



Preliminary testing using Mokken scaling of an Italian translation of the Edinburgh Feeding Evaluation in Dementia (EdFED-I) scale



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ABSTRACT

Purpose: To study the psychometric properties of an Italian version of the Edinburgh Feeding Evaluation in Dementia (EdFED-I) Scale.

Background: The EdFED Scale is the only validated instrument that measures difficulty with feeding in older people with dementia. The original English version of the EdFED had three factors measuring: behavioral aspects of feeding difficulty (obstinacy/passivity); indicators of feeding difficulty; and nursing interventions.

Methods: Participants affected by dementia and living in nursing homes ($n = 210$) were selected. Data collectors were trained to observe the residents' eating problems and their food intake. The data were analyzed using Mokken scaling and Pearson's correlation.

Results: The Italian version of the EdFED Scale formed a Mokken scale which correlated in the expected direction with measures of residents' weight, Body Mass Index, time taken to eat, Mini Mental State Examination score and Barthel Index according to the unmet needs model of Cohen-Mansfield.

Conclusions: The EdFED-I shows reasonable psychometric properties and can be used for the assessment of feeding difficulty in Italian samples of older people with dementia. However, further work with larger samples is required to test the utility of the whole range of items and the necessity of their inclusion in the EdFED-I.

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1. Introduction

1.1. Background

Older people with dementia frequently develop problems around mealtimes and in the later stages of dementia there are an inevitable decline in food intake and an increasing difficulty with self-feeding (Watson & Green, 2006). Difficulty with feeding spans a range of aversive behaviors such as refusal to eat, turning the head away and spitting out food, and, ultimately, an inability to swallow food (Watson, 1996). Associated with feeding difficulty in dementia there are profound weight loss and the sequelae of skin breakdown, muscle wastage and emaciation; low food intake compounds the problem and the outcome is very distressing for family and professional carers and dangerous for the person with dementia.

As recent reviews have shown, there is very little evidence for effective interventions to assist older people with dementia to eat (Liu, Cheon, & Thomas, 2014, Watson & Green, 2006). However, there is

some evidence that behavioral and educational methods such as spaced retrieval and Montessori methods (Lin et al., 2010) can help older people with dementia to feed themselves better and to increase body mass index. Crucial to any research in this field is the ability to measure feeding difficulty—i.e. extent and change—and, towards that end, the Edinburgh Feeding Evaluation in Dementia (EdFED) Scale remains the only validated instrument (Aselage, Amella, & Watson, 2011). The EdFED scale has been studied in several forms; the original version had 11 items and the factor structure (Watson, 1996) and the scaling properties (Watson & Deary, 1994) of the EdFED scale in English have been analyzed. The EdFED Scale measures patient obstinacy or passivity, nursing intervention and indicators of feeding difficulty (Watson, 1996). Five items related to the behavioral aspects of feeding difficulty in older people with dementia loaded on the obstinacy or passivity factor; however, the most commonly applied version of the EdFED scale focuses solely on patient obstinacy or passivity (with 6 behavioral items in the scale) and these have been shown, using Mokken scaling, to form a hierarchy of items (Watson, 1996). This hierarchy is reasonably stable across different UK samples of older people with dementia and even across cultures (Lin, Watson, Lee, Chou, & Wu, 2008, Liu, Watson, & Lou, 2014), with minor differences that may be explained by different levels of dementia and also due to different levels of training provided to data collectors in different studies. Nevertheless, the hierarchical arrangement of items runs generally from a general refusal to eat through

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more actively aversive behaviors to letting food fall from the mouth. The EdFED Scale has been successfully used as an outcome measure in intervention studies by Lin et al. (2010), Lin et al. (2011), and Wu, Lin, Wu, Lin, and Liu (2014).

The version of the EdFED Scale used in the above studies is the 6 behavioral items version; since Mokken scaling was first applied to the EdFED (Watson, 1996), these have been the focus of attention to the exclusion of the remaining items. However, recent work on activity of daily living (ADL) scales demonstrates that, using hierarchical scaling methods, it is worth including a wider range of items to test the predictive ability of a scale (Fieo, Watson, Deary, & Starr, 2010). In other words, it is worth investigating if there are behaviors or items that can be detected early in a disease process that may indicate subsequent difficulty. For that reason, in the present study, 10 items of the EdFED Scale were included in the analysis. An item of the original EdFED scale, which was a three point measure of nursing care based on Orem's (1991) model of nursing, included to see if the remaining items correlated with it, was not related specifically to feeding difficulty. Therefore, this item was not included in the original factor analysis and Mokken scaling and is excluded in the present analysis.

1.2. Mokken scaling

The present study uses Mokken scaling, the application of which will be described in more detail in the Methods section. Mokken scaling is a method based on item response theory (IRT) (Watson et al., 2012), which uses a series of parameters to evaluate the quality of and the relationship between items in a scale. The unit of analysis in Mokken scaling—in common with other methods of IRT—is the item characteristic curve (ICC). The ICC describes the relationship, in a plot for individual items, between how that item positions respondents on the latent trait (in the present study the latent trait is feeding difficulty) and the probability of obtaining that score (Watson et al., 2012). Conventionally, Mokken scaling software plots the 'restscore', which is a plot of the total score on the trait minus the item score of interest against the probability of obtaining that score (Stochl, Jones, & Croudace, 2012), and plots this against the actual score on the item obtained by people scoring the restscore. However, total scores on the latent trait may also be used (Watson, Egberink, & Doyle, 2015) in place of restscores.

In item response theory an order in the way items are scored is assumed and these methods, therefore, provide a meaningful relationship between the score on a scale and the latent trait that is being measured (Watson et al., 2012). Items in a Mokken scale are ordered in terms of their 'difficulty' and, in this sense, difficulty refers to psychometric difficulty or the likelihood that an item will be endorsed. Items are, therefore, ordered according to their mean scores and, for example, where a high score on an item indicates a greater degree of the latent trait, then those items with a high mean score are more readily endorsed than those with the lower mean score and the latter are referred to as being more difficult. The utility of a Mokken scale is judged by a range of parameters and these include:

scalability (H) which is assessed using Loewinger's coefficient ($H > 0.30$ indicating low but acceptable scalability with $H > 0.40$ and $H > 0.50$ indicating a moderate and a strong Mokken scale, respectively) (Watson et al., 2012). H uses the expected order of items in the scale and violations thereof to assess the unidimensionality of a set of items and H can be calculated for individual items, item pairs and for the overall scale;

monotone homogeneity which is a property of individual items whereby the score on an item increases as the score on the latent trait increases (Watson et al., 2012), in other words, the item characteristic curves (ICCs) are monotone. (Mokken scaling software produces indices indicating violations of monotone homogeneity and the 'Crit' statistic is used to indicate violations of monotonicity (Molenaar, Sijtsma, & Boer, 2000). Ideally Crit should be zero but

values up to 80 are considered acceptable and this was used in the present study;

reliability is measured using Rho and values of Rho > 0.7 are considered acceptable;

invariant item ordering (IIO) whereby the order of scoring of items is unaffected by the level of the latent trait being measured (Ligtvoet, van der Ark, Marvelde, & Sijtsma, 2010) and this is assessed using H^T (analogous to H above with values of $H^T > 0.30, 0.40$ and 0.50 indicating weak, moderate and strong IIO, respectively). H^T is an estimate of the mean distance between the items in a scale. The further apart the items, the greater IIO is likely to be.

More recently, developments in Mokken scaling have enabled standard errors (SE) of H to be calculated and this includes H for the total scale (H_s), H for individual items (H_i) and H for item pairs (H_{ij}). Calculating SE allows the calculation of confidence intervals (CI) and for scale and item H these should not include the lowerbound value of 0.30 and for item pairs they should not include 0 (Kuijpers, van der Ark, & Croon, 2013). Little is known about the sample size requirements for Mokken scaling. However, recent simulation work by Straat (2010) shows that one of the factors which influences sample size is the values of item H_i . Where H_i is moderate, sample sizes can be relatively small in the 50–250 range but for smaller values of H_i sample sizes in the thousands may be required.

1.3. Theoretical framework

In common with Lin et al. (2008) we used the unmet needs model of Cohen-Mansfield (2000a): 'The unmet needs model describes how the dementia process results in a decreased ability to meet one's needs because of a decreased ability to communicate the needs, and a decreased ability to provide for oneself. Therefore, according to this model, eating needs go unmet as a result of cognitive impairment. This includes inability to communicate hunger and being unaware of the need to eat, and being unable to meet needs related to eating (Cohen-Mansfield, 2000b).

2. Methods

2.1. Aim

The aim of this study was to assess the psychometric properties of the Italian version of the EdFED Scale (EdFED-I). Specifically we investigated: the scalability; monotone homogeneity; reliability; and invariant item ordering.

2.2. Design

A survey design was used, with direct observational methods, to obtain data using a series of questionnaires, anthropometric measures and time. The series of questionnaires were the Italian version of the EdFED questionnaire, which was completed by our specially-trained observers, as well as the MMSE, the Barthel Index and the anthropometric measures. Anthropometric measures included height, weight, waist, and hip circumference, which were routinely updated on a monthly basis and included in each patient's clinical record.

The structure of the EdFED-I was investigated using Mokken scaling and the validity was studied by correlation using a series of measures related to feeding difficulty and dementia, according to the unmet needs model of Cohen-Mansfield, Marx, Lipson, and Werner (1999):

The Mini-Mental State Examination (MMSE): The MMSE was used to evaluate general cognitive functions, including orientation, registration, attention and calculation, recall and language (Folstein, Folstein, & McHaugh, 1975). Lower scores on the MMSE mean more impaired cognitive function.

The Barthel Index: The Barthel Index was used to measure aspects of daily living as follows: feeding, bathing, grooming, dressing,

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