



Original Article

Reliability and validity assessment of an apathy scale for home-care patients with Parkinson's disease: a structural equation modeling analysis

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Abstract. [Purpose] Based on the Starkstein Apathy Scale, an apathy scale was developed for home-care patients with Parkinson's disease using structural equation modeling (SEM), with which the data compatibility of extraction factors can be verified. [Subjects and Methods] The participants were 122 home-care patients with Parkinson's disease (mean age: 70.9 ± 7.8 years) who were member of the Aomori branch or Tohoku/Hokkaido block of the Japan Parkinson's Disease Association. A questionnaire survey (anonymous, self-administered) was carried out by distributing and collecting questionnaires by mail or a collective survey at a workshop. Construct validity was evaluated by confirmatory factor analysis using SEM. Internal consistency was investigated using Cronbach's alpha coefficient. Criterion-related validity was assessed by correlation analysis with the total score of the Beck Depression Inventory. [Results] Concerning construct validity, 11 of the 14 question items of the original scale were extracted. Cronbach's α of this scale was 0.939. For criterion-related validity, Spearman's rank correlation coefficient was 0.831. [Conclusion] The construct validity, internal consistency, and criterion-related validity of the 11-item apathy scale were confirmed. The 11-item apathy scale can serve as a useful tool for the efficient and effective assessment of rehabilitation, establishment of rehabilitation goals and programs for patients with Parkinson's disease.

Key words: Parkinson's disease, Apathy scale, Reliability and validity

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INTRODUCTION

In order to provide effective home rehabilitation for patients with Parkinson's disease (PD), approaches to improve physical functions and environmental factors are not sufficient but psychological aspects of the patients should also be taken into account.

Apathy is defined as the lack of feeling, emotion, interest, concern, and behavior recognition of goals¹⁾. A characteristic lack of motivation, absence of willingness and drive, is the most important factor of apathy. A number of studies in recent years have revealed that apathy is one of the major psychological signs of patients with PD cared for at home²⁻⁹⁾.

The Starkstein apathy scale (SAS)¹⁾ has been reported to be the optimal psychological tool for the assessment of apathy in patients with PD¹⁰⁾. Several researchers have investigated the reliability and validity of the SAS using limited statistical procedures such as the receiver operating characteristic plot¹¹⁾, exploratory factor analysis¹⁰⁾, and analysis of variance and the chi-square test¹⁾. However, these statistical procedures are inadequate for determining whether the extracted factors are in significant agreement with the data. In exploratory factor analysis, even when the factor loading is large, the statistical significance is unclear, and when its absolute value is small, it cannot be dismissed as non-significant. Moreover, we frequently encounter situations in which the value of factor loading is unignorable large but still difficult to interpret.

Confirmatory factor analysis using structural equation modeling (SEM) can compensate for the above-mentioned prob-

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lems with exploratory factor analysis. Therefore, the use of confirmatory factor analysis by SEM has recently become recommended for the verification of construct validity¹²⁾. Confirmatory factor analysis permits a statistical judgment of whether the estimated value is accidental and irreproducible or has sufficient importance to warrant significance. Therefore, this method is useful because it produces results that better fit the data.

The objective of this study was to evaluate the construct validity of an apathy scale based on the SAS by confirmatory factor analysis using SEM together with its internal consistency and criterion-related validity for home-care patients with PD, for the development of a scale that fits this population.

SUBJECTS AND METHODS

The subjects were 188 home-care patients with PD who were members of the Aomori branch or Tohoku/Hokkaido block of the Japan Parkinson's Disease Association. After the exclusion of those who did not consent to the survey or provided invalid answers, the answers received from 122 patients were analyzed. The respondents were 60 males (49.2%) and 62 females (50.8%), with a mean age of 70.9 ± 7.8 years.

A questionnaire survey was performed by distributing and collecting the questionnaires (anonymous, self-administered) by mail or a collective survey at a workshop. The items investigated were the age, gender, time of onset of PD, apathy, and depression. Apathy was evaluated using the Japanese version of the Starkstein Apathy Scale¹³⁾ (SAS). For this scale, patients were requested to answer 14 questions, each of which is scored on a 4-point scale of 0–3, and apathy is rated as severer as the total score (0–42) increases (Table 1). Depression was evaluated using the Beck Depression Inventory¹⁴⁾ (full score: 63).

This study was approved by the Research Ethics Committee of Aomori University of Health and Welfare (Approval No.: 1330). According to the rules of the review board, sufficient explanation about the objective and methods of the study was provided in writing together with a guarantee over the voluntary nature of the recruitment and selection of subjects, protection of personal information, etc., was given to the relevant organizations and individuals. The subjects were assumed to have consented to this study if they answered and submitted the questionnaire.

To confirm reliability, the internal consistency was evaluated using Cronbach's α . Construct validity was evaluated by confirmatory factor analysis using SEM. Apathy, a construct in this analysis, was used as a latent variable, and the scores of the 14 questions of the SAS were used as observed variables. Since the factor-mean of the latent variable in this model was expected to be affected by the age, gender, and time after the onset of PD⁹⁾, the effects of these 3 variables were adjusted (Fig. 1). A maximum likelihood estimation was performed, because the sample size was relatively small and the data showed a non-normal distribution. In addition, simulation by the bootstrap method¹⁵⁾ was performed in order to correct for the effects of non-normality and the small sample size, and to estimate standard errors and the bias of the estimated values. The number of samples was set at 1,000.

Criterion-related validity was evaluated by correlation analysis with the total score of the Beck Depression Inventory (full score: 63).

The statistical software used was IBM SPSS Statistics, Bass 19, Amos 6.0.

RESULTS

The quartiles of the time after the onset of PD in the subjects were as follows: the median, 11.50 months; 25 percentile, 57.75 months; 75 percentile, 179.25 months. The mean score of the SAS and the Beck Depression Inventory were 26.6 ± 8.12 and 35.4 ± 8.71 , respectively.

Confirmatory factor analysis using SEM showed a high goodness of fit, however, the effect indicator was less than 0.7 for Questions 3, 11, and 13 (Fig. 1). When the effect indicator is less than 0.7, the question is inappropriate as an indicator variable of a latent variable. Therefore, confirmatory factor analysis was performed again after the exclusion of these 3 questions, and the remaining 11 questions showed a high goodness of fit and adequately fit the data (Fig. 2). The excluded questions were: "Are you concerned about your condition?" Question 3; "Are you unconcerned with many things?" Question 11; and "Are you neither happy nor sad, just in between?" Question 13 (Tables 1 and 2). The Wald test showed that all effect indicators were significant at the 5% level. The bootstrap method showed that the p-value was greater than 0.05 in all models on the Bollen and Stine goodness of fit test, and the goodness of fit of the models was satisfactory (Figs. 1 and 2).

Cronbach's α , which represents the internal consistency of the 11-item apathy scale, was 0.939. For the criterion-related validity, Spearman's rank correlation coefficient (rs) between the Beck Depression Inventory total score used as the external criterion and the 11-item apathy scale was 0.831 ($p=0.000$).

The mean score of the 11-item apathy scale was 21.3 ± 6.88 .

DISCUSSION

The Japanese version¹³⁾ of the Starkstein Apathy Scale, used in the present study, has been verified for its validity and reliability for Japanese patients with the sequelae of stroke¹³⁾. Like stroke, Parkinson's disease is a central nervous system disease. Hence, the Japanese version may also be applicable to patients with Parkinson's disease.

Evaluation of the construct validity by confirmatory factor analysis using SEM demonstrated that 11 of the 14 question items of the SAS were extracted, with the exclusion of 3 items, and the extracted scale fitted the data obtained from the home-care patients with PD. In addition, this 11-item apathy scale had high internal consistency and criterion-related validity.

Previous reports have shown that depression is a primary symptom of PD²⁻⁴⁾ and the prevalence of depression is high in parkinsonian patients^{4, 16, 18)}. Moreover, apathy is related to depression^{1, 6, 9)} and typical symptoms of apathy have been suggested to change with depression⁴⁾. From these observations, depression was selected as an external criterion in this study

Table 1. Starkstein Apathy Scale

1. Are you interested in learning new things?
2. Does anything interest you?
3. Are you concerned about your condition?
4. Do you put much effort into things?
5. Are you always looking for something to do?
6. Do you have plans and goals for the future?
7. Do you have motivation?
8. Do you have the energy for daily activities?
9. Does someone have to tell you what to do each day?
10. Are you indifferent to things?
11. Are you unconcerned with many things?
12. Do you need a push to get started on things?
13. Are you neither happy nor sad, just in between?
14. Would you consider yourself apathetic?

Apathy Scale. Scoring: For questions 1–8, not at all=3 points; slightly=2; some=1; a lot=0. For questions 9–14, not at all=0; slightly=1; some=2; a lot=3

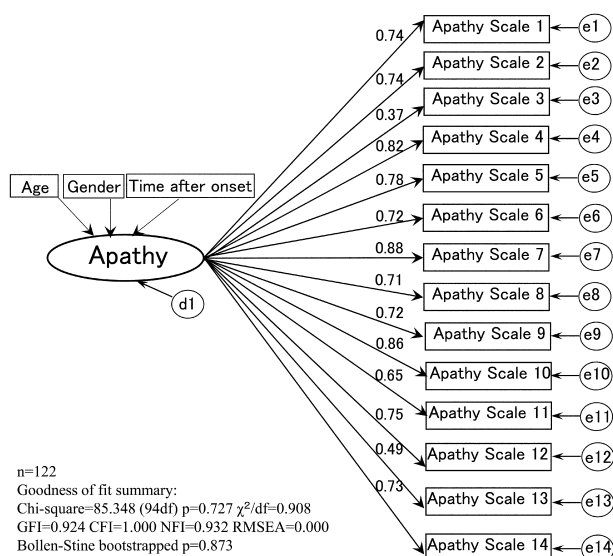


Fig. 1. Results of confirmatory factor analysis: Starkstein Apathy Scale

All numbers represent standard estimates. The effect indicators were all significant at the 5% level.

Oval, latent variable; squares, observed variables; d, prediction error of latent variable; e, measurement error of observed variable.

GFI: Goodness of Fit Index; CFI: Comparative Fit Index; NFI: Bentler-Bonett Normed Fit Index; RMSEA: Root Mean Square error of Approximation.

The covariance between errors is omitted.

Table 2. Apathy scale for home-care patients with Parkinson's disease

1. Are you interested in learning new things?
2. Does anything interest you?
3. Do you put much effort into things?
4. Are you always looking for something to do?
5. Do you have plans and goals for the future?
6. Do you have motivation?
7. Do you have the energy for daily activities?
8. Does someone have to tell you what to do each day?
9. Are you indifferent to things?
10. Do you need a push to get started on things?
11. Would you consider yourself apathetic?

Apathy Scale. Scoring: For questions 1–7, not at all=3 points; slightly=2; some=1; a lot=0. For questions 8–11, not at all=0; slightly=1; some=2; a lot=3

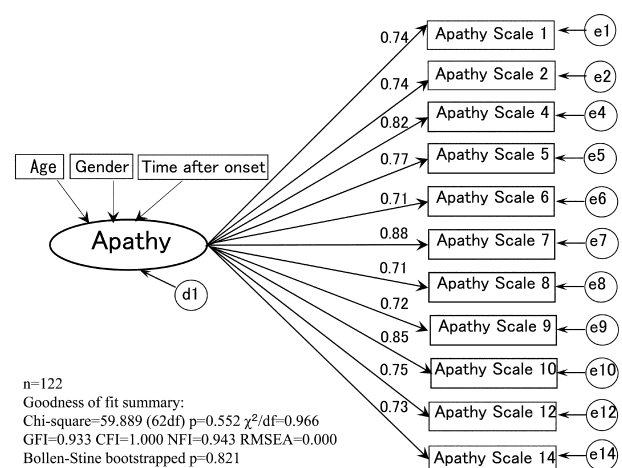


Fig. 2. Results of confirmatory factor analysis: Apathy scale for home-care patients with Parkinson's disease

All numbers represent standard estimates. The effect indicators were all significant at the 5% level.

The covariance between errors is omitted.

Questions 3, 11, and 13 were excluded.

for the evaluation of the criterion-related validity.

Questions 3, 11, and 13 were excluded because low effect indicator values were obtained in the evaluation of the construct validity. Only 0.8% of the subjects selected “not at all” as an answer to Question 3: “Are you concerned about your condition?” This very low rate of selection may have led to this question’s elimination. Since the physical and mental conditions of home-care patients with PD are likely to change between and within days¹⁷⁾, few patients are considered to be totally indifferent to their state of health. The results of the present study support the view of Pedersen et al.¹⁰⁾, who proposed the exclusion of Question 3. In addition, few subjects selected “a lot” as an answer to Question 11: “Are you unconcerned with many things?” and Question 13: “Are you neither happy nor sad, just in between?” These low selection rates may have reduced the effect indicator values.

The 11-item apathy scale is convenient to use because of the small number of questions. Therefore, since it was confirmed to be reliable and valid in this study, it may be useful for the evaluation of apathy in home-care patients with PD. The measurement of apathy in home-care patients with PD using this 11-item apathy scale may lead to the efficient and effective assessment of rehabilitation, establishment of rehabilitation goals and programs, and improvements in patients’ degree of activities of daily living independence and quality of life.

Some minor limitations of this study should be noted. Since the subjects of this study were primarily elderly people living in eastern Japan, the results cannot be generalized to young or middle-aged people, or to people living in western Japan. Also, while this study was cross-sectional in design, the low standard deviation of the subjects’ age suggests that the results obtained reflect the true state of the investigated area. Lifestyle and life events are considered to vary with age, gender, and area of residence. Therefore, intergroup comparisons by these attributes using multiple group SEM need to be performed in the future. In addition, the applicable range of this scale must be widened by repeating studies using SEM with a longitudinal design using models with time-dependent latent variables, and with analysis of covariance models to evaluate the intervention effect.

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