

**An examination of the validity and reliability of the Caregiver Reaction
Assessment Scale among Japanese family caregivers for older members**

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Abstract

Objectives: Recent studies suggest the need to adjust the construct of the Caregiver Reaction Assessment Scale among the family caregivers according to different social norms and differential public services. The aim of this study is to examine the reliability of the original five-subscale CRA and to evaluate the four-subscale CRA proposed by Malhotra, Chan, Malhotra, and Ostbye (2012) among the Japanese family caregivers of old people. **Method:** I conducted confirmatory factor analysis of the original Given's Caregiver Reaction Assessment scale among Japanese family caregivers for older persons and found its fit to be less than satisfactory. I then conducted exploratory factor analysis and modified CRA scale for a better fit.

Results: The second confirmatory factor analysis of a modified four-factor CRA model, similar to the one developed by Manhotra et al., (2012), showed an acceptable fit. Furthermore, I checked group invariance between the two important groups of family caregivers in Japan— married women caring for parents-in-law and women caring for own parents—and confirmed configural and metric invariance of the modified (18-item four-factor) scale.

Conclusion: Thus I believe my 18-item four-factor CRA is a good empirical instrument for evaluating both positive and negative effects of informal caregiving in Japan, and possibly in some other countries in Asia.

Keywords: family caregivers, Caregiver Reaction Assessment, confirmatory factor analysis, group invariance, psychometrics

1. Introduction

Today, in every developed country of the world, more elderly people are living longer, often functionally impaired or with chronic illnesses. In most cases, families take care of them as a matter of course, with some members volunteering to serve as primary caregivers. But social, demographic, and economic changes are making it more difficult to continue the practice. At the same time, because of the mounting fiscal demands of an aging society, government often shifts more caregiving responsibility on family.

Naturally, the well-being of both caregivers and care-receivers is important for the family but there are a number of reasons why the burden of caregivers is important for public policy as well. For example, Deeken, Taylor, Mangans, Yabroff, and Ingham (2003) list the following four reasons; (i) patients are more likely to have unmet needs if their family caregiver has a high degree of burden; (ii) increased burden on family caregivers results in increases the use of formal, paid helpers; (iii) higher levels of burden can lead to earlier institutionalization in nursing homes, or readmission to hospitals; and (iv) increased burden has been shown to be detrimental to the caregiver's health. These reasons are all the more important for a country like Japan, which has long term care insurance (LTCI).

In the last two decades, analysis of the well-being of the family caregiver has

made great progress as psychometric instruments have been developed for family caregivers under various circumstances. First to come was the Zarit Caregiver Burden Interview (ZBI) (Zarit, Reever, & Bach-Peterson, 1980) developed for caregivers of family members with senile dementia. The original ZBI consisted of 29 items for the interview, but later self-report instruments such as a 20-item version (Zarit, 1983) and a popular 22-item version (Zarit, Orr, & Zarit, 1985) have been added. In Japan, ZBI was translated into Japanese by Arai and her associates (Arai, Kudo, Hosokawa, Washio, & Miura, 1997), who also developed an eight-question version (Arai, Tamiya, Izumi, & Yano, 2003).¹

The ZBI, however, left a number of unresolved problems in measuring the burden of family caregivers (Abe, 2007; Yamamoto & Wallhagen, 1997). First was the obvious heterogeneity in ZBI items, ranging from the symptoms of older people to the subjective feelings of caregivers. This led to the subsequent separation of the objective measures and subjective measures of the burden (Montgomery, Gonyea, & Hooymen, 1985). Second were the difficulties in capturing the complex feelings of burden in a single dimension. This led to the subsequent development of multidimensional instruments, including the Caregiver Reaction Assessment CRA (Yamamoto &

¹ Since the introduction of long term care insurance in 2000, ZBI is often used by the researchers in nursing science, but application in health economics has been very limited (Kishida & Tanigaki, 2007; Suzuki, Ogura, & Izumida, 2008).

Wallhagen, 1998). Third was the possible need for a flexible instrument to adjust for the different social or communal services provided to older people and their families in different societies or countries.²

Among a number of instruments for assessing caregiver experience subsequently developed, the CRAs (Given et al., 1992) was judged to be ‘well-developed, well-tested, and contains most areas of interest’ (Deeken et al., 2003 p. 937), or to have ‘the greatest potential for quantitatively measuring the subjective experience of caregiving’ in heart failure (Harkness & Tranmer, 2007). The original CRA consists of 24 items, which are broken down to five subscales: impact on schedule (or IS), lack of family support (or LFS), impact on finances (or IF), impact on health (or IH), and caregiver’s esteem (or CE).

Most authors in using CRA emphasized that CRA not only takes into account negative aspects but also positive aspects of caregiver experience. These studies involved family caregivers of cancer patients, often in Europe and in Asia, (Bachner, O’Rourke, & Carmel, 2007; Chen, Chu, & Chen, 2004; Ge et al., 2011; Grov et al., 2006; Kurtz, Kurtz, Given, & Given, 1995; Hudson & Hayman-White, 2006; Misawa

² Malhotra, Chan, Malhotra, & Ostbye (2012) note that ‘there is cross-national variation in societal norms for extent or involvement of family members in providing care to older persons or family members in the use and availability of formal care services and/or caregiver support services. . . . These factors may limit the applicability of the CRA, developed and validated for the use in the US, in other countries.’

et al., 2009; Nijboer, Triemstra, Tempelaar, Sanderman, & van den Bos, 1999), while some were heart failures patients (Luttik et al., 2007; Luttik, Jaarsma, Veeger, Tijssen, & Sanderman, 2008). Only recently have caregivers of the community-dwelling elderly with activity limitations been tested (Malhotra et al., 2012). These authors were mostly concerned with assessing the internal consistency of a part or all of the original 24-item, five-factor model, but some conducted exploratory factor analysis (EFA) or confirmatory factor analysis (CFA) and adjusted several items to different subscales from the original one.

Most recently, Malhotra et al. (2012) observed that ‘studies assessing the validity and/or reliability of the CRA in other countries are neither fully congruent with the original CRA nor with each other’ (Malhotra et al., 2012. p. 1004), and hypothesized that applicability of CRA may be limited by the societal norms on the family caregiving and the availability of formal services and support services. The adjustments in these studies are summarized in Table 1 (Grosv et al., 2006; Hudson & Hayman-White, 2006; Misawa et al., 2009; Nijboer et al., 1999; Persson, Wennman-Larsen, Sundin, & Gustavsson, 2008).

Malhotra et al. (2012) went on to test the validity and reliability of CRA among the family caregivers of community-dwelling Singaporeans aged 75 years or older, and

came up with a modified four-factor (schedule and health, finances, family support, and esteem) CRA with 21 items. They concluded that ‘With the suggested modifications, it is suitable for assessing negative and positive effects of caregiving among informal caregivers of older persons with activity limitations in Singapore.’

2. The study

Recent studies suggest the need for adjusting the construct of CRA among the family caregivers according to different social norms and differential public services (Bachner et al., 2007; Ge et al., 2011; Malhotra et al., 2012). The aim of this study is to examine the reliability of the original five-subscale CRA and to evaluate the four-subscale CRA proposed by Malhotra et al. (2012) for Singaporean family caregivers among the Japanese family caregivers of old people.

3. Methods

3.1 Data: Survey on family caregivers

The data used in this paper were obtained in March 2011 in my annual internet survey of Japanese households practicing informal care for their family members, and also in March 2012 when the same survey was repeated on the responding individuals as in the previous year. The survey questions have been prepared by the author, but the survey

had been conducted by a national marketing survey company on their panel of ‘monitors,’ in the month of March 2006. The company solicited around 5,000 from their list of more than 35,000 individuals (or ‘monitors’) living with someone needing long-term care. These individuals had been chosen separately in each of nine large regions of Japan so as to reflect the national distribution of the elderly population.

The marketing survey company, however, recruits its monitor-households and conducted the survey in the Yahoo Japan portal site. Consequently all the respondents had to be active internet users, which skews the age and sex distribution of our sample caregivers; in general, our average family caregiver is much younger, more often male, more often a child than a spouse, and probably more educated and with higher income than the national average family caregivers (Table 2).

The numbers of individuals responding were 2,491 in 2011 and 1,753 in 2012, which translate to response rates of 46.5% and 56.8%, respectively. Families that are no longer providing long term care because of the death or institutionalization of the member, as well as those caring for two or more family members, are excluded. As a result, the sample size is 1,878 individuals in 2011 and 1,183 individuals in 2012. The number of individuals who consider themselves primary caregivers was 1,164 in 2011 and 697 in 2012, with the rest being secondary caregivers.

3.2 Instruments:

Caregiver Reaction Assessment

The original CRA scale was developed and tested by Given et al. (1992) for caregivers of elderly patients with various disorders. It consists of 24 items and five subscales, standing for correlated but independent dimensions of caregiver burden. ‘Impact on schedule’ (five items) measures the extent to which caregiving interrupts the caregiver’s own daily activities; ‘lack of family support’ (five items) measures the extent to which the caregiver feels that caregiving is exclusively her or his responsibility; ‘impact on finances’ (three items) measures the strain of the costs of caregiving on caregiver and the family; ‘impact on health’ (four items) measures the strain of the caregiving on the physical health of the caregiver; and ‘caregiver’s esteem’ (seven items) measures the positive value attributed to caregiving by the caregiver (Table 3). Regarding a Japanese version of CRA scale, in 2007, I obtained permission to use the CRA in the questionnaire from the Family Care Research Program of Michigan State University, translated the items into Japanese, and tested them in our surveys. After Misawa et al. (2009) was published, I compared their translation (J_CRA) with mine, and found four substantially different items. In my 2010, 2011, and 2012 surveys, I added these four items from their translation to my earlier versions, and chose two of theirs on the basis of Cronbach’s alpha values within each scale to complete my own version (J_CRA_2).

J-ZBI-8

The most commonly used version of ZBI consists of 22 items, each of which is scored on a Likert scale from 0 to 4 (Deeken et al., 2003). In this paper, I use an eight-question version, called J-ZBI-8 score (Table 4) developed by Arai et al. (2003).

The minimum of J-ZBI-8 is 0 and the maximum is 32.

CES-D

The Center for Epidemiologic Studies Depression Scale (CESD) was created in 1977 by Laurie Radloff, and it has been adopted in the U.S. Center for Disease Control's National Health and Nutrition Surveys (Radloff 1977). Each of its 20 items asks the frequency of a symptom usually associated with depression, ranging from depressive moods and physical symptoms to personal relationships. The answers are scored on a Likert scale from 0 to 3 and the total scores (ranging from 0 to 60).

Katz ADL

The Katz Index of Independence in Activities of Daily Living, or Katz ADL, is one of the most widely used instruments for assessing the functional status of older adults in performing activities of daily living independently. Care-receivers are scored yes or no

for independence in each of the six functions (bathing, dressing, toileting, transferring, continence, and feeding). A score of 6 indicates full function, 4 indicates moderate impairment, and 2 or less indicates severe functional impairment (Wallace & Shelkey, 2008).

Time spent for care

We asked the caregivers to select the number of hours spent for caring during a typical day, from a list of eight categories (i.e., almost no time, less than 1 hour, 1~2 hours, 2~3 hours, 3~4 hours, 4~6 hours, half a day, all day). We computed the average hours of caregiving per day, by taking the midpoints of each interval.

Indicator for paid by family

We asked the caregivers about the sources of funds for paying for the out-of-pocket costs of Long Term Care Insurance or other uncovered goods and services needed for the care. We then made up an indicator variable for all the cases where family contributed at least some of these costs.

Self-evaluated burden

We asked the family caregivers to quantify the burden of the care using a Likert scale from 1 to 11. In the choices, the number 1 is noted as ‘no burden at all,’ the number 6 as ‘expected level,’ and the number 11 as ‘an unbearable burden.’

Self-evaluated health

Family caregivers are asked to rate their own health using a Likert scale from 1 to 5. In the choices, the number 1 is noted as ‘not good,’ the number 3 is noted as ‘normal,’ and number 5 is noted as ‘good.’

Indicator for caregiving for in-law relatives

This is an indicator variable for the caregivers who are caring for family members who are neither spouses nor biological parents.

Indicator for secondary caregiver

This is an indicator variable for the individuals who answered that there is another family member bearing primary responsibility for providing care.

3.3 *Statistical analysis*

For all the statistical works in this paper, I have used Stata 12, a statistical package very popular among economists. The sample of each year was randomly divided into equal halves using Stata’s proportion command.

The first half of the sample was subjected to an EFA using the principal factors

method, followed by an oblique rotation. The number of factors to be retained was determined jointly by the value of eigenvalues and by the scree plot. After selecting the appropriate number of factors, factors were rotated, and factor loadings of the full 24 items were examined and compared with the original Given's five-factor model and other preceding works (Ge et al., 2011; Malhotra et al., 2012; Misawa et al., 2009; Nijboer et al., 1999).

The second half of the sample was subjected to a CFA to fit of the original five-factor model with full 24 items. I then modified the CRA on the basis of the preceding EFA of the first part, and carried out a second CFA using the modified CRA, which consists of 21 items with four subscales, and model fit was reassessed.

4. Results

4.1 Descriptive statistics of family caregivers

The socioeconomic characteristics of family caregivers and the descriptive statistics with respect to my instruments are shown in Table 5.

4.2 CFA of five factor-24 item CRA (original CRA)

I will first show the results of the original CRA model using the second half of my sample.

Reliability

The Cronbach's alpha for the 24-item scale was 0.89, indicating 'excellent' internal consistency (Table 6). The alpha values of the subscales, however, pointed to a different problem. On one hand, the alpha values of impact on schedule and caregiver's esteem subscales exceeded 0.85, and those of impact on finance and lack of family support exceeded 0.80. The alpha value for impact on health, however, was only 0.65. This situation was very similar to the one described by Ge et al. (2011), in which 'some items in the subscale do not capture the family caregivers' reaction in the same manner as other items, and should probably be adjusted' (p. 257).

Test-retest reliability of the items

Few studies that have used the CRA instrument reported test-retest reliability, including the latest one by Malhotra et al. (2012). Since I have randomly split the sample into two equal halves, in the second half-sample there are 342 individuals who participated in both surveys. From this subset, I have removed 95 individuals who apparently cared for different persons in 2012. For the remaining 247 individuals, I have computed the means and standard deviations of the sum of the items of each subscale, and the coefficients of correlation across individuals (Table 7). Also, the means, standard deviations, and coefficients of correlation for each item are shown in the same table.

Considering that the second test was given a year after the first one, subscale correlations around 0.80 seem to be good, and each item seems to have reasonable reliability around 0.66.

Construct validity of the original CRA subscales

Correlations of the original five subscales with various selected variables in my survey are listed in Table 8. The construct validity of these subscales is sufficiently supported as in the preceding studies (Malhotra et al., 2012; Misawa et al., 2009; Nijboer et al., 1999). Caregiving hours (CH) and ADL score have the highest (absolute value) correlation with impact on schedule (IH). The JZB-8, CES_D, self-evaluated burden, and self-evaluated health have the highest correlations with impact on health (IH). Paid-by-family has the highest correlation with impact on finance (IF). The indicator for being a secondary caregiver has the highest (negative) correlation with lack of family support (LFS). Caring for relatives in-law (In_Law) has the highest negative correlation with caregiver esteem (CE).

Factor validity.

With respect to goodness-of-fit measures, I have found the original 24-item five-factor model to fall short of the acceptable range, as the other two CFA studies using the East Asian data (Ge et al., 2011; Malhotra et al., 2012) have found. My chi-squared (242, N

= 2121) statistic was 5807.2 ($P = 0.000$), which is not surprising for a sample of this size, but the other goodness-of-fit indices were below acceptable levels, too. Root mean Square error of approximation (RMSEA) was 0.104, comparative fit index (CFI) was 0.80, and standardized root mean squared residual (SRMR) was 0.123.

While all the factor loadings were statistically significant, item 2 and item 5 in IH had rather small loadings (0.121 and 0.255, respectively) as is shown in Figure 1. The variance-covariance structure is characterized by such a high covariance (0.91) between IS and IH that probably justifies the merger of the two subscales.³

Modification indices suggested additional loadings of both item 2 and item 5 (both IH) on IS and CE, item 18 (IH) on IS, and item 15 (CE) on all the other four factors.

Accordingly, I have decided to remove item 15,⁴ item 2 and item 5. I will confirm these findings by an exploratory factor analysis using the other half of the sample.

4.3 Exploratory factor analysis

The result of my EFA using the first half of the sample is listed in Table 9. The top four factors have eigenvalues larger than 1, but the fifth factor has an eigenvalue of only 0.60.

Also each of the top four factors account for more than 10% of the total variation, but

³ On this point, Malhotra et al. (2012) stated that a high correlation ($\rho = 0.63$) between the original IS and IH subscales, and loadings of almost all the items in the two subscales indicated a considerable overlap between them, and merged the two subscales into one subscale ISH.

⁴ Malhotra et al. (2012) found item 2 and item 22 to have low loading values and item 15 to be a complex variable.

the fifth accounts for only 5%. On both accounts, I have chosen four factors, as

Malhotra et al. (2012) have done.⁵

After factor rotation, the loading patterns of these items are reported in Table 10, which follows the style of Table 3 in Malhotra et al. (2012). My Factor 1 consists of all of the items in the original IS subscale and two items in IH subscale (item 8 and item 18). Factor 2 captures the CE subscale, Factor 3 captures LFS subscale, and Factor 4 captures IF subscale without modification.

Incidentally, in their five-factor EFA, Ge et al. (2011) also moved item 8 and item 18 into their Disrupted Schedule, noting that ‘the Disrupted Schedule’ and ‘Health Problems’ factors may be indistinct; this is exactly my Factor 1.⁶

4.4 Four-factor -21 item CRA

In view of the results of my CFA and EFA, as well as those of Ge et al. (2011) and Malhotra et al. (2012), I have decided to move item 8 and item 18 of IH to the combined impact on schedule and health ISH subscale, together with all original items of IS subscales. I dropped the rest of the IH subscale (item 2 and item 5) and item 15 of CE, making our CRA into a 21-item four-factor model.

⁵ On the other hand, Ge et al. (2011) obtained a five-factor model.

⁶ In addition, in their four-factor model, Malhotra et al. (2012) added item 5 to their impact on schedule and health subscale.

Reliability of 21-item CRA

Internal consistency of my modified CRA seems to be quite good. Cronbach's alpha was 0.88 for the whole test, indicating excellent reliability of the 21-item model. As to the subscales, ISH had the highest alpha at 0.91, followed by SE at 0.87, LFS at 0.84, and IF at 0.81.

Factor validity of 21 item CRA

The results of the CFA on my 21-item CRA (without items 2, 5, and 15) using the first half of the sample are shown in Figure 2. Again all factor loadings are statistically significant, and only four items out of 21 had factor loadings less than 0.6, which is slightly better than the results of Malhotra et al. (2012).

The adjustments improved the goodness of fit considerably; chi square statistics were down to 2708.8 ($df = 183$ $p = 0.0000$), RMSEA was reduced to 0.081, CFI increased to 0.895, and SPMR was reduced to 0.071. As a result, these goodness-of-fit indices are now in the 'acceptable' range (Brown, 2006, pp. 151–156).

Covariance between the subscales are 0.47 between ISH and IF, 0.602 between ISH and LFS, -0.123 between ISH and CE, 0.372 between IF and LFS, -0.207 between IF and CE, and -0.176 between LFS and CE.

To show the construct validity of the four-factor model, correlations of the four

subscales with selected variables in my survey data are listed in Table 11. Hours of caregiving per day, self-rated health, and CES-D are correlated with ISH, indicator variable of caring for in-law relatives (In_Law) is negatively correlated with CE, indicator of caregiver's family paying for the long-term care costs (Paid) is correlated with IF, and the indicator for the secondary caregivers (Secondary) is negatively correlated with LFS.

5. Discussion

Although my 21-item four-factor RCA model shows decent overall fit, it is still not free of some 'local strains.' First of all, observation of the modification indices suggests additional loadings of both item 1 (in ISH) and item 3 (in LFS) with CE subscale. In order to avoid double loadings, hence, we may want to drop these two items.

From the practical point of view, group invariance of CRA is quite important for a psychometric test. In particular, as several authors have argued (Asai & Kameoka, 2007; Yamamoto & Wallhagen, 1997, 1998), many Japanese family caregivers provide care more as a family responsibility than as a personal responsibility.⁷ Caring for

⁷ 'Under the influence of Chinese traditional Confucianism, if an individual is sick, it is the responsibility of the family members to take care of them. For the spouse, it is a "hand-in-hand" responsibility; for children, it is a filial piety; for siblings, it is a blood relationship; for parents, it is "perfect love."' (Ge et al., 2011, pp. 257–258). In Japan, such classic Confucianism is losing ground rapidly among the daughters-in-law now, who would rather look after their own parents than parents-in-law.

parents-in-law has traditionally been imposed on women married to the oldest son. I have already shown that CE (caregiver's esteem) subscale of CRA is negatively correlated with the indicator for those caring for in-law relatives, but how about the other subscales? Do the items of the modified CRA have the same factor structure and same factor loadings in these two heterogeneous groups?

For this purpose, I have selected women caring for their own parents and women caring for parents-in-law in my second-half sample. The descriptive statistics of these two groups of women are listed in Table 12. The most conspicuous difference between these two groups is the proportion of the married women: almost everyone in in-law group is married, but fewer than half of women caring for own parents are married. Using this subset data and Stata's sem command with group option and other options, I have estimated the following sequence of CFA models for each subscale:

Model 1. Free parameters for each group.

Model 2. Common loadings for both groups.

Model 3. Common loadings and intercepts for both groups.

The results of this sequence of estimations are listed in Table 13. First of all, in all four subscales, 'goodness of fit' statistics of my four-factor CRA model are comparable in both groups, establishing configural invariance. Second, the fit

deteriorated only slightly when I imposed the restriction of equal loadings in these two groups, establishing metric invariance, except in CE. In CE the fit deteriorated significantly by the assumption of common slope, but when I removed item 12 ('I feel privileged to care for'), I could secure the invariance of loadings across these groups. Third, however, the fit deteriorated significantly in LFS and CE when I imposed the equality of intercepts, suggesting the differential means of some of the items between these two groups. In contrast, I could not rule out the null hypothesis of common intercepts in ISH and IF. Thus, I have at least comparable changes in my subscales for a given change in my latent variables among these two heterogeneous groups.

The results of the CFA on my 18-item CRA (without items 1–5 and item 12 of the original 24 items) using the same sample are shown in Figure 3. All factors loadings are statistically significant, and all but one item (item 22) out of 18 had factor loadings less than 0.6 (0.54). The goodness-of-fit indices improved even further; RMSEA was 0.075, CFI increased to 0.920, and SRMR was down to 0.059. Except for chi square statistics ($df = 129$, $\chi^2 = 1680$ $p = 0.000$), they all indicate good fit.

6. Conclusions

Although it is important to utilize standardized scales for better cross-national

comparisons of the effects of caregiving, as Malhotra et al. (2012) pointed out, it is equally important to adjust the scales so as to assess negative and positive effects of caregiving as precisely as possible in each country.

In an attempt to strike the best balance, I have first conducted CFA and examined the fit of the original five-factor 24-item CRA among the Japanese family caregivers of the elderly. After finding the fit of the original CRA model to be less than satisfactory, I have conducted EFA, and then CFA, and come to the conclusion that the modified four-factor CRA model provides an acceptable fit. In the process, I had deleted three items, as they did, two of which are identical.

Furthermore, I also checked group invariance between the two selected groups of women, one caring for parents-in-law, the other caring for natural parents, and confirmed configural and loadings invariance of the modified (18-item four-factor) instrument without item 12. Thus my 18-item four-factor CRA seems to be a good empirical instrument with which to evaluate the positive and negative effects of caregiving in Japan, and possibly among family caregivers in East Asia.

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Table 1. Summary of works on the Caregivers Reaction Assessment instrument

Study	Sample size	Care-receiver	Caregiver	Mean age (yrs)	Female (%)	Spouse (%)	Anal.	Model	Factor structures
Given, et al., 1992	377	267 cancer patients 64+; 110 Alzheimer's patients 55+ Colorectal cancer surgery patients from 10 hospitals with survival estimate of 6+ months	Family member providing most of care	Cancer 55.1; Alz. 63.1.	Cancer 81.4; Alz. 64.1	Cancer 55.4; Alz. 79.0	EFA & CFA	Original 24-item 5-factor	CE (12, 15, 19, 21, 10, 4, 6), LFS (13, 11, 3, 9, 17), IS (1, 7, 20, 14, 16), IF (22, 23, 24), IH (18, 8, 5, 2)
Nijboer et al. 1999	181	Metastatic cancer patients with survival estimate of 4+ months	Partner	55-65 (46), > 65 years (43)	65.0	100	EFA	Five-factor 24 items	CE (10, 19, 12, 6, 4, 15), IS (14, 20, 7, 16, 1; 8, 5, 18), LFS (13, 11, 17, 9, 3), IF (23, 24, 22; 21, 3), IH (2, 8, 5, 18)
Grov et al. 2006	85	Metastatic cancer patients with survival estimate of 4+ months	Primary caregiver	55.7	47.1	80	EFA	Five-factor 24 items	CE (12, 15, 19, 10, 4, 6, 5, 2), LFS (11, 3, 9, 17), IF (22, 24, 23), IS (1, 7, 20, 14, 16, 18, 8), F5 (19)
Hudson & Hayman-White, 2006	106	Cancer patients receiving home-based palliative care at one hospital in Australia		n.a.	n.a.	n.a.	EFA	Five-factor 17 items (items 3, 4, 5, 7, 10, 16, 18 excluded)	CE (6, 12, 19, 10, 4, 21), LFS (11, 17, 13, 3), IS (7, 20, 14), IF (23, 24), IH (5, 2)
Bachner O'Rourke, & Carmel, 2007	236	Cancer patients of four hospitals in Israel	Care-givers w. relative dying of cancer at 59 + yrs in past yr	55.37	77.5	45	EFA & CFA	Five-factor 17 items (substantial changes in items and factors)	n.a.

Misawa et al., 2009	57	Community-dwelling advanced cancer patients (> 20 years)	Primary family caregiver	57	77.0	52	EFA	Five-factor 18 items (items 2, 3, 5, 15, 22 and 18 excluded)	IS (1, 7, 14, 16, 20), CE (6, 12, 19, 10, 4), LFS (11, 17, 13, 9), IH (8, 18), IF (23, 24)
Ge et al., 2011	312	Cancer patients (lukemia 40.1%, gynecological 36.2%, colon 9.3%, lung 8.3%, breast 6.1%)	Primary family caregiver	46.6	51.3	50	EFA & CFA	Five-Factor 24 items	IS (1, 7, 8 , 14, 16, 18 , 20), LFS (3, 9, 11, 13, 15 , 17), IH (2, 4 , 5), IF (22, 23, 24), CE (6, 10, 12, 19, 21)
Persson, Wennman- Larsen, Sundin & Gustavsson, 2008	209	Malignancy (151 patients), dementia (12), impairment (42), unknown disease (4)		60	55.5	78	EFA & CFA	Five-Factor 23 item (item 12 excluded)	IH (18, 8, 5, 2) CE (12, 15, 19, 10, 4, 6), IF (22, 23, 24), LFS (13, 11, 3, 9, 17), IS (7, 20, 14, 1, 16)
Malhotra et al., 2012	1211	Community-dwelling Singaporeans 75 + receiving assistance for at least one ADL	Primary informal caregiver	55.6	60.2	16	CFA & EFA	Four-Factor 21 items (items 2, 15, and 22 excluded):	IFS (1, 7, 14, 16, 20, 5, 8, 18), IF (24, 23), LFS (3, 9, 11, 13, 17), CE (4, 6, 10, 12, 19, 21)

Note: Numbers after the factor name stand for item number adopted by Nijboer et al. (1999). Item numbers in boldface type stand for out-of-place loadings in the original CRA instrument.

Table 2. Biases in the age distribution of family caregivers (percentage of sample)

Age of caregivers (years)	National Survey (2010)			Author's sample (2011)		
		Male	Spouse		Male	Spouse
Less than 40	2.9	1	0.1	20.3	8.9	0.5
40~49	8.3	2.9	0.2	29.4	13.6	1.3
50~59	26.6	6.9	1.8	32	14.1	1.7
60~69	29.3	7.5	8.8	15.7	7.5	2
70~79	20.6	6	17.2	2.4	1.7	1.5
More than 80	12.3	6.3	11.8	0.2	0.2	0.2
Total in sample	100.0	30.6	40.1	100.0	46.1	7.2

Note: Data are from Comprehensive Survey of Living Conditions (2010).

Table 3. Caregiver Reaction Assessment instrument

FCRP ^a item number	Nijboer's item number	Items
1	12	I feel privileged to care for ____.
2	13	Others have dumped caring for ____ onto me.
3	22	My financial resources are adequate to pay for things that are required for caregiving. ^b
4	1	My activities are centered around care for ____.
5	18	Since caring for ____, it seems like I'm tired all of the time. It is very difficult to get help from my family in taking care of
6	11	_____.
7	15	I resent having to take care of ____. ^b
8	7	I have to stop in the middle of work.
9	19	I really want to care for ____.
10	8	My health has gotten worse since I've been caring for ____.
11	20	I visit family and friends less since I have been caring for ____.
12	21	I will never be able to do enough caregiving to repay ____.
13	3	My family works together at caring for ____. ^b I have eliminated things from my schedule since caring for
14	14	____. ^b
15	5	I have enough physical strength to care for ____. ^b
16	9	Since caring for ____, I feel my family has abandoned me.
17	10	Caring for ____ makes me feel good. The constant interruptions make it difficult to find time for
18	16	relaxation.
19	2	I am healthy enough to care for ____. ^b
20	4	Caring for ____ is important to me.
21	24	Caring for ____ has put a financial strain on the family. My family (brothers, sisters, children) left me alone to care for
22	17	_____.
23	6	I enjoy caring for ____.
24	23	It's difficult to pay for ____ 's health needs and services.

^a From the Family Care Research Program, Michigan State University.

(<http://www.thecarenet.ca/docs/CaregiverReactionAssessmentForm.pdf>)

^b These are reverse score items.

Table 4. J-ZBI_8 Items (Arai et al., 2003)

Original Zarit item number	Factors ^a	Items
4	P	I feel embarrassed over his/her behavior.
5	P	I feel angry when I am around the person I care for
6	R	I feel that he/she currently affects my relationship with other family members or friends in a negative way.
9	P	I feel strained when I am around the person I care for. I feel that my social life has suffered because I am caring for this person.
12	R	I feel uncomfortable about having friends over because of him/her.
13	R	
18	P	I wish I could leave the care of this person to someone else.
19	P	I feel uncertain about what to do about the person I care for.

^aFactor P is J-ZBI_8 'personal strain'; Factor R is J-ZBI-8 'role strain.'

Table 5. Socioeconomic characteristics of my survey samples

		Survey year		Total
		2011	2012	
Sample Size		1878	1183	3061
Caregivers				
Male (% of sample)		0.470	0.505	0.484
Age (years)	mean	48.90	50.70	49.60
	sd	11.10	10.95	11.10
Relationship (% of sample)				
Spouse		0.081	0.072	0.077
Parents		0.597	0.643	0.615
Parents-in-law		0.092	0.076	0.086
Grandparents		0.045	0.034	0.041
Others		0.144	0.128	0.138
Primary Caregiver (% of sample)		0.380	0.411	0.392
Married (% of sample)		0.567	0.572	0.569
Education (% of sample)				
High school		0.323	0.330	0.326
College or more		0.629	0.631	0.630
Other		0.048	0.039	0.048
Care-receivers				
Male (% of sample)		0.312	0.307	0.310
Age (years)	mean	74.700	77.000	75.600
	sd	18.800	16.900	18.100
Care need (% of sample)				
Independent		0.022	0.015	0.019
Support 1		0.063	0.060	0.062
Support 2		0.089	0.093	0.091
Grade 1		0.156	0.141	0.150
Grade 2		0.177	0.199	0.186
Grade 3		0.158	0.158	0.158
Grade 4		0.106	0.115	0.109
Grade 5		0.096	0.111	0.102
Non-certified		0.132	0.108	0.123
Instruments				
CRA Scale	mean	68.40	68.10	68.30
	sd	10.10	10.40	10.20
JZBI_8	mean	21.90	21.40	21.70
	sd	7.00	6.90	7.00
CES_D	mean	20.00	19.10	19.70
	sd	10.80	10.70	10.80

ADL	mean	2.30	2.10	2.20
	sd	2.20	2.10	2.10
Care hours	mean	2.71	2.81	2.75
	sd	2.76	2.89	2.81
Paid by family	mean	0.42	0.38	0.41
	sd	0.49	0.49	0.49
Self-evaluated burden	mean	6.06	6.09	6.07
	sd	2.42	2.42	2.42
Self-evaluated health	mean	2.92	2.86	2.90
	sd	0.87	0.86	0.86
In_law	mean	0.16	0.14	0.15
	sd	0.37	0.35	0.36
Secondary	mean	0.30	0.33	0.31
	sd	0.46	0.47	0.46

Table 6. Internal consistency of original CRA scale (2121 observations)

Subscales	Cronbach's alpha
Impact on schedule	0.876
Impact on health	0.654
Impact on finance	0.805
Lack of family support	0.834
Caregiver's esteem	0.863
Overall CRA scale	0.894

Table 7. Results of test-rest by item (N = 247)

Subscales	Items	Mean		Sd		Corr. Coeff.
		2011	2012	2011	2012	
IS		16.186	16.117	4.279	4.517	0.772
	Item 1	3.251	3.263	1.109	1.100	0.669
	Item 7	3.109	3.202	1.040	1.122	0.584
	Item 14	3.547	3.449	0.957	1.010	0.624
	Item 16	3.032	3.065	1.096	1.132	0.673
	Item 20	3.247	3.138	1.155	1.178	0.644
IF		8.223	8.332	3.003	3.129	0.794
	Item 22	2.980	2.976	1.231	1.220	0.568
	Item 23	2.619	2.672	1.094	1.152	0.710
	Item 24	2.623	2.684	1.183	1.195	0.709
LFS		12.267	12.328	4.272	4.528	0.855
	Item 3	2.741	2.733	1.122	1.141	0.702
	Item 9	2.032	2.077	0.910	0.940	0.691
	Item 11	2.526	2.551	1.147	1.174	0.711
	Item 13	2.405	2.417	1.100	1.137	0.671
	Item 17	2.563	2.551	1.153	1.167	0.730
IH		11.113	11.028	2.982	30.680	0.781
	Item 2	2.389	2.381	0.871	0.875	0.568
	Item 5	2.729	2.668	0.943	0.977	0.639
	Item 8	2.753	2.769	1.122	1.119	0.735
	Item 18	3.243	3.211	1.088	1.121	0.678
CE		20.798	20.672	5.509	5.216	0.848
	Item 4	3.462	3.502	0.936	0.864	0.667
	Item 6	2.324	2.300	0.975	0.967	0.643
	Item 10	2.672	2.696	0.912	0.865	0.553
	Item 12	2.692	2.721	0.995	0.912	0.654
	Item 15	3.526	3.425	1.150	1.197	0.743
	Item 19	2.964	2.838	1.094	1.023	0.663
	Item 21	3.158	3.190	1.124	1.055	0.752
CRA	24 items	68.470	38.590	10.390	9.730	0.816

Table 8. Construct validity of original CRA: Coefficients of correlation with selected variables (N = 2121)

	Hours per day	ADL_ score	Self- evaluated health	Self- evaluated burden	jZ_8	CES_D	In_ law	Paid by family	Secondary caregiver
IS24	0.384	-0.285	-0.309	0.638	0.655	0.453	0.049	0.044	-0.083
IF24	0.099	-0.155	-0.240	0.420	0.442	0.401	0.012	0.257	0.078
LFS24	0.144	-0.082	-0.234	0.436	0.493	0.407	0.074	-0.027	-0.126
IH24	0.305	-0.243	-0.359	0.682	0.725	0.524	0.084	0.035	-0.080
CE24	0.153	-0.076	0.141	-0.314	-0.467	-0.264	-0.215	0.058	0.033

Note. Variables in column 1 are predicted values of the corresponding latent variables in Fig. 1. Figures in boldface type stand for the highest absolute values of coefficients of correlation in each column.

Table 9. Results of Factor Analysis of the original 24 items of CRA scale: Principal factors method

Factor	Factor analysis/correlation			
	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	6.872	3.683	0.534	0.534
Factor 2	3.189	1.706	0.248	0.782
Factor 3	1.483	0.079	0.115	0.897
Factor 4	1.404	0.806	0.109	1.006
Factor 5	0.598	0.132	0.047	1.053
Factor 6	0.466	0.302	0.036	1.089
Factor 7	0.163	0.053	0.013	1.102
Factor 8	0.110	0.022	0.009	1.110
Factor 9	0.088	0.049	0.007	1.117
Factor 10	0.039	0.033	0.003	1.120
Factor 11	0.006	0.040	0.001	1.120
Number of observations		937		
Number of parameters		209		
Retained factors		11		
Rotation: unrotated				

Table 10. Results of EFA: Item factor loadings (rotated factor pattern; N = 937)

Subscale	Variable	Factor_1	Factor_2	Factor_3	Factor_4
IS	Item 1	0.74	0.08	-0.02	-0.04
	Item 7	0.66	-0.09	0.15	0.01
	Item 14	0.78	0.08	-0.02	0.02
	Item 16	0.61	0.00	0.17	0.10
	Item 20	0.73	-0.01	0.03	0.03
IF	Item 22	0.07	-0.07	-0.06	0.63
	Item 23	0.14	0.07	0.08	0.72
	Item 24	0.11	0.15	0.04	0.72
LFS	Item 3	-0.10	-0.17	0.53	-0.02
	Item 9	0.02	-0.01	0.60	0.18
	Item 11	0.11	0.02	0.80	-0.05
	Item 13	0.10	-0.17	0.64	0.02
	Item 17	0.09	0.07	0.81	-0.01
IH	Item 2	-0.15	-0.42	-0.02	0.45
	Item 5	-0.05	-0.39	-0.04	0.44
	Item 8	0.51	-0.13	0.15	0.28
	Item 18	0.70	-0.17	0.11	0.08
CE	Item 4	0.12	0.72	-0.07	-0.07
	Item 6	-0.24	0.73	-0.01	0.11
	Item 10	-0.06	0.57	0.15	0.05
	Item 12	-0.02	0.82	0.02	0.05
	Item 15	-0.17	0.42	-0.43	-0.09
	Item 19	-0.04	0.78	-0.07	0.05
	Item 21	0.04	0.67	-0.06	-0.02
Eigenvalue		4.61	4.47	4.40	3.11
Proportion		0.36	0.35	0.34	0.24

Note: Item numbers in column 2 follow the numbering of Nijboer et al. (1999). The figures in boldface type stand for the largest absolute values for each row (i.e. each item).

Table 11. Construct validity of 21-item four-factor CRA: Coefficients of correlation with selected variables (N = 2121)

	Hours per day	ADL_ score	Self- evaluated health	Self- evaluated burden	jZ_8	CES_D	In_ law	Paid by family	Secondary caregiver
ISH21	0.337	-0.292	-0.355	0.643	0.708	0.492	0.080	0.032	-0.071
IF21	0.156	-0.167	-0.227	0.416	0.434	0.371	0.027	0.257	0.070
LFS21	0.160	-0.098	-0.282	0.428	0.560	0.447	0.112	-0.007	-0.106
CE21	0.182	-0.080	0.156	-0.271	-0.425	-0.252	-0.228	0.058	0.028

Note. Variables in column 1 stand for predicted values of the corresponding latent variables in Fig. 2. The figures in boldface type stand for the largest absolute values for each column.

Table 12. Descriptive statistics of the two groups of female caregivers

		Natural parents	In-law parents	Total
Sample size		808	341	1149
Caregivers				
Age (<u>yrs</u>)	mean	50.139	51.044	50.407
	sd	9.437	8.775	9.251
Primary caregivers		0.719	0.73	0.722
Married***		0.448	0.971	0.56877
Education				
High school		0.339	0.372	0.326
Some college or more		0.622	0.613	0.63
Other		0.039	0.015	0.048
Care-receiver				
Male		0.199	0.199	0.199
Age (<u>yrs</u>)	mean***	78.97	81.55	79.73
	sd	10.59	11.77	11.02
Care need				
Independent		0.016	0.018	0.017
Support 1		0.047	0.047	0.047
Support 2		0.093	0.1	0.095
Grade 1		0.157	0.188	0.166
Grade 2		0.211	0.235	0.219
Grade 3		0.158	0.173	0.163
Grade 4		0.113	0.111	0.112
Grade 5		0.113	0.067	0.099
Non-certified		0.092	0.062	0.083
Instruments				
CRA scale	mean***	70.06	67.3	69.25
	sd	10.25	8.92	9.95
JZBI_8	mean***	22.94	24.9	23.52
	sd	7.09	6.79	7.06
CES_D	mean***	20.57	18.36	19.91
	sd	11.36	10.61	11.18
ADL	mean	2.28	2.11	2.26
	sd	2.11	2.12	2.11
Care hours	mean	3.1	2.94	3.05
	sd	2.84	2.64	2.78
Paid by family	mean	0.365	0.482	0.356
	sd	0.334	0.472	0.479
Self-evaluated burden	mean*	6.41	6.67	6.5

Self-evaluated health	sd	2.36	2.38	2.37
	mean*	2.84	2.94	2.87
Secondary	sd	0.89	0.8	0.86
	mean	0.239	0.234	0.238
	sd	0.427	0.424	0.426

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

|

Table 13. Test results of group-invariance (biological daughters vs. daughters-in-law)

Subscales	18-Items	Model 1: Different slopes, different intercepts		Model 2: Common slopes, different intercepts		Model 2 vs. Model 1
		df	chi 2	df	chi 2	P-value
ISH	7, 14, 16, 20, 8, 18	18	93.05	23	93.61	0.99
IF	22, 23, 24	0	0	2	1.8	0.407
LFS	9, 11, 13, 17	4	9.69	7	13.87	0.249
CE ^a	4, 6, 10, 19, 21	10	36.79	14	40.39	0.463
		Model 3: Common slopes, common intercepts		Model 3 vs. Model 2	Model 3 vs. Model 1	
		df	chi2	P-value	P-value	
ISH	7, 14, 16, 20, 8, 18	28	99.42	0.325	0.173	
IF	22, 23, 24	4	2.6	0.67	0.627	
LFS	9, 11, 13, 17	10	49.08	0	0	
CE ^a	4, 6, 10, 19, 21	18	67.63	0	0	

^a Without item 12 from the 18-item scale.

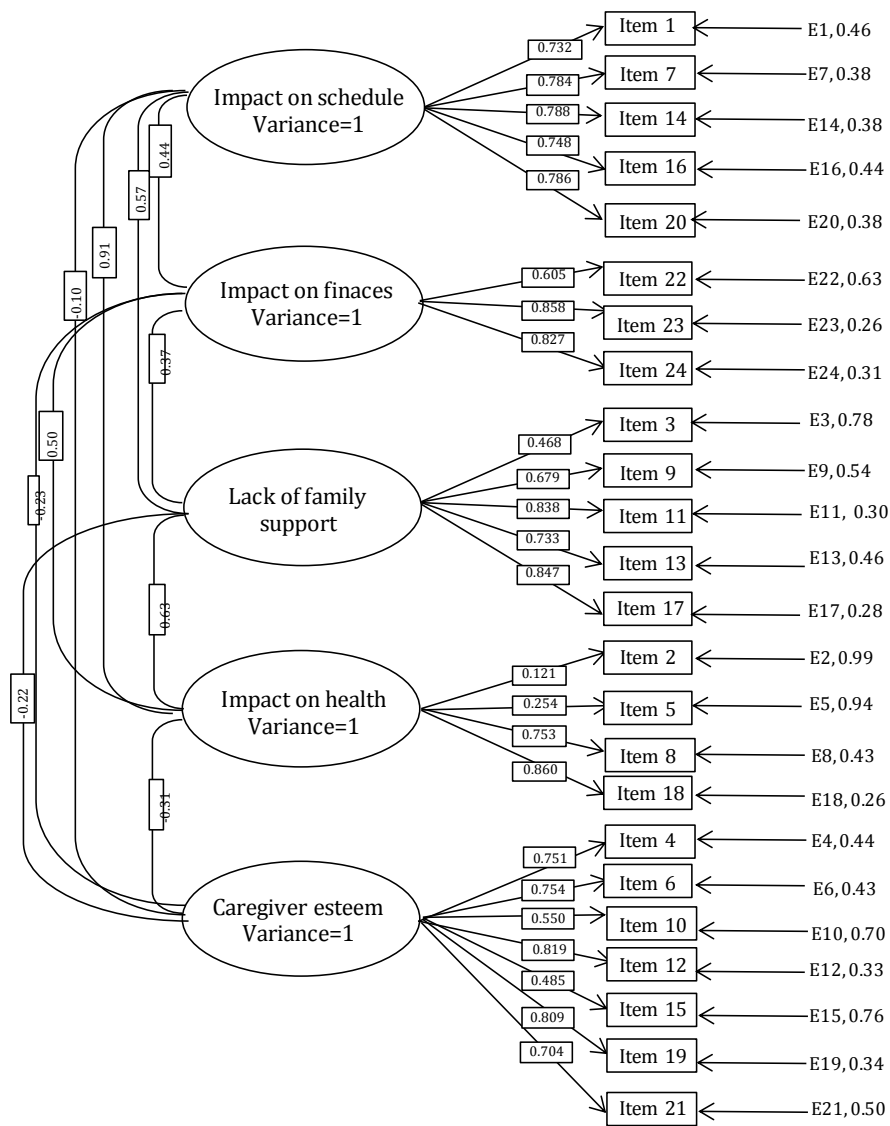


Figure 1. Confirmatory factor analytic model of original five-factor-24 item CRA (N = 2121), maximum likelihood estimates. Numbers on the lines between factors are covariances between the factors, and numbers on arrows from factors to scale items are standardized factor-loading estimates.

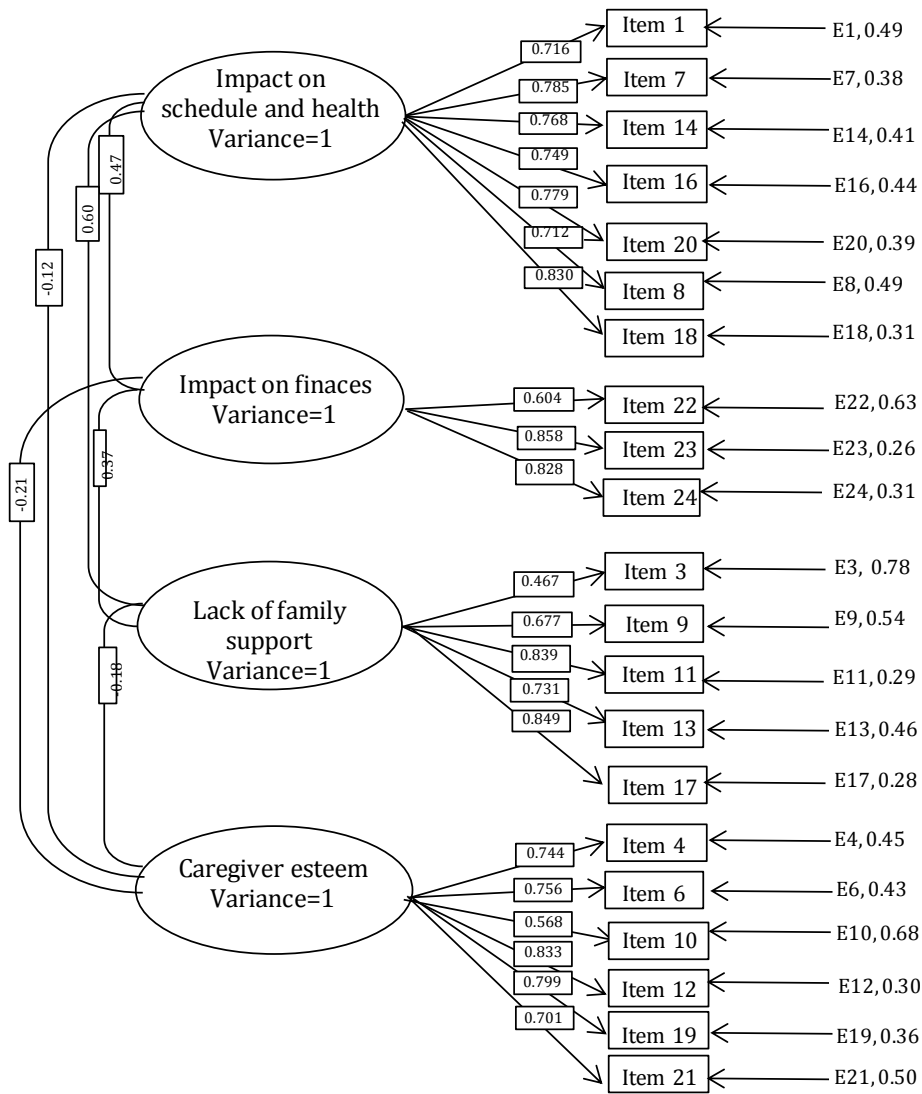


Figure 2. Confirmatory factor analytic model of four-factor-21 item CRA (N=2121), maximum likelihood estimates. Numbers on the lines between factors are covariances between the factors, and numbers on arrows from factors to scale items are standardized factor-loading estimates.

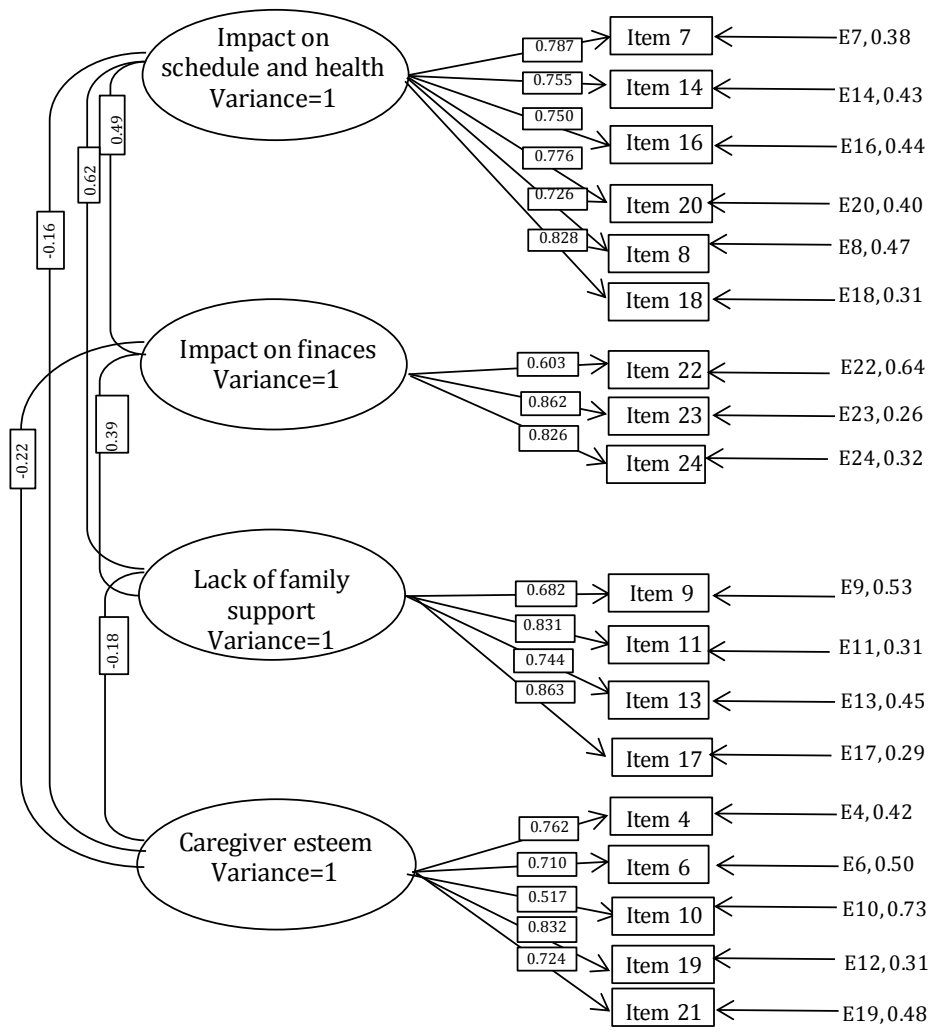


Figure 3. Confirmatory factor analytic model of four-factor 18-item CRA (N=2121), maximum likelihood estimates. Numbers on the lines between factors are covariances between the factors, and numbers on arrows from factors to scale items are standardized factor-loading estimates.