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Title

Investigating the psychometric properties of the Carers' Fall Concern instrument to measure carers' concern for older people at risk of falling at home: A cross-sectional study

Aims

This study aimed to investigate the psychometric properties of the Carers' Fall Concern Instrument (CFC-I) for measuring carers' concern for older people (care recipients) at risk of falling.

Background

Family carers are crucial in preventing older people from falling at home. Their concerns for older people at risk of falling have severe implications on carers' psychological wellbeing and ability to prevent falls. However, there is no validated instrument measuring this concern.

Methods

A cross-sectional study was used to examine the validity and reliability of the CFC-I. Carers looking after older people living at home completed the 17-item CFC-I and provided information about their care arrangements and the older people's fall history. Construct validity was tested using exploratory factor analysis and hypothesis testing. Internal consistency was determined by calculating the Cronbach's alpha coefficient.

Results

143 carers completed the survey either by face-to-face or online. After deleting one item with an item-total correlation of below 0.3, the remaining 16-item CFC-I reported a Cronbach's alpha of 0.93. Construct validity was supported by strong item-total correlations (0.51-0.76),

mean inter-item correlations (0.47), and factor loadings (0.557-0.809). Factor analysis revealed three factors that include concerns about care recipients' health and function, living environment, and carers' perception of fall and fall risk. The 16-item CFC-I can discriminate between carers of older people with and without recurrent (fallen 3/ more times) falls.

Conclusion

The 16-item CFC-I is a valid and reliable scale for measuring carers' concern for the older people's risk of falling. Future analysis of test-retest and inter-rater reliability of the instrument will further support its clinical use for carers.

Implications for practice

The newly developed multi-item CFC-I can be used to quantify the carers' level of fall concern and inform targeted interventions for carers when caring for older people who are at risk of falling.

Keywords

Carers, older people, falls, fall concern, fall risk, fear of falling

SUMMARY STATEMENT OF IMPLICATIONS FOR PRACTICE

What does this research add to existing knowledge in gerontology?

1. Family carers are concerned about older people being at risk of falling at home.
2. The Carers' Fall Concern instrument is valid and reliable for measuring carers' fall concern.
3. Three factors identified contributing to carers' fall concern: care recipients' health and function, care recipients' living environment, and carers' perception of fall and fall risk.

What are the implications of this new knowledge for nursing care with older people?

1. Health care professionals need to consider carers' fall concern when developing fall prevention strategies for older people at home.
2. An individualised fall prevention programme for carers is needed to support carers in managing the older people's fall risk and fall concern.

How could the findings be used to influence policy or practice or research or education?

1. The 16-item CFC-I is recommended to be used as an end-point measure to evaluate the efficacy of fall prevention programme for carers.
2. As a multi-item instrument, the CFC-I can assist health care professionals to prescribe targeted intervention based on the needs of carers.

Introduction

Informal carers such as family or friends are important in providing support to older people (care recipients) in activities such as self-care, household chores, or their mobility at home (Australian Institute of Health and Welfare, 2015). This support often complements the care provided by healthcare professionals and allows the older persons to continue living in their home. The World Health Organisation (2007) recommends the active participation of family carers in falls prevention due to their close involvement in the daily care of the older people. Previous studies have reported that falls among older people, particularly people with dementia, can cause significant care-related emotional difficulty for their family carers (Leggett, Polenick, Maust, & Kales, 2018), and increased caregiver burden (Dow, Meyer, Moore, & Hill, 2013; Kuzuya et al., 2006). Many carers also reported the need for increased home supervision which contributed to a reduction in their personal time for resting and socialising (Faes et al., 2010; Habermann & Shin, 2017).

Besides concerns about the older people's risk of falling again, some carers were frustrated with their care recipients' non-adherence to fall prevention advice (Faes et al., 2010), and risk-taking behaviour (Davey, Wiles, Ashburn, & Murphy, 2004; Dow et al., 2013). Other causes of concern related to the older people who had medical conditions such as Parkinson's disease or dementia that could lead to a gradual loss of cognitive, mobility or functional abilities, contributing to an increasing risk of falling (Faes et al., 2010).

A recent qualitative study further explored the impact of older people's fall risk on carers and their management of fall risk at home (Ang, O'Brien, & Wilson, 2019). The findings revealed that fall concern was not limited to the intrinsic factors related to the older person such as ageing, cognitive and functional decline, or non-compliance to fall prevention advice which

can increase the risk of falling. Concerns also included environmental and social factors, such as the older person living alone, presence of stairs at home and the lack of social support from neighbours or friends. Moreover, the study found that carers of older people who did not have a fall, were equally concerned about their care recipients falling. The carers' choice of fall prevention strategies may vary, depending on the caring relationship, support and knowledge about being able to prevent falls (Ang, O'Brien, et al., 2019).

Family carers need to be well supported to increase their involvement falls prevention for older people at home (Wilkinson et al., 2018). However, this is only possible with greater understanding of the carers' concern about their care recipients' fall risk in order to develop tailored interventions for the older person and their carer. An integrative review was conducted to explore the causes and impact of fall concerns on carers and their fall prevention strategies (Ang, O'Brien, & Wilson, 2020). These findings revealed that carers' fall concern could indirectly affect the fall risk of the older people by undermining fall prevention efforts at home. For instance, excessive concerns regarding the older persons' risk of falling can lead to the unnecessary restriction of the care recipients' activity to prevent falls. Only two studies explored the prevalence of carers' fall concern and these reported that between 58% and 91% of the carers were fearful of their care recipients falling again (Faes et al., 2011; Liddle & Gilleard, 1995). However, the conceptualisation of instruments for measuring carers' fall concern in terms of methodology and design were not described in either study.

A validated measure of carers' level of concern could provide insights into the resources of carers in managing the older people's risk of falling. Increased fall concern may indicate the lack of risk awareness, knowledge, and support in fall prevention (Ang et al., 2020).

Therefore, it can serve as an interval measure for healthcare professionals to assess the need for providing education, skills training, and psychosocial support to carers in preventing falls at home. Furthermore, the association between carers' fall concern and care recipients' risk of falling also means the instrument may serve as a proxy measurement for assessing the fall risk of older people with cognitive impairment.

In a previous study (Phase Two of this study), we developed and conducted preliminary testing of the Carers' Fall Concern Instrument (CFC-I) (Ang, Wilson, & O'Brien, 2019). The CFC-I is a multi-item instrument specifically designed to assess carers' concern for older people's risk of falling and to detect variation in the level of concern based on different situations. To guide the development of the CFC-I, the construct carers' fall concern was defined as the concern among carers regarding older people (with or without falls) being at risk of falling. The findings from the pilot study reported that the 17-item CFC-I had good internal consistency with Cronbach's alpha 0.94 and average inter-item correlation of 0.50. However, the instrument has only been pilot tested on a small sample of 32 carers which is not sufficient to determine the factor structure of the CFC-I. Therefore, the current study (Phase Three) aimed to investigate the psychometric properties of the CFC-I on a larger sample of carers.

Methods

Research design

The CFC-I was developed and tested using an exploratory sequential mixed method design (Creswell & Clark, 2011). The study comprised of three phases and description of the recruitment and data collection process was reported in the protocol paper (Ang, O'Brien, & Wilson, 2018). Phase One included conducting a descriptive qualitative study to identify

factors contributing to the fall concern of carers (Ang, O'Brien, et al., 2019). Phase Two included the development and testing of the pilot instrument. The process of Phase Two development, which described the content and face validity of the CFC-I from the perspectives of experts and carers has also been reported in another paper (Ang, Wilson, et al., 2019). Phase Three involved field testing the instrument by applying the CFC-I on a larger sample of carers.

This paper focuses on Phase Three of the study to investigate the validity and reliability of the CFC-I. The CFC-I was validated following Consensus-based Standards for the selection of health Measurement INstruments (COSMIN) guidelines (Mokkink et al., 2019). We incorporated a cross-sectional study design to investigate the construct validity of the instrument by using factor analysis and hypothesis testing. To determine validity of the CFC-I, it was hypothesised that: a) carers of older people who had fallen will report a significantly higher level of fall concern than carers of older people without falls; and, b) the distribution of items scoring in the CFC-I (factors) will converge with themes from the descriptive qualitative study in Phase One.

Ethical considerations

Phase Three study was conducted between June 2018 and November 2018 and approved by the local health district Human Research Ethics Committee (HREC) with reciprocal approval from the University of Newcastle's HREC. Permission was also obtained from a local research institute and non-government state organisation for carers to recruit participants from the registry or membership list (Ang, O'Brien, et al., 2018). All participants were provided with the participant information sheet which contained the study information,

purpose and procedures before completing the survey. Implied consent was assumed for those who have completed the survey as no personal identifying information was collected.

Instrument after pilot testing

The CFC-I contains 17 items measuring four themes: 1) carers' perception of fall and fall risk, 2) care recipients' behaviour and attitude towards fall risk, 3) care recipients' health and function, and 4) care recipients' living environment that increase carers' fall concern (Table 1). To ensure broad coverage of different situations and to improve the validity of the instrument, eight items were adapted from the Falls Efficacy Scale-International (FES-I) and modified to assess concerns related to the care recipients' health and function, and risk of falling in their living environment (Yardley et al., 2005). The FES-I is the gold standard for measuring fear of falling among older people and reports a Cronbach's alpha and intra-class correlation of 0.96 (Yardley et al., 2005). One item from the fall-related impulsive behaviour scale (FIBS) assessing impulsive falls risk behaviour among older people (Whitney, Jackson, Close, & Lord, 2013), was also modified and adapted in the instrument to measure the care recipients' behaviour and attitudes towards fall risk. Carers were asked to rate the level of their concern about the older people's risk of falling using a five-point Likert scale ranging from 1 to 5 for each item (1 = not applicable/ not at all concerned, 2 = slightly concerned, 3 = somewhat concerned, 4 = moderately concerned, 5 = extremely concerned). The five-point response option was decided by the authors to be most appropriate for carers to discriminate their level of concern meaningfully (DeVellis, 2017).

Participants

Carers who provided support for older people in at least one activity of daily living (ADL) were recruited via convenience sampling. The older person (care recipient) must age 60 years

and above, and living in their own home. However, those who were: 1) paid or professional carers, 2) looking after a care recipient aged below 60 years old, or 3) caring for a care recipient who was wheelchair- or bed-bound were excluded. The carers were recruited from four main study sites: 1) a local research institute volunteer register, 2) a non-government state organisation for carers (membership list), 3) a rheumatology outpatient clinic, and 4) a day rehabilitation centre in a regional hospital. Both the registry and membership list had provided the researchers access to the general population of carers living in New South Wales, Australia. Another two study sites had carers looking after older people who were likely to have had a previous fall at home. The study recruitment information was also published on Facebook pages, websites, and newsletters.

The sample size was estimated following the guidelines of four to ten carers per item required to conduct factor analysis (Kline, 2000). While taking into account possible attrition, the authors aimed to recruit 170 participants (17 items multiplied by 10). Based on the pilot study by Ang, Wilson, et al. (2019), the magnitude of difference in mean CFC-I scores between 24 carers looking after older people who had fallen in the past year (mean = 91.42, standard deviation (SD) = 27.67) and 8 carers looking after older people who did not fall (mean = 74.75, SD = 24.56) was moderate ($d = 0.64$) (Cohen, 1988). With this effect size, a subsample of 40 carers from each group (fallers and non-fallers) would achieve 80% power with a significance level of 0.05 using a two-tailed test (Soper, 2019). In this study, a fall was defined as an unintentional coming to rest on the floor or lower level (World Health Organisation, 2007).

Data collection

Consenting carers were asked to complete the 17-items CFC-I either by face-to-face interview, or online survey. The online survey was administered using Research Electronic Data Capture (REDCap) which is a secure web-based application for developing questionnaires and managing research data (Harris et al., 2009). Carers were also asked to provide their socio-demographic information including age, gender, employment status, relationship to care recipients, history of the older people falling and injury sustained from the fall in the past 12 months, and medical history. For face-to-face interviews, the researcher ensured that the participants had answered all the questions in the CFC-I before collecting the questionnaires. Carers who completed the online surveys were prompted by the REDCap system if they did not complete all the CFC-I questions and were unable to submit their questionnaire. Therefore, no missing data was reported during the analysis of the CFC-I.

Data analysis

The analyses were performed using SPSS for Windows (Version 24.0, IBM Corp, Armonk, NY, USA). Descriptive statistics were used to describe the socio-demographic characteristics. The internal consistency of the CFC-I was determined by calculating the Cronbach's alpha and the overall structure of the modified CFC-I was examined by exploratory factor analysis using principal component analysis with Varimax rotation. Distinct factors of the CFC-I were identified based on the eigenvalue of more than one, scree test, and themes derived from Phase One study (Ang, O'Brien, et al., 2019; Williams, Onsman, & Brown, 2010). The validity of the CFC-I was assessed using independent t-tests to examine between-group differences in total scores according to the study variables. ANOVA with Bonferroni post hoc tests examined score differences among carers of older people who had not fallen, fallen once, twice, and three, or more times.

Results

Socio-demographic characteristics

One hundred and forty-three carers completed the survey. The mean age of the carers was 65.52 years (SD = 12.08), and 107 participants were females (74.8%). The majority of the carers were caring for their spouses (n = 75, 52.4%), followed by caring for their parents (n = 52, 36.4%). The mean age of the older people was 78.63 years (SD = 9.21), and 75 (52.4%) were females. One hundred and two carers (71.3%) reported that the older persons had fallen in the previous year and 86 (84.3%) sustained an injury from the fall. One hundred and ten carers (76.9%) completed the survey face-to-face, while 33 carers (23.1%) completed the online survey. Carers who completed the survey face-to-face were significantly older than those who completed the survey online (mean age = 66.98 versus 60.59 years, $P = 0.008$).

Reliability

The overall internal consistency of the 17-item CFC-I was high with a Cronbach's alpha coefficient of 0.93 and the mean inter-item correlation of 0.43 ranging from -0.01 to 0.74. Item 3 with an item-total correlation of below 0.3 indicated that it could be measuring something different from the overall scale and was deleted (Table 1). The Cronbach's alpha for the remaining 16-item was 0.93, with an improved inter-item correlation of 0.47 (range 0.15-0.74).

Overall Structure

Based on the eigenvalue above one, the factor analysis identified three factors from the 16-item CFC-I, which converged with three of the four hypothetical themes derived from the semi-structured interviews (Table 2). Items assessing concerns about the care recipients' health and function loaded highly onto the first factor which explained 27.0% of the variance.

Items assessing concerns about the care recipients' living environment loaded highly onto the second factor which explained 26.1% of the variance. Two items, that assessed carers' perception of fall and fall risk provided 13.2% of the variance for the third factor. An inspection of the scree plot revealed four factors, however only the first three factors with eigenvalue above 1 were extracted for analysis (Figure 1) (Williams et al., 2010).

Distribution

The mean total 16-item CFC-I score was 47.20 (SD = 16.07) with scores ranging from 19 to 80. The distribution of the CFC-I which was close to normal has a skewness of 0.319 (standard error of mean [SEM] 0.203) and kurtosis of -0.823 (SEM 0.403). The carers used every response such as one to five of the Likert scale in the 16-item CFC-I. Three carers (2.1%) gave the maximum score of 80, and none gave the minimum score of 0 which indicates an absence of floor or ceiling effect (de Vet, Terwee, Mokkink, & Knol, 2011).

Validity

Carers looking after older people with a history of falls reported significantly higher CFC-I scores than carers of older people who did not fall indicating that the 16-item CFC-I has good construct validity (Table 3). Carers who completed the survey online and were below the age of 66 years old also reported significantly higher CFC-I scores. The significant difference in total CFC-I scores obtained by face-to-face interviews and an online survey was probably due to older age carers recruited from the outpatient clinic and day rehabilitation centre at the regional hospital. However, after controlling for age (partial eta squared = 0.038, $p = 0.021$), the methods of administration have no effect on CFC-I scores (partial eta squared = 0.021, $p = 0.091$). Other variables did not reveal any significant differences in CFC-I scores (Table 3).

Analysis of variance with Bonferroni post hoc tests was used to examine between-group differences in CFC-I scores according to the frequency of falls (Table 4). Significant differences in CFC-I scores were reported between carers of older people who did not fall (mean = 40.74, SD = 13.97), fallen once (mean = 42.53, SD = 15.05), fallen twice (mean = 45.78, SD = 13.87), or fallen three or more times (mean = 56.20, SD = 15.68) over the past year ($F_{3,137} = 9.578$, $p < 0.001$). Post-hoc comparisons using the Bonferroni test revealed that the CFC-I scores for carers of older people who fell three or more times were significantly different from carers of older people who did not fall, or fell less than three times in the previous year.

Discussion

This study aimed to test the psychometric properties of the CFC-I on a large sample of 143 carers. The 16-item CFC-I is the first multi-item instrument developed systematically over three phases to measure carers' concern for older people at risk of falling. Compared with the existing single-item questionnaires (Faes et al., 2011; Liddle & Gilleard, 1995), the 16-item CFC-I provides more detail about the carers' level of fall concern in different situations, ranging from the older people's performance of daily activities to the indicators of dangerous environments. Initial validation of the 17-item CFC-I reported internal reliability of 0.93. However, one item measuring carers' concern regarding the older person "not wanting to be assessed for fall risk" was removed because it had an item-total correlation of 0.19, which was below the recommended value of 0.3 (DeVon et al., 2007). The poor fit of this item may have been due to carers being mainly recruited from the outpatient clinic and day rehabilitation centre where the older people had their fall risk assessed during admission. After deleting this item, the Cronbach's alpha of the remaining 16-item CFC-I maintained at 0.93 but reported an improved mean inter-item correlation of 0.47. Overall, the 16-item CFC-

I demonstrated good construct validity with item-total correlations above the recommended range of 0.3 (0.51-0.76) and factor loadings of more than 0.40 (0.557-0.809) (DeVon et al., 2007).

From the factor analysis, only three factors were identified from the 16-item CFC-I that assessed concerns related to the care recipients' health and function, living environment, and the carers' perception of falls and fall risk. This is in contrast to four factors conceptualised from the qualitative findings. Two items: "falling when walking without a walking aid" and "falling when trying to walk without help" which were thought to assess concerns related to the care recipients' behaviour and attitude towards fall risk, were found loading onto the factor for the living environment. It was hypothesised that the older people's behaviour and attitude towards fall risk could be dependent on their environmental awareness. Therefore, they may be unable to take advance precautions if they do not foresee the risks in the environment (Stevenson & Taylor, 2018).

The 16-item CFC-I was able to discriminate between carers looking after older people with and without previous falls. Further analysis revealed that the level of fall concern is only significantly higher for carers of older people who have sustained three or more falls. This finding is consistent with previous studies which found most carers worry about older people having a recurrent fall (Faes et al., 2011; Liddle & Gilleard, 1995). The current study also found younger carers to have significantly higher level of fall concern. This is comparable to another study which revealed carers caring for their parents experienced greater care-related emotional difficulty (Leggett et al., 2018). It was postulated in a previous qualitative study that carers in a parent-child relationship could have a greater disparity in fall risk appraisal than those in spousal relationship (Ang et al., 2020). For example, a child carer may not see

the same fall risk as their parent care recipient due to differences in age and functional abilities, thus resulting in the child carer having a greater concern for their parents falling at home.

Other advantages of the 16-item CFC-I include the non-significant difference in the level of fall concern to caregiving arrangements, normal distribution, and stability across different modes of administration. These advantages appear to show that the instrument is only sensitive to the carers' concern regarding the potential of older people falling. An increase in fall concern may indicate the need for professional intervention for carers, such as fall concern counselling, education on risk identification and strategies in managing falls. The use of CFC-I could encourage the active involvement of carers in implementing suitable fall prevention strategies to effectively reduce the fall rates among older people at home (Wilkinson et al., 2018).

Implications for practice

As a multi-item instrument, the CFC-I can identify different situations contributing to the concern of carers which facilitate the prescription of targeted interventions based on the specific needs of carers. For example, healthcare professionals may refer carers who are concerned about their older people's living environment for ergonomic home assessment or assistance in home modification. The assessment of carers' fall concern may also reveal other underlying issues such as increased caregiving burden, psychological distress, lack of fall risk awareness, or any inadequate knowledge in preventing falls. The multiple issues associated with carers' fall concern also indicates a need for a multidisciplinary healthcare team to manage the needs of carers and the older persons during fall prevention.

Future studies are recommended to determine the relationship of carers' fall concern with other fall risk variables among older people such as gait/ balance, fear of falling, or medications (Rubenstein, Vivrette, Harker, Stevens, & Kramer, 2011). Therefore, healthcare professionals can ascertain if carers have an accurate appraisal of fall risk and take appropriate actions to prevent older people from falling (Ang, Wilson, & O'Brien, 2018). There is also a need to assess the impact of carers' fall concern on other psychological factors such as anxiety and depression among carers, which may have implications on their ability to prevent falls among older people. Lastly, the psychometric properties and feasibility of the CFC-I could be explored in different populations or settings to determine possible cultural influences.

Limitations

Due to poor study responses, the authors were unable to achieve the estimated sample size calculated within the designated recruitment time frame. However, the sample size of 143 participants was found to be adequate for factor analysis (seven times total number of items) and had sufficient power to detect significant differences in the level of concern between carers of non-fallers and fallers (Mokkink et al., 2019). Another limitation of this study was the inability to conduct test-retest reliability and inter-rater reliability for the instrument. However, internal consistency reliability was calculated to determine the correlation of items. The authors also acknowledge that the causes of carers' fall concern are not limited to the items in the CFC-I. However, these 16 items were the most common causes identified by carers for increasing their fall concern in this study. The CFC-I was developed using carers of a general population of older people who were living independently at home with some form of assistance. The findings may not be generalisable to carers of people with lower functioning abilities who are wheelchair- or bed-bound.

Conclusion

Carers' fall concern is a multi-dimensional construct which is affected by the care recipients' health and function, living environment, and carers' perception of fall and fall risk. The CFC-I has been found to provide a simple, yet reliable scale for measuring carers' concern for older people's risk of falling. Currently, there is no multi-item instrument for measuring carers' fall concern. In providing targeted and effective interventions to prevent falls among older people, healthcare professionals are encouraged to assess the fall concern of carers who are looking after older people at home. Addressing carers' fall concern would also help to prevent sequelae of adverse outcomes such as adopting harmful strategies to prevent falls (restraint or restriction), increased caregiving burden, and putting the older person at greater risk of falling.

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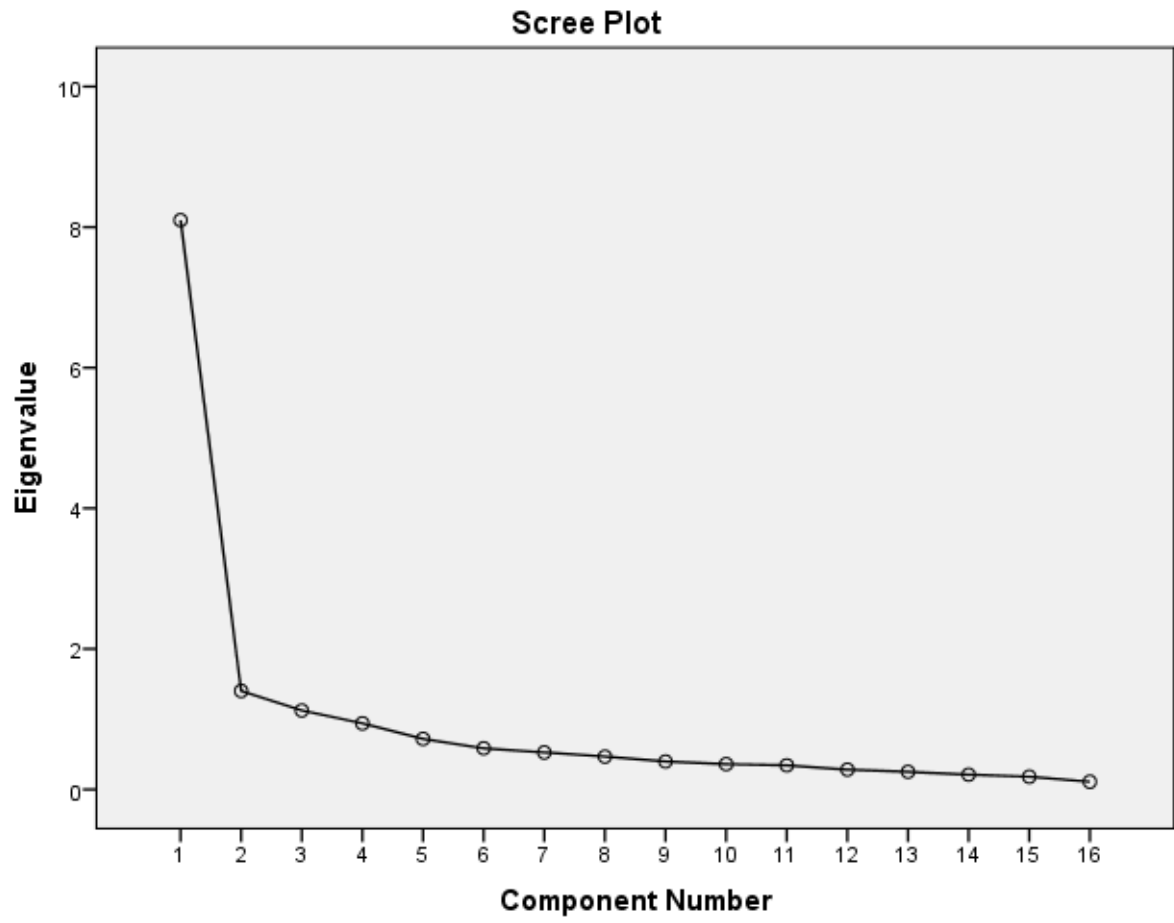


Figure 1. Scree plot

Table 1. Mean, standard deviation (SD), item-total correlation, and alpha coefficient if item deleted

Items	Mean (SD)	Item-total correlation 17-item	Alpha if item deleted 17-item	Item-total correlation 16-item	Alpha if item deleted 16-item
1. Not recovering from a fall	3.50 (1.32)	0.51	0.93	0.51	0.93
2. Requiring extra care and support after a fall	3.41 (1.34)	0.52	0.93	0.52	0.93
3. Not wanting to be assessed for fall risk ^a	1.97 (1.32)	0.19	0.93	-	-
4. Falling when taking a bath or shower ^c	2.58 (1.46)	0.65	0.92	0.64	0.93
5. Falling when getting in and out of a chair or bed ^c	2.44 (1.35)	0.72	0.92	0.72	0.93
6. Falling when using the stairs ^c	2.58 (1.47)	0.59	0.92	0.59	0.93
7. Falling when reaching up or for something on the ground ^c	2.81 (1.36)	0.71	0.92	0.71	0.93
8. Falling when rushing to do things	2.90 (1.40)	0.69	0.92	0.69	0.93
9. Falling when going to the toilet at night	2.50 (1.41)	0.75	0.92	0.75	0.93
10. Falling when at home alone	3.09 (1.42)	0.74	0.92	0.73	0.93
11. Falling when going out alone	2.58 (1.58)	0.52	0.93	0.53	0.93
12. Falling when walking on a slippery surface ^c	3.57 (1.30)	0.72	0.92	0.72	0.93
13. Falling when walking in crowded places ^c	2.76 (1.38)	0.71	0.92	0.71	0.93
14. Falling when walking on an uneven surface ^c	3.61 (1.26)	0.77	0.92	0.76	0.93
15. Falling when walking up or down a slope ^c	3.30 (1.43)	0.69	0.92	0.69	0.93
16. Falling when walking without a walking aid e.g. walker	2.83 (1.66)	0.61	0.92	0.62	0.93
17. Falling when trying to walk without help, when asked not to ^d	2.74 (1.63)	0.64	0.92	0.64	0.93
Overall scale		0.43 ^b (-0.01-0.74)	0.93	0.47 ^b (0.15-0.74)	0.93

^aItem was deleted.

^bMean inter-item correlation (range).

^cItems modified from the Falls Efficacy Scale – International (FES-I).

^dItem modified from the Fall-related Impulsive Behaviour Scale (FIBS).

Table 2. Factor loadings of the 16-item CFC-I

Item	Three factor solution		
	Factor 1: Health and function	Factor 2: Living environment	Factor 3: Carers' perception of fall and fall risk
1. Not recovering from a fall			0.797
2. Requiring extra care and support after a fall			0.801
3. Falling when taking a bath or shower	0.743		
4. Falling when getting in and out of a chair or bed	0.750		
5. Falling when using the stairs	0.663		
6. Falling when reaching up or for something on the ground	0.713		
7. Falling when rushing to do things	0.786		
8. Falling when going to the toilet at night	0.618	0.463	
9. Falling when at home alone	0.533	0.446	
10. Falling when going out alone		0.671	
11. Falling when walking on a slippery surface	0.452	0.661	
12. Falling when walking in crowded places	0.518	0.629	
13. Falling when walking on an uneven surface	0.449	0.656	
14. Falling when walking up or down a slope		0.762	
15. Falling when walking without a walking aid e.g. walker		0.707	0.407
16. Falling when trying to walk without help, when asked not to		0.763	

Table 3. Mean and standard deviation (SD) of the 16-item CFC-I for subgroups based on socio-demographic characteristics (N = 143)

Variables	Group 1	Number	Mean (SD)	Group 2	Number	Mean (SD)	P-value
Administration format	Face-to-face	110	45.65 (15.92)	Online	33	52.36 (15.75)	0.035
Age of carer (years) ^a	<66	70	51.43 (15.08)	≥66	70	43.10 (16.02)	0.002
Gender of carer	Male	36	46.53 (17.47)	Female	107	47.43 (15.66)	0.772
Employment status	Not working	99	45.76 (16.31)	Working	44	50.45 (15.22)	0.107
Caring relationship ^b	Spouse	75	45.83 (15.99)	Parent	52	49.38 (16.15)	0.222
Hours spent caring per week	≤70	58	48.88 (15.17)	>70	85	46.06 (16.66)	0.305
Years spent caring	<8	105	47.50 (15.44)	≥8	38	46.37 (17.90)	0.710
Living with care recipient	No	38	49.53 (15.88)	Yes	105	46.36 (16.14)	0.300
Age of care recipient (years)	<79	68	47.24 (15.90)	≥79	75	47.17 (16.34)	0.982
Gender of care recipient	Male	68	47.56 (16.67)	Female	75	46.88 (15.62)	0.802
Previous falls ^c	No	39	40.74 (13.97)	Yes	102	49.83 (16.22)	0.002
Injury from the fall	No	16	47.38 (13.01)	Yes	86	50.29 (16.77)	0.512
Number of chronic illness	<2	68	45.34 (16.99)	≥2	75	48.89 (15.11)	0.188

^a3 carers did not report their age.

^b16 carers not included (3 caring for siblings, 5 caring for friend, 3 caring for partner, 3 caring for mother-in-law, 1 caring for grandparent, and 1 caring for older child).

^c2 carers were not sure if their care recipients had fallen.

Table 4. Bonferroni-adjusted mean differences of the 16-item CFC-I based on frequency of falls among care recipients

Mean difference	No fall	1 fall	2 falls	3 or more falls
No fall	-	-1.79	-5.04	-15.46***
1 fall	1.79	-	-3.25	-13.67**
2 falls	5.04	3.25	-	-10.42*
3 or more falls	15.46***	13.67**	10.42*	-

*p < 0.05, **p = 0.001, ***p < 0.001.