



## Adaptation of the Lawton Instrumental Activities of Daily Living Scale to Turkish: Validity and Reliability Study

Emir Ibrahim Isik<sup>1</sup>, Seyda Yilmaz<sup>2</sup>, Ismail Uysal<sup>3</sup>, Selda Basar<sup>2</sup>

<sup>1</sup>Department of Therapy and Rehabilitation, Abdi Sutcu Vocational School of Health Services, Cukurova University, Adana, Turkey

<sup>2</sup>Department of Physiotherapy, Faculty of Health Sciences, Gazi University, Ankara, Turkey

<sup>3</sup>Fethiye Vocational School of Health Services, Mugla Sitki Kocman University, Mugla, Turkey

Corresponding Author:

Emir Ibrahim Isik, MSc

Department of Therapy and Rehabilitation, Abdi Sutcu Vocational School of Health Services, Cukurova University, Adana 01330, Turkey

E-mail: [eisik@cu.edu.tr](mailto:eisik@cu.edu.tr)

ORCID:

<https://orcid.org/0000-0002-8219-6013>

Received: December 19, 2019

Revised: February 27, 2020

Accepted: March 4, 2020

**Background:** The Lawton Instrumental Activities of Daily Living (IADL) scale is the most widely used scale for the assessment of IADL in the elderly population. The aim of this study was to adapt the Lawton IADL Scale in Turkish and to investigate the validity and the reliability of the scale in older adults. **Methods:** A total of 80 participants with a mean age of 71.6±5.8 years were included in the study. The independent living skills of the older adults were measured using Lawton IADL, Hodkinson Mental Test, Functional Independence Scale, Barthel Index, Katz Index, and visual analog scale. Lawton IADL was translated into Turkish, validated by professional reviewers, translated back into English, and then tested. Cronbach's alpha was used to measure reliability in a group of 34 participants and test-retest was performed 1 week after the first test. Pearson correlation analysis was used to show the relationship between Lawton IADL and other scales and indexes. **Results:** Internal consistency (Cronbach's alpha) value was 0.843 for the whole scale. The intraclass correlation coefficient value of the scale was 0.915. **Conclusion:** These results confirm that the Turkish version of the Lawton IADL scale has excellent reliability and validity.

**Key Words:** Rehabilitation, Geriatric assessment, Activities of daily living

### INTRODUCTION

Functional capacity is a complex concept that includes basic activities of daily living (BADL), instrumental activities of daily living (IADL),<sup>1)</sup> and advanced activities.<sup>2)</sup> Since inadequacies in BADL affect daily activities, work performance, and leisure activities, BADL is one of the most important indicators of success to define the skill level, demonstrate the effectiveness of rehabilitation, and determine a person's ability to perform activities of daily living.<sup>3,4)</sup> The BADL may decline due to age, a specific disease, or a variety of factors such as decreased muscle strength, muscle atrophy, degenerative changes in joints, impaired neuromuscular coordination, loss of vision, and postural changes.<sup>5)</sup>

BADL represent the activities necessary for self-care (e.g., bathing, dressing, feeding, etc.) while IADL represent the activities that allow independence in social life.<sup>6,7)</sup> In addition to some BADL,

IADL also include outside activities such as shopping. Inadequacies in fulfilling IADL cause disability by decreasing the functional capacity of older adults. In 1969, Lawton and Brody<sup>8)</sup> developed the Lawton Instrumental Activities of Daily Living Scale (Lawton-IADL) to measure disability levels and assess parameters in community-dwelling older adults. This scale comprises eight items, including the ability to use a telephone, shopping, food preparation, housekeeping, laundry, use of public transportation, managing self-medication, and handling finances. Responses to each of the eight items on the scale are scored as 0 (cannot perform or can partially perform) or 1 (can perform). The total score ranges from 0 (low-functioning, dependent) to 8 (high-functioning, independent). There are Spanish,<sup>2)</sup> Hong Kong Chinese,<sup>9)</sup> Korean,<sup>10)</sup> and Persian<sup>11)</sup> versions of the scale.

The Lawton-IADL is the most widely used scale for IADL assessment in older adults. The present study aimed to adapt the

Lawton-IADL developed by Lawton and Brody<sup>8)</sup> to Turkish and investigate the validity and reliability of the scale in older adults.

## MATERIALS AND METHODS

The study was approved by the Gazi University Ethics Committee (No. E.128338). Informed consent forms were obtained from all volunteers who participated in the study. Required permissions for the translation of Lawton-IADL to Turkish and its use were obtained via e-mail from Oxford University Press, Permissions, and Rights (Oxford University Press, Oxford, UK).

### Study Group

The cognitive status of the older adults were assessed by the Hodkinson Mental Test (HMT). The study included 87 older Turkish volunteers aged  $\geq 65$  years ( $71.6 \pm 5.8$  years) with HMT scores of  $\geq 8$  and without any visual or hearing impairments or mental illnesses (major depression, schizophrenia, psychosis, etc.). Individuals who had previously had a transient ischemic attack or stroke or had undergone orthopedic surgery in the last 2 years were excluded from the study. Since 5 of the 87 participants had HMT scores of  $\leq 7$  and two left the study willingly, the study finally included 80 volunteers—48 men (60%) and 32 women (40%). These participants resided in either Fethiye nursing home (Mugla, Turkey) or had applied to the Department of Physiotherapy and Rehabilitation at Gazi University Faculty of Health Sciences (Ankara, Turkey).

### Assessment Criteria

Sociodemographic characteristics such as age, sex, weight, and height were recorded. The HMT, Functional Independence Scale (FIS), Barthel Index (BI), Katz Index of Activities of Daily Living, and visual analog scale (VAS) scores were used to evaluate patient status.

### Hodkinson Mental Test

The HMT is a standardized test used for the assessment of cognitive functions that comprises 10 questions. It contains simple questions such as the date and patient name and address. The minimum score is 0 and the maximum score is 10.<sup>12)</sup>

### Functional Independence Scale

The FIS comprises motor scores including those for self-care, sphincter control, transfers, and mobility skills as well as cognitive scores including those for communication and social perception skills. The total score varies from 18 to 126. Higher scores indicate a higher level of independence.<sup>13)</sup> The scale was adapted to Turkish

in 2001 by Kucukdeveci et al.<sup>14)</sup>

### Barthel Index

The BI is used to determine the independence level of an individual in carrying out activities such as feeding, bathing, self-care, dressing, defecation and urine control, going to the toilet, passing from bed to wheelchair, using a wheelchair/walking, and climbing stairs. The index was developed by Mahoney and Barthel<sup>15)</sup> and consists of 10 items with a total score ranging from 0 to 100. An increasing total score indicates increasing levels of independence. The Turkish version of the index was developed by Kucukdeveci et al.<sup>16)</sup>

### Katz Index of Activities of Daily Living

The Katz index, developed in 1963 by Katz et al.,<sup>17)</sup> evaluates the activities that provide the basic requirements necessary for living. The Katz Index consists of 6 questions including information about bathing, dressing, using the toilet, mobility, excretion, and feeding activities. The Katz Index was adapted to Turkish by Arik et al.<sup>18)</sup>

### Visual analog scale

The VAS allows researchers to measure values that cannot be directly quantified. The VAS appears as a straight horizontal line with a fixed length, usually 100 mm, with the ends defined as the extremes of the parameter to be measured, orientated from the left (lowest) to the right (highest). The patient is asked to determine a point on the line for which the relevant situation makes sense for him/her. The length of the distance from where the relevant situation never takes place to the point that the patient has marked provides a numerical value.<sup>19)</sup> In our study, the “ability to use a telephone” and “responsibility for taking their own medication” were assessed using the VAS.

### Adaptation of the Lawton-IADL to Turkish

We used the proposals of Guillemin et al.<sup>20)</sup> and Beaton et al.<sup>21)</sup> for translation of the Lawton-IADL into Turkish and while investigating its validity and reliability. The English version of the Lawton-IADL was translated into Turkish by two independent groups, and the two versions were analyzed by an expert committee. The translations were evaluated considering Turkish cultural characteristics. A common version was then created by combining these translations. The created Turkish version was translated back into English by two native English speakers who were also fluent in Turkish. These two back translations were then combined and the English-translated version and original Lawton-IADL were compared by the committee. A pilot study was conducted with 30 vol-

unteers (15 men and 15 women) who met the inclusion-exclusion criteria to determine whether the questions were easily comprehensible. Then, the committee either confirmed the equivalence of the original Lawton-IADL and the Turkish version or made changes if necessary. Based on the findings, the scale was reviewed by the expert committee and minor changes were made. After being finalized, the Turkish version of Lawton-IADL was applied to the relevant population.

### Statistical Analysis

All statistical analyses of this study were performed using SPSS version 22 for Windows (IBM, Armonk, NY, USA). The values of the analyses were expressed as mean  $\pm$  standard deviation. The reliability of the Lawton-IADL was assessed using internal consistency and test-retest methods. Internal consistency was determined by Cronbach's alpha, while test-retest reliability was determined by calculating the intraclass correlation coefficient (ICC). Cronbach's alpha values of  $\geq 0.70$  and ICC values of  $\geq 0.80$  were considered significant.<sup>22)</sup> Construct validity was assessed by conjoint analysis. Pearson correlation analysis was performed between the total score of the Lawton-IADL and those of the FIS, BI, and Katz Index for conjoint validity.<sup>23)</sup> Similarly, Pearson correlation analyses were performed between the relevant subheadings of the Lawton-IADL and the Katz Index and between the VAS and the non-similar subtitles in the Katz Index. The results of these analyses were defined as excellent for values ranging from 0.81–1.00, very good for 0.61–0.80, good for 0.41–0.60, weak for 0.21–0.40, and bad for 0–0.20.<sup>24)</sup> p-values less than 0.05 were considered statistically significant.

## RESULTS

A total of 80 people participated in this study, including 48 men and 32 women. Table 1 shows the sociodemographic characteristics of these older adults and the average scores of the scales.

### Reliability of the Scale

Reliability is defined as the accuracy and repeatability of a measurement made with a scale.<sup>25)</sup> To determine the reliabilities and test-retest of the Lawton-IADL, Cronbach's alpha and ICC were calculated, respectively. The Cronbach's alpha was 0.843 for the whole scale, indicating the high internal consistency of the scale. The test-retest analysis was used to evaluate the time-invariance of the scale. For this, the scale was applied again to 34 volunteers for 7 days. The ICC of the scale was 0.915. The test-retest correlation coefficients for each item varied between 0.74 and 0.98 ( $p < 0.001$ ). The results of these analyses showed that the test-retest reliability of the subscales and the total scores were high, except for that of the ability

to use a telephone (Table 2). These results demonstrated the high time-invariance of the Lawton-IADL.

### Construct Validity

Validity is the degree of a scale's ability to measure what is intended for measurement.<sup>25)</sup> To determine the conjoint validity of the scale, Pearson correlation analysis was performed between the total score of the scale and the total scores obtained from FIS, BI, Katz Index scores. The Lawton-IADL showed excellent correlations with the FIS, BI, and Katz Index scores ( $p < 0.001$ ) (Table 3).

Pearson correlation analysis was performed using the Lawton-IADL subheadings and the similar subheadings in the Katz Index, and Pearson correlation analysis was also performed using non-similar subheadings and VAS. The construct validity of the scale was also investigated. The correlation coefficients of subheadings were between 0.263 and 0.843. Statistically significant

**Table 1.** Demographic information

Characteristic	Value
Age (y)	71.6 $\pm$ 5.8
Height (cm)	165.8 $\pm$ 10.2
Weight (kg)	76.8 $\pm$ 14.3
Sex	
Male	48 (60)
Female	32 (40)
Scale results	
HMT	8.6 $\pm$ 0.7
FIS	110.0 $\pm$ 24.5
BI	89.9 $\pm$ 20.0
Katz Index	26.0 $\pm$ 5.1
Lawton-IADL	6.1 $\pm$ 2.1

Values are presented as mean  $\pm$  standard deviation or number (%).

HMT, Hodkinson Mental Test; FIS, Functional Independence Scale; BI, Barthel Index; Lawton-IADL, Lawton Instrumental Activities of Daily Living.

**Table 2.** Test-retest reliability

Lawton-IADL	Cronbach's alpha	ICC
Ability to use a telephone	0.847	0.743
Shopping	0.813	0.876
Food preparation	0.850	0.921
Housekeeping	0.810	0.896
Laundry	0.815	0.875
Transportation method	0.806	0.868
Medication use	0.809	0.980
Handling finances	0.838	0.957
Total	0.843	0.915

Lawton-IADL, Lawton Instrumental Activities of Daily Living Scale; ICC, intraclass correlation coefficient.

**Table 3.** Correlation of the Lawton-IADL with the FIS, BI, and Katz Index

Scale	r	p-value
FIS	0.850	< 0.001
BI	0.843	< 0.001
Katz Index	0.896	< 0.001

Lawton-IADL, Lawton Instrumental Activities of Daily Living Scale; FIS, Functional Independence Scale; BI, Barthel Index.

moderate and strong correlations were observed among the subheadings (Table 4). These data supported the validity of the scale.

## DISCUSSION

Declining functional levels in older adults may be directly or indirectly related to their quality of life, major health problems, and mortality.<sup>26,27</sup> Assessment of the independence level of functions helps healthcare personnel to provide appropriate treatment, care, and counseling services by identifying the needs of older individuals and taking necessary measures.<sup>28</sup> This study adapted the Lawton-IADL, which is used to determine the IADL level in older adults, and analyzed its validity and reliability.

Our study group comprised adults more than 65 years of age with no acute health problems. The sociodemographic distribution of the patients showed that most were living alone and had one or more chronic diseases. These results were consistent with the population profiles in the current literature.<sup>29</sup> Similarly, most of the patients were not using any assistive devices ( $n = 63$ , 78.7%) and their final state assessment scale scores (FIS,  $110.0 \pm 24.5$ ; BI,  $89.9 \pm 20.0$ ; Katz Index,  $26.0 \pm 5.1$ ; Lawton-IADL,  $6.1 \pm 2.1$ ) indicated high functional levels.

Participants in our study had relatively high cognitive level (HMT,  $8.6 \pm 0.7$ ). A decline in cognitive function can lead to deficiencies in decision-making ability<sup>30</sup> and subsequent ethical problems in both the clarity of the scale items and in obtaining informed consent. Laudisio et al.<sup>4</sup> observed normal and higher cognitive function adequacy in individuals with HMT scores above 7, while Chen et al.<sup>31</sup> reported that cognitive disorders negatively affected IADL performance. For these reasons, the present study used HMT scores of  $\geq 8$  one as an inclusion criterion. Therefore, during data collection, no difficult to understand part was reported from the volunteers for scale questions. Hence, authors believe that the study population is adequate to draw study conclusions of validities.

The Lawton-IADL results showed a higher inadequacy of the ability to use a telephone than other subheadings of Lawton IADL. Vergara et al.<sup>2</sup> also reported a higher inadequacy of this ability

**Table 4.** Relationships of Lawton-IADL with the Katz Index and VAS by Pearson's correlation

Subheadings		r	p-value
Ability to use a telephone	VAS	0.553	< 0.001
Shopping	Katz Index	0.843	< 0.001
Food preparation	Katz Index	0.716	< 0.001
Housekeeping	Katz Index	0.619	< 0.001
Laundry	Katz Index	0.619	< 0.001
Transportation method	Katz Index	0.718	< 0.001
Use of medication	VAS	0.827	< 0.001
Handling finances	Katz Index	0.263	< 0.001

Lawton-IADL, Lawton Instrumental Activities of Daily Living Scale; VAS, visual analog scale.

compared to the other subheadings of the Lawton-IADL. One possible explanation for these results may be the late entry of phone use in the lives of individuals over 65 years of age and the late increase in its prevalence. No widespread inadequacy was observed for other subheadings of the scale.

The Cronbach's alpha value, which indicates the internal consistency of the scale, was excellent (0.843). The Cronbach's alpha scores for the Chinese (Hong Kong), Korean, and Spanish and Persian versions were 0.86, 0.90, and 0.94, respectively.<sup>2,9-11</sup>

Our study evaluated the Lawton-IADL's temporal reliability by the test-retest method, with an ICC value of 0.915, compared to 0.96 for the original version of the scale.<sup>8</sup> The test-retest method was used to determine the reliability of the Chinese, Korean, and Persian versions of the scale, with values of 0.90, 0.90, and 0.99, respectively.<sup>9-11</sup> In the Spanish version of the study, the Comparative Fit Index was 0.99, with values  $> 0.90$  considered satisfactory.<sup>2</sup> These results are similar to those of our study; the high ICC values in the Turkish version, show that the translation did not change the characteristics of the scores to a large extent.

Assessment of the test-retest correlation coefficients for the subheadings revealed the lowest value for the ability to use the telephone (0.74); however, even this value was above the threshold value for correlation.

The original version of the study investigated the correlations of the scale with the Physical Classification, Mental Status Questionnaire, Behavior and Adjustment rating scales, and Physical Self-Maintenance Scale (PSMS) scores. The Lawton-IADL showed a good correlation with the PSMS and moderate correlations with the other scales, thus supporting the validity of Lawton-IADL.<sup>8</sup> In the Chinese version of the study, the validity of the scale was examined by factor analysis, which identified nine content items.<sup>9</sup> The correlations between scale scores and disability levels in the Korean version of Lawton-IADL were -0.67 ( $p < 0.001$ ) for men and -0.58 ( $p < 0.001$ ) for women.<sup>10</sup> The correlations be-

tween the Spanish version compared to the BI, Medical Outcome Study (MOS) 12-items short form, Western Ontario and McMaster Universities Arthritis Index (WOMAC) short form, and Quick DASH (Disabilities of the Arm, Shoulder, and Hand) scales were above 0.40.<sup>2)</sup> In the Persian version, Mehreban et al.<sup>11)</sup> reported a correlation coefficient of -0.688 for the comparison of the scale with the Functional Assessment Staging test. Considering the results of other studies, the target older population, and the scale contents, the FIS, BI and Katz Index were considered appropriate to assess the validity of the Lawton-IADL. The total score of the scale showed excellent correlations with other indexes such as FIS (0.850), BI (0.843), and Katz Index (0.896). These findings indicate that IADL are related to the level of independence and BADL in older adults. The very high correlations between the Lawton-IADL and the FIS, BI and Katz Index supports that this scale is a valid tool for use in older populations.

Apart from the original scale and other version studies, the present study investigated the correlation of each Lawton-IADL subheading with another subheading with similar content. We observed that the Lawton-IADL was highly correlated with Katz Index subheadings similar to shopping, cooking, housekeeping, laundry, and transportation, and was poorly correlated with the subheading of handling finances. Although activities of daily living such as transportation, housekeeping, and food preparation are associated with physical health and independence, the handling of finances may be affected by mental health, educational level, and cognitive skill factors. In other words, it is not surprising that handling finances, an IADL, was not highly correlated with the Katz Index, a marker of activities of daily living.

We observed moderate correlations between the VAS scores and subheadings of the ability to use a telephone and medication. However, we obtained different results in the other subheadings, with a higher correlation using the Katz Index. The reason for this difference was that the Lawton-IADL subheadings included verbal and singular results, while the VAS score yielded quantitative and frequently plural results.

The high values, indicators of the validity and reliability of the Lawton-IADL, may be attributed to the fact that this scale is clear, feasible, and has a low scoring range.

Our study has some limitations. The study population comprised people from the same geriatric rehabilitation unit and nursing home environment, which may have affected the generalizability of the data. Including participants from two different cities (Mugla and Ankara) may also have affected the results, as participants from different cities may exhibit different sociodemographic characteristics. Also, the Lawton-IADL may not be sensitive enough to detect minor changes in IADL due to its scoring system.

However, Yasuda et al.<sup>32)</sup> compared the strengths of the scale to those of the Lawton-IADL for evaluating activities of daily living and reported that the strength of the scale was the ability to measure more complex function levels, increased sensitivity to detect serious dysfunctions since the person is likely to lose complex activities before simple activities, and more predictable detection in patients than that with an external performance assessment.

In conclusion, the Turkish version of the Lawton-IADL, which is widely used for the evaluation of IADL, is a valid and reliable scale for use in Turkish older adults.

## ACKNOWLEDGMENTS

### CONFLICT OF INTEREST

The researchers claim no conflicts of interest.

### AUTHOR CONTRIBUTIONS

Conceptualization, EII, SB; Data curation, IU, SY; Funding acquisition, EII, SB, IU, SY; Investigation, SB, IU, SY; Methodology, EII, SB; Project administration, EII, SB; Supervision, SB; Writing\_ original draft, EII, SY, IU; Writing, review & editing, EII, SB.

## REFERENCES

1. Suh GH, Jung HY, Lee CU, Lee SK, Lee NJ, Kim JH, et al. Effect of galantamine on caregiver time and activities of daily living in mild to moderate Alzheimer's disease: a 1-year prospective study. *J Korean Geriatr Soc* 2007;11:74-82.
2. Vergara I, Bilbao A, Orive M, Garcia-Gutierrez S, Navarro G, Quintana JM. Validation of the Spanish version of the Lawton IADL Scale for its application in elderly people. *Health Qual Life Outcomes* 2012;10:130.
3. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc* 1991;39:142-8.
4. Laudisio A, Marzetti E, Pagano F, Cocchi A, Franceschi C, Bernabei R, et al. Association of metabolic syndrome with cognitive function: the role of sex and age. *Clin Nutr* 2008;27:747-54.
5. Ishizaki T, Watanabe S, Suzuki T, Shibata H, Haga H. Predictors for functional decline among nondisabled older Japanese living in a community during a 3-year follow-up. *J Am Geriatr Soc* 2000;48:1424-9.
6. Lawton MP. The functional assessment of elderly people. *J Am Geriatr Soc* 1971;19:465-81.
7. LaPlante MP. The classic measure of disability in activities of daily living is biased by age but an expanded IADL/ADL measure is not. *J Gerontol B Psychol Sci Soc Sci* 2010;65:720-32.

8. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist* 1969;9:179-86.
9. Tong AY, Man DW. The validation of the Hong Kong Chinese version of the Lawton Instrumental Activities of Daily Living Scale for institutionalized elderly persons. *OTJR* 2002;22:132-42.
10. Kim SY, Won JW, Cho KW. The validity and reliability of Korean version of Lawton IADL Index. *J Korean Geriatr Soc* 2005;9:23-9.
11. Hassani Mehraban A, Soltanmohamadi Y, Akbarfahimi M, Taghizadeh G. Validity and reliability of the Persian version of Lawton instrumental activities of daily living scale in patients with dementia. *Med J Islam Repub Iran* 2014;28:25.
12. Hodkinson HM. Evaluation of a mental test score for assessment of mental impairment in the elderly. *Age Ageing* 1972;1:233-8.
13. Keith RA, Granger CV, Hamilton BB, Sherwin FS. The functional independence measure: a new tool for rehabilitation. *Adv Clin Rehabil* 1987;1:6-18.
14. Kucukdeveci AA, Yavuzer G, Elhan AH, Sonel B, Tennant A. Adaptation of the Functional Independence Measure for use in Turkey. *Clin Rehabil* 2001;15:311-9.
15. Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. *Md State Med J* 1965;14:61-5.
16. Kucukdeveci AA, Yavuzer G, Tennant A, Suldur N, Sonel B, Arasil T. Adaptation of the modified Barthel Index for use in physical medicine and rehabilitation in Turkey. *Scand J Rehabil Med* 2000;32:87-92.
17. Katz S, Ford AB, Moskowitz RW, Jackson BA, Jaffe MW. Studies of illness in the aged: the Index of ADL: a standardized measure of biological and psychosocial function. *JAMA* 1963;185:914-9.
18. Arik G, Varan HD, Yavuz BB, Karabulut E, Kara O, Kilic MK, et al. Validation of Katz index of independence in activities of daily living in Turkish older adults. *Arch Gerontol Geriatr* 2015; 61:344-50.
19. McCormack HM, Horne DJ, Sheather S. Clinical applications of visual analogue scales: a critical review. *Psychol Med* 1988; 18:1007-19.
20. Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. *J Clin Epidemiol* 1993;46:1417-32.
21. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine (Phila Pa 1976)* 2000;25:3186-91.
22. Revelle W, Zinbarg RE. Coefficients alpha, beta, omega, and the glb: comments on Sijtsma. *Psychometrika* 2009;74:145.
23. Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J Chiropr Med* 2016;15:155-63.
24. Feise RJ, Michael Menke J. Functional rating index: a new valid and reliable instrument to measure the magnitude of clinical change in spinal conditions. *Spine (Phila Pa 1976)* 2001;26:78-87.
25. Cook DA, Beckman TJ. Current concepts in validity and reliability for psychometric instruments: theory and application. *Am J Med* 2006;119:166.e7-16.
26. Long A, Robinson K, Goldberg S, Gordon AL. Effectiveness of exercise interventions for adults over 65 with moderate-to-severe dementia in community settings: a systematic review. *Eur Geriatr Med* 2019;10:843-52.
27. Liira H, Mavaddat N, Eineluoto M, Kautiainen H, Strandberg T, Suominen M, et al. Health-related quality of life as a predictor of mortality in heterogeneous samples of older adults. *Eur Geriatr Med* 2018;9:227-34.
28. Desai AK, Grossberg GT, Sheth DN. Activities of daily living in patients with dementia: clinical relevance, methods of assessment and effects of treatment. *CNS Drugs* 2004;18:853-75.
29. Alonso-Moran E, Nuno-Solinis R, Orueta JF, Fernandez-Ruano-va B, Alday-Jurado A, Gutierrez-Fraile E. Health-related quality of life and multimorbidity in community-dwelling telecare-assisted elders in the Basque Country. *Eur J Intern Med* 2015; 26:169-75.
30. Pu B, Peng H, Xia S. Role of emotion and cognition on age differences in the framing effect. *Int J Aging Hum Dev* 2017;85:305-25.
31. Chen HM, Lin HF, Huang MF, Chang CW, Yeh YC, Lo YC, et al. Validation of Taiwan Performance-Based Instrumental Activities of Daily Living (TPIADL), a performance-based measurement of instrumental activities of daily living for patients with vascular cognitive impairment. *PLoS One* 2016;11:e0166546.
32. Yasuda N, Zimmerman S, Hawkes WG, Gruber-Baldini AL, Hebel JR, Magaziner J. Concordance of proxy-perceived change and measured change in multiple domains of function in older persons. *J Am Geriatr Soc* 2004;52:1157-62.