronbach's α coefficients for the overall scale and subscales only increased by 0.02–0.04 when the two items were deleted, and thus, these two items were not excluded from the factor analysis.

The Kaiser–Meyer–Oklin value was 0.90 and Bartlett's test of sphericity ($=0.80$) reached a statistical significance ($P=0.10$), thus supporting its factorability.¹¹ The results of factor analysis indicated that there were three components (“Criticism toward older relative”, “Showing encouragement”, and “Active management strategies”) with eigenvalues >1.2 and supported by the Cattell's scree test that the three factors containing 32 items were retained (ie, having a factor loading of ≥ 0.40 in one-factor solution).¹¹ The remaining two items with a factor loading of 0.16 and 0.18

Table 1 Characteristics of family caregivers (N=211)

Characteristics	Respondents (n=211), f (%) or M ± SD	Those refusals (n=70), f (%) or M ± SD	χ^2 test or t-test, P-value
Family caregivers			
Sex			$\chi^2=1.38, P=0.36$
Female	141 (66.82)	42 (60.00)	
Male	70 (33.18)	28 (40.00)	
Age (y)	48.76±19.12 (range 21–62)	49.48±20.16 (range 20–64)	t=1.30, P=0.20
Relationship with dementia relative			$\chi^2=1.49, P=0.33$
Spouse	81 (38.39)	25 (35.71)	
Child	79 (37.44)	25 (35.71)	
Sibling/parent	40 (18.96)	15 (21.43)	
Others (eg, granddaughter)	10 (4.74)	5 (7.15)	
Monthly household income (HKD) [#]			$\chi^2=1.80, P=0.19$
< 10,000	50 (23.70)	15 (21.43)	
10,001–20,000	93 (44.08)	30 (42.86)	
20,001–40,000	57 (27.01)	19 (27.14)	
>40,000	10 (4.74)	6 (8.57)	
Education level			$\chi^2=2.19, P=0.12$
Primary school or below	33 (15.64)	14 (20.00)	
Secondary school	142 (67.30)	39 (55.71)	
Tertiary (eg, university or postgraduate study)	36 (17.06)	17 (24.29)	
Persons sharing with caregiving			$\chi^2=2.48, P=0.10$
Spouse	49 (23.22)	16 (22.86)	
Child	55 (26.07)	18 (25.71)	
Sibling/other relatives	67 (31.75)	26 (37.14)	
Domestic helper	40 (18.96)	10 (14.29)	
Duration of caregiving (mo)	18.34±9.91 (range 8–32)	17.19±9.98 (range 7–36)	t=1.34, P=0.25
Time of caregiving (h) per week	4.84±1.98 (range 2–8)	4.10±2.07 (range 2–7)	t=2.08, P=0.10
Types of daily tasks assisted for relative (eg, bathing, dressing, and toileting)	7.81±2.25 (range 4–12)	8.90±4.02 (range 4–14)	t=1.98, P=0.11
Perceived health conditions			
Visiting medical doctor (1= none to 4 more than 2 times per month)	2.12±1.01 (range 1–4)	–	
Number of hospital admission	1.52±1.01 (range 0–4)	–	
Use of psychotropic drugs	98 (42.65)	–	
Level of sleeping difficulty (1= generally sufficient to 3= generally insufficient)	2.05±0.80	–	
Weight change >£5	105 (49.76)	–	
Perceived current health (1= much better to 5= much worse than 1 year ago)	3.51±1.32 (range 1–5)	–	
Community support services received			$\chi^2=2.48, P=0.10$
Community Psychiatry Team (psychogeriatric)	89 (42.18)	25 (35.71)	
Family therapy	36 (17.06)	9 (12.86)	
Respite care	49 (23.22)	17 (24.29)	
Self-help/mutual support group	42 (19.91)	11 (15.71)	
CBT/mindfulness training	32 (15.17)	10 (14.29)	
Others (eg, day care center)	78 (36.97)	20 (28.57)	

Note: [#]HKD 7.8= US\$ 7.8.

Abbreviations: y, years; mo, months; h, hours; SD, standard deviation; CBT, cognitive behavioral therapy.

were deleted after the factor analysis, including “I was kept busy just cleaning up or repairing things after the damage my older relative had done” (item 29) and “I tried to soothe my relative’s emotions when he/she got upset” (item 33).

After varimax rotation was performed, all 32 items had high loadings of >0.40 on only one factor (Table 2), except

“I made sure my older relative got enough medications to keep him/her calm/cooperative” (item 30), as shown in Table 3. Item 30 was loaded into two factors, namely, “Criticism toward older relative” (factor loading =0.40) and “Active management strategies” (factor loading =0.46). By interpreting its meaning and a higher indicated χ^2 loading, it

Table 2 Characteristics of dementia relatives (N=211)

Characteristics	Respondents (n=211), f (%) or M ± SD	Those refusals (n=70), f (%) or M ± SD	χ^2 test or t-test, P-value
Dementia relatives			
Sex	96 (45.50)	31 (44.29)	$\chi^2=1.74, P=0.25$
Male	115 (54.50)	39 (55.71)	
Female	66.40±8.29	67.49±9.21	
Age	14 (6.64)	4 (5.71)	$t=1.38, P=0.30$
55–60	40 (18.96)	8 (11.43)	
61–65	71 (33.64)	24 (34.29)	
66–70	86 (40.76)	34 (48.57)	
>70	98 (46.45)	34 (48.57)	
Type of dementia	53 (25.12)	17 (24.29)	$\chi^2=1.25, P=0.24$
Alzheimer's disease	42 (19.91)	13 (18.57)	
Vascular/frontotemporal	18 (8.53)	6 (8.57)	
Lewis bodies/semantic	1.12±0.90	1.30±0.81	
Others	10.18±5.90	9.01±4.79	
Hospitalization in the past 3 months			
Number of hospitalization			$t=1.89, P=0.23$
Length of hospitalizations (days)			$t=1.10, P=0.30$
Number of family members living with patient	2.15±0.90 (range 1–4)	2.34±0.98 (range 1–4)	$t=1.56, P=0.20$
Duration of dementia (months)	17.40±9.54 (range 8–35)	19.13±10.49 (range 7–34)	$t=1.14, P=0.28$
Psychiatric medications			
Antidepressants	28 (13.27)	8 (11.43)	$\chi^2=1.97, P=0.25$
Anticonvulsants	7 (3.32)	4 (5.71)	
Atypical antipsychotics	12 (5.69)	8 (11.43)	
Conventional antipsychotics	11 (5.21)	7 (10.00)	
Hypnotics	18 (8.53)	7 (10.00)	
Others (eg, lithium salts)	8 (3.79)	4 (5.71)	
Psychiatric treatments receiving			
CPT visits and education	78 (36.97)	19 (27.14)	$\chi^2=1.96, P=0.15$
Cognitive remediation	32 (15.17)	9 (12.86)	
Memory training (eg, reminiscence)	59 (27.96)	10 (14.29)	
Exercise and self-care training	58 (27.49)	10 (14.29)	
Complimentary therapies	27 (12.80)	6 (8.57)	
Others (eg, relaxation and self-regulation)	30 (14.22)	10 (14.29)	

Abbreviations: SD, standard deviation; CPT, community psychiatric team.

would only be counted in the factor “Active management strategies”. Three factors derived from the rotated matrix were generally more interpretable as each set of items was loaded high onto one factor only. The total scale variance explained by the three factors was 72.05%. The 32 items included in the three-factor solutions (12 items for “Criticism toward older relative”, 10 items for “Showing encouragement”; and 10 items for “Active management strategies”) could represent three domains of management strategies adopted by the family caregivers in dementia care.

Internal consistency of the Chinese version of DMSS

With the three-factor solutions identified, Cronbach's α coefficients of these subscales of the Chinese version of DMSS in these caregivers were 0.86 for “Criticism toward older relative”, 0.88 for “Active management strategies”, and 0.90 for “Showing encouragement”. Therefore, the Chinese

version demonstrated satisfactory internal consistency of the three subscales. All corrected item-total and item-subscale correlations were between 0.34 and 0.56, indicating moderate correlations between the overall scale, subscales, and their included items.

Reproducibility of the Chinese version

ICC test was used to compare the mean scores of the Chinese version of DMSS between the first and second measurement over 6 months in the caregivers (n=107) who reported no changes or very little changes (ie, score change <2) in both their level of distress (NPI distress score) and older relatives' neuropsychiatric symptoms. The ICCs between the two measurements in those caregivers were 0.87 ($F=5.12, df=105, P=0.01$) for the overall scale and 0.85–0.89 ($F=4.90–5.98, df=11–13, P=0.02–0.008$) for the three subscales, indicating very satisfactory levels of reproducibility over 6 months in

Table 3 Results of varimax rotation of three factors identified in the Chinese version of DMSS

Items	Factor loading		
	Factor 1	Factor 2	Factor 3
1. I yelled or acted enraged; it was often the only way to get my way with him/her. [26] ^a	0.67		
2. I criticized or scolded my older relative to try to prompt better behavior from him/her. [15] ^a	0.57		
3. I threatened my relative with undesirable consequences if he/she did not cooperate. [21] ^a	0.61		
4. I withdrew from my older relative. [22] ^a	0.59		
5. I blamed my older relative for having created the difficulties. [1] ^a	0.52		
6. I was firm with my older relative and insisted that he/she live up to certain expectations I have for him/her. [13] ^a	0.45		
7. I told my relative to stop doing things that caused worry because of what it did to me (or to other family members). [29] ^a	0.51		
8. I left the situation for a while when relating to my older relative got too difficult. [27] ^a	0.56		
9. I tried to get my relative to agree to do certain things, or to do them in a certain way. [31] ^a	0.54		
10. I asked my relative to explain why he/she was doing something to draw his/her attention to his/her mistakes. [11] ^a	0.51		
11. I tried to communicate to my older relative how concerned or worried I was about him/her. [32] ^a	0.49		
31. I overlooked or ignored my older relative's feelings when I suspected that paying attention to them might lead to unpleasantness between us. [8] ^a	0.5		
12. I tried to engage my older relative in discussing his/her feelings and emotions. [4] ^a	0.69		
13. I made a point of praising him/her when he/she did what I considered appropriate. [5] ^a	0.65		
14. I tried to help my older relative look on the bright side of things. [20] ^a	0.62		
15. I tried to reason with my older relative. [28] ^a	0.58		
16. I encouraged my relative to adopt a fighting attitude toward his/her disability and to do as much as possible for him/herself. [16] ^a	0.55		
17. I tried to suggest ideas my older relative might accept and follow-through. [23] ^a	0.52		
18. I showed special amounts of physical affection. [7] ^a	0.48		
19. I encouraged my older relative to keep up with friends to visit them by him/herself. [9] ^a	0.48		
32. I tended to indulge my older relative. [17] ^a	0.46		
34. I tried to hold my anger and frustration to protect my older relative from these feelings. [18] ^a	0.49		
20. I tried to arrange my older relative's environment to safeguard him/her against causing problems, getting into trouble, or endangering him/herself. [10] ^a			0.66
21. I tried to do many things for my relative since he/she is no longer capable of doing them. [6] ^a			0.62
22. I tried to divert my relative's attention when he/she began to feel upset. [12] ^a			0.55
23. I repeated the same things over and over again to make sure my older relative got them. [19] ^a			0.54
24. I tried to arrange situations I hoped would be stimulating to my older relative (mentally or emotionally). [2] ^a			0.51
25. I kept a close eye on what my older relative was doing so that I could head off any problems before they developed too far. [3] ^a			0.5
26. I tried to have my relative participate in as much of the ordinary family routine as possible. [25] ^a			0.5
27. I tried to teach everyone involved to approach my older relative in the same, planned way. [33] ^a			0.48
28. I tried to make sure my relative got enough physical activity or exercise. [34] ^a			0.48
30. I made sure my older relative got enough medications to keep him/her calm or cooperative. [30] ^a	0.40 ^b		0.46
Eigenvalue	6.61	5.52	5.3
Percentage of variance explained	27.58	23.79	20.68

Notes: Factor loadings ≥ 0.40 are reported. Factor 1, criticism toward older relative; Factor 2, showing encouragement; Factor 3, active management strategies. ^aItem number in the original English version. ^bItem 3 had fairly high factor loading on two factors (1 and 3). After consideration of its meaning and level of loading, it was only retained in factor 3 only.

Abbreviation: DMSS, Dementia Management Strategies Scale.

these family caregivers with stable conditions of caregiving distress and dementia symptoms.

Responsiveness of the Chinese version to change in neuropsychiatric symptoms

Among those caregivers caring for a relative who indicated a considerable negative change in symptom severity (ie, change in NPI score >10 ; $n=104$), the observed changes in mean scores of the Chinese version ranged from 9.26 to 15.89 for the overall scale and from 2.45 to 4.12 for the three subscales, and followed the same patterns of changes (negatively) in their NPI total scores ($r=-0.50$, $P=0.005$). In addition, the mean scores of the Chinese version showed moderate effect sizes for detecting an increase in severity of neuropsychiatric symptoms ($n=52$), Cohen's d values were 0.58 for the overall scale and ranged from 0.50 for the subscale "Criticism toward older relative" to 0.60 for "Active management strategies".

Discussion

Sound psychometric properties of the Chinese version of DMSS

While there are few researches on the levels of dementia management strategies in Chinese or Asian families and even Western populations, this study tested and provided evidence on the reliability and validity of a Chinese version of the DMSS in a fairly large sample of 211 Chinese families of people with mild-to-moderate dementia. First of all, the results indicated that the 32-item Chinese version of DMSS demonstrated sound psychometric properties to be a measure of family caregivers' perusal of different strategies in dementia care at home. These strategies included both active and encouraging strategies and criticisms and blame on their older relatives regarding their illness and problematic behaviors. The Chinese version showed very satisfactory semantic equivalences with the original English version in terms of items (kappa values of 0.80–0.94) and overall scale/subscales (ICCs of 0.82–0.93). The test–retest reliability (at 2-week interval) and internal consistency (based on the three-factor structure identified) were high ($r=0.87$ – 0.93 and Cronbach's $\alpha=0.86$ – 0.90 , respectively). Therefore, the Chinese version demonstrated very satisfactory content validity and reliability in the assessment of dementia management strategies among family caregivers, similar to the original English version.^{8–10}

Three-factor solutions identified in the Chinese version

The results of exploratory factor analysis indicated that the Chinese version of DMSS consisted of three domains of management strategies, involving both adaptive and nonadaptive

measures. These three domains included providing encouragement (eg, engaging the relative in discussing their feelings and emotions) and supervision, active management strategies (eg, better arrangement of safe and stimulating environment and diversion of attention away from feeling upsets), and, in contrast, soliciting criticisms toward their dementia relative (eg, yelling, acted enraged, and threatened the care recipient). This three-factor model was found similar to the results of factor analysis on the original English DMSS among 152 family caregivers in New York.⁶

However, compared with the original version of DMSS, the three factors identified from the Chinese version contained more items (ie, each factors had extra one to two items), presenting with moderately higher levels of item scale, between factors and factor-scale correlations ($r=0.49$ – 0.65 vs $r=-0.35$ – 0.54) and explained a higher percentage of total variance (72% vs 60%). Therefore, the Chinese version may demonstrate higher and more clear-cut factor loadings to the three-factor solutions, indicating its better factor structure in this Chinese sample than the original version tested in the US population. In addition, this result reinforced the findings of Hong et al²² in 330 Singapore Chinese family caregivers (using the original English version) that the similar three-factor solutions of dementia management strategies might be the best fit in classifying the types of family caregiving and coping styles in dementia care among Chinese populations across countries. In addition, the Chinese version was shortened from 34 to 32 items, and all items were embedded into one of the three-factor solutions separately with better (and moderate) item-scale correlations than the original version.

Similar to the theoretical basis of the original DMSS, the three-factor model identified from this Chinese version can also be explained by the coping theories (eg, Folkman and Lararus's theories of Cognitive Appraisal and Coping with Stress).^{14,23} This similarity between the two versions indicate that the conventional coping and caregiving styles adopted by Western families may be applicable to those adopted by the Chinese family caregivers. Nonadaptive strategies measured with the subscale "Criticism toward older relative" can reflect the family caregivers' excessive emotions and negative attitudes toward dementia, which are common to or coincided with those Chinese families in caring for people with other serious mental health problems,^{21,23} and also found harmful to the caregivers' physical and psychological well-being,¹⁰ whereas the other two adaptive strategies (ie, encouragement and active management) may indicate the use of conventional and positive problem-focused coping styles such as using directive or environmental structuring

and emotional support and stimulations among these Chinese caregivers for dementia care.^{6,7}

With this Chinese version, both adaptive and nonadaptive strategies used by family caregivers of people with dementia can be measured. The measurement results can reveal the situational specificity and multidimensional nature of dementia management strategies adopted by these family caregivers. In addition, these strategies may capture the caregivers' cognitive and behavioral patterns of interactions with their relatives with dementia in their home environment and their changes or improvements over time, which can be considered and measured as one of the outcomes for family intervention focused on caregivers' coping and problem-solving strategies in dementia care.^{6,23}

Reproducibility and responsiveness of the Chinese version in relation to changes in neuropsychiatric symptoms

The Chinese version of DMSS indicated a satisfactory reproducibility in terms of its total and subscale mean scores in those caregivers of a dementia relative with relatively stable mental and behavioral conditions (ie, neuropsychiatric symptoms) at a 6-month interval. Indeed, there is no evidence on the stability of DMSS in assessing dementia management strategies among family caregivers. This result reveals that if the mental condition of the dementia relative remains stable, the Chinese version can be reliable to assess the types and levels of these caregiving strategies consistently over a reasonable period of time.^{21,22} This also coincides with the satisfactory test–retest reliability at 2-week interval found in this study.

In addition, the Chinese version showed a very satisfactory responsiveness to changes (or deterioration) in neuropsychiatric symptoms of dementia sufferers with moderate effect sizes over 6 months. As suggested by previous research, the ways that caregivers' manage the problematic behaviors presented by the dementia sufferers can be an important predictor of the progress of dementia,^{5,6} as well as their success in coping with caregiving.^{13,23} It is noteworthy that these changes in management strategies and level of distress among the caregivers may be not only related to the changes in severity of neuropsychiatric symptoms but also resulted from training received by these caregivers in coping with dementia caregiving.²² Relationship between changes in caregiving strategies and levels of symptom severity in dementia care should be further investigated. Indeed, active management strategies (ie, effect size =0.60) and positive encouragement (ie, effect size =0.56) in the Chinese version increasingly adopted by these caregivers to manage dementia

symptoms may be useful in both improving better family functioning and well-being and stabilizing the behavioral and mental conditions of the relatives with dementia.^{5,6,23}

The abovementioned satisfactory results on the reliability and validity and factor structure of the Chinese version of DMSS support the recommendations by the original authors Hinrichsen and Niederehe⁶ that the DMSS (and the Chinese version) can be a reliable and valid instrument to measure the levels of dementia management strategies adopted and self-reported by family caregivers. With an increasing emphasis on understanding about the functioning and well-being of families in taking care of a relative with dementia, this validated Chinese version of DMSS can be applied to community mental health care service for assessment of environmental and psychosocial strategies used by family caregivers in dementia care, with consideration of limited time, resources, and/or available measuring tools.⁵⁻⁷

Levels of three approaches to dementia management strategies among caregivers

From the mean scores of the validated Chinese version of DMSS in this study, the family caregivers reported moderate levels of dementia management strategies used (ie, 109.89 ± 15.12 in these 211 caregivers, whereas possible score range 32–160). In terms of the three management approaches (ie, criticisms, active management strategies, and encouragement toward their dementia relative), similar moderate levels of all three approaches to dementia care were also found to be adopted by these family caregivers. While a wide variety of dementia management strategies can be adopted, family caregivers may employ varied amounts/levels of adaptive and nonadaptive ones according to their caregiving styles.^{24,25} Fewest strategies were used in subgroups of these caregivers such as male, sibling, or parent and those perceived current health condition is worse than 1 year ago, suggesting a more passive attitude or apathy and low involvement in dementia care among these subgroups.²² As suggested by Hong et al²² those caregivers who presented with fewer management strategies (ie, both adaptive and nonadaptive ones) may be more devolved from providing direct care and less likely to experience caregiving distress and burden but on the other hand, fewer gains from caregiving. However, there are limited studies to examine levels of dementia management strategies and their correlates, or an optimal balance between adaptive and nonadaptive approaches to caregiving, in attending the demands for dementia care.^{13,23} The findings in this study may provide a basic understanding, and a valid tool, for further investigation of the ways and extents how different approaches to

family caregiving can attend to dementia sufferers' unmet needs and challenging behaviors, as well as their caregivers' psychosocial adjustments and well-being.

Limitations and implications

There were a few limitations of this study. First, this study only used the family caregivers' self-reports of their management strategies. In contrast with more objective observational studies, it could be that the caregivers' responses or ratings on their own usage of caregiving strategies are likely unreliable due to subjective biases or social desirability. The correlations found between the mean scores of DMSS and other psychosocial measures used in this study would be artificially inflated.^{23,24} Other psychosocial measures such as self-efficacy and competence in caregiving should also be added to validate or countercheck with the self-report results for this scale.

Second, although the sample in Phase II of this study was randomly selected from the client lists, the participants were still selective due to the caregivers being recruited from two community care centers only, where similar socioeconomic backgrounds and mental health care services were found. In addition, most of the families recruited were well-educated, middle-class people who might be motivated to participate and Hong Kong born Chinese, whereas their relatives had <2 years duration and mild-to-moderate levels of dementia. Therefore, such testing of the psychometric properties of the Chinese version should be replicated in larger family samples with diverse sociodemographic and clinical backgrounds of both caregivers and dementia relatives.

Third, an early and still-prevalent rule of thumb (ie, five subjects per item) used in estimating the sample size for exploratory factor analysis in this study may not be adequate to determine whether or not the factor structure and the individual items' loading on each factor are valid. With a larger pool of study population, not less than ten subjects per item should be considered to ensure very small percentage of items being misclassified on the wrong factor, as well as very low errors in factor loadings.²⁶

Finally, confounding factors influencing caregiving for dementia such as the use of psychotropic medication and mental health care services by both these family caregivers and their dementia relatives were not considered when evaluating the validity of DMSS in this study. Further testing of the three-factor model of the Chinese version and comparing the constructs with the ones proposed by the original authors are recommended, using the confirmatory factor analysis. Evaluation of the concurrent and/or convergent validity of

the Chinese version with valid measures on coping styles such as Ways of Coping Checklist or Coping Strategies Inventory^{24,25} is recommended to provide stronger evidence on the degree to which the operationalization of the Chinese version correlates with other measures that it is theoretically predicted to correlate with.¹¹

This self-report Chinese version has the advantages that they are easily administered and repeated measurements and require minimal training and relatively simple interpretations from the caregivers' own perceptions. This Chinese version can be applied to mental health practice for better understanding and measuring the levels of caregiving strategies in families of dementia populations. A universal model of the construct of dementia management strategies and its relationships with and effects on neuropsychiatric symptoms, familial burden and functioning, and other family and patient variables may contain not only the three-factor model suggested by the original authors of DMSS but also the influence of cultures and other illness-related variables.

Conclusion

The findings of this study support the fact that the translated Chinese version of DMSS can be a reliable and valid measuring tool for family caregivers of Chinese people with dementia. The Chinese version indicated very satisfactory levels of content validity, semantic equivalence with the original English version and reliability (internal consistency and test-retest reliability). The 32-item finalized version also showed moderate effect sizes for detecting changes in neuropsychiatric symptoms and demonstrated a three-factor structure, accounting for about 72% of the total variance of dementia management strategies used by the caregivers. Overall, the family caregivers in this study reported moderate levels of dementia management strategies. The validated Chinese version can be further tested in various types and duration of dementia, as well as among different Chinese or Asian communities.

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Disclosure

The author reports no conflicts of interest in this work.

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