Reliability of Pictorial Longshi Scale for Informal Caregivers to Evaluate the Functional Independence and Disability

Xiangxiang Liu

The First Affiliated Hospital of Shenzhen University, Shenzhen Second People's Hospital

Yan Gao

The First Affiliated Hospital of Shenzhen University, Shenzhen Second People's Hospital

Jingpu Zhao

The First Affiliated Hospital of Shenzhen University, Shenzhen Second People's Hospital

Mingchao Zhou

The First Affiliated Hospital of Shenzhen University, Shenzhen Second People's Hospital

Li Wan

The First Affiliated Hospital of Shenzhen University, Shenzhen Second People's Hospital

Guohui Nie

The First Affiliated Hospital of Shenzhen University, Shenzhen Second People's Hospital

Yulong Wang (✉ ylwang668@163.com)

The First Affiliated Hospital of Shenzhen University, Shenzhen Second People's Hospital

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Abstract

Background: Numerous instruments to evaluate the functional independence and disability are available for healthcare professionals, making it difficult for patients and their families to evaluate and explain the results. Longshi Scale is the first pictorial-based disability assessment tool and it may allow a much simply and inclusive assessment across all population. The objective of this study was to test the reliability of the Longshi Scale for informal caregivers to assess functional independence and disability.

Methods: This study was conducted at the inpatient rehabilitation departments from 24 hospitals in 11 cities across China. The patients who were more than 18 years old and diagnosed with cerebral infarction, cerebral hemorrhage, brain trauma, spinal cord injury, postoperative brain tumors, and other disorders causing physical functional disabilities were recruited. Then the Longshi Scale was used to assess the functional independence and disability of patients by both healthcare professionals and informal caregivers. Descriptive statistics (i.e., frequency, percentage, mean, and standard deviation) were calculated. The Kolmogorov-Smirnov test was used to examine the normal distribution of the data. The chi-square test or McNemar-Bowker test was used to compare the nominal variables of the three groups. T-tests were used to compare the mean of the quantitative variables of the two groups. The agreement between the scores was assessed using Cohen's kappa statistic and the marginal homogeneity test.

Results: In total of 947 patients were included. Of these, 419 were in the "bedridden group", 298 in the "domestic group", and 230 in the "community group". The mean scores were 5.00 ± 1.936 , 5.37 ± 1.656 and 7.18 ± 2.055 in the bedridden, domestic, and community groups, respectively. The mean score of each item was compared, and there were no significant differences between healthcare professionals and informal caregivers ($p > 0.05$). The Longshi Scale items and the sum score had fair or better agreement (weighted kappa > 0.50) between healthcare professionals and informal caregivers' scores. The reliability of Longshi Scale was found to be acceptable.

Conclusions: This study demonstrated fair or better agreement between healthcare professionals' and informal caregivers' scores on Longshi Scale items and their sum scores. The Longshi Scale for the assessment of the functional independence and disability by informal caregivers, is reliable.

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1 Background

Approximately 15% of the world's population suffers from some kind of disability, and every year this number is increasing[1]. Disability is a various condition, owing to many varieties of trauma, aging and acute or chronic diseases[2]. Many medical conditions related to disability expand the healthcare needs and cause loss of working ability, whereas others do not[3]. Functional independence and disability assessment are needed for multiple purposes, including design of rehabilitation plans, eligibility for rehabilitation services, disability benefits, and support from work, community, and school[4]. However, assessment of disability now is mainly implemented by healthcare professionals using special scales[5,

6], which is time-consuming and terminological, making it difficult for patients and their families to evaluate and explain the results. Therefore, it is important to develop simple and reliable assessment of functional disability that can be used by healthcare professionals, non-professionals as well as patients.

Informal caregivers are defined as “individuals who provide ongoing care and assistance, without pay, for family members and friends in need of support due to physical, cognitive, or mental conditions”[7]. Informal caregivers play an essential role in the rehabilitation setting supporting the patients and preparing them for discharge to home[8]. In Norway, family cares offer roughly 50% of all care[9]. Across the EU, informal caregivers provide approximately 80% of all care[10]. Actually, it has higher proportion in Asia, because the cultural norms and strong social encourage families to care for their elders, usually in their homes[11]. Informal caregiving will continue to be indispensable as for the future demographic makeup of the population and the cost pressure on long-term care systems[11, 12].

Some studies have shown that the families, non-professional health and social works can early observe the functional impairments and disease signals of the elderly[13], which has an important impact on the early diagnosis, intervention and prognosis of patients. However, in China, it is not consistent on disability assessment at different stages of recovery[14]. Patients who are admitted to hospital have different degrees of disabilities from mild to severe. While there is no available homecare rehabilitation system or easy-use assessment for following-up the disabilities when the patients are dismissed from hospital[3]. Furthermore, due to the lack of specialist physicians in rehabilitation medicine[1, 15], there are needs to have a family used disability assessment tool that does not require training in its administration.

There are several existing instruments to measure functional independence or disability, such as Barthel Index[16], Functional Independence Measure scale (FIM)[6], modified Rankin scale (mRS)[17], World Health Organization (WHO) disability assessment scale[18], which are word-based. These scales are expressed in specific medical terms, or ask patients to verbally report their problems and limitations, which are not feasible for people with communication issues, including dementia, or people with language barriers. Visual scales provide an alternative to the language-based tools and have been widely used in the medical field[19-22]. It may allow a much more simple and inclusive assessment across all populations, especially for population with limited health literacy or education level.

In 2013, our team developed a pictorial Longshi Scale based on a survey of 1862 people with disabilities in China[3]. To our knowledge, this is the first pictorial disability scale[5]. Previous study had shown that therapists, interns and personal health aids could use Longshi Scale to assess patients' functional independence and disability after training[3]. However, the study only selected people in one city, which limited the extrapolation of the conclusion, and it did not test the psychometry property of Longshi scale assessed by non-healthcare professionals who may be involved in the care of disabled adult. The correlation between the validity of Longshi Scale and education level of informal caregivers is also unclear. Therefore, the purpose of this study is to verify the validity of Longshi Scale assessed by informal caregivers and its relationship with education level.

2 Methods

2.1 Study Design

This was a multi-center and cross-sectional study.

2.2 Setting

This study was conducted in the departments of rehabilitation of 24 hospitals located in 11 cities across China from September 2020 to December 2020.

2.3 Sample Size

The minimum number of subjects needed for the study was based on an assessed disability proportion of 15 per 100 study population[3]. The sample size was calculated using the formula for random sampling.

$$N = \mu_{\alpha}^2 \pi (1 - \pi) / \delta^2$$

Where π is the proportion of adults with disability ($\pi=15\%$); μ_{α} is the critical value of the two-sided test of the first type of error probability ($\mu_{\alpha}=2.580$); δ is the allowable error ($\delta=0.05$); We added 20% to cover drop outs and incomplete study instruments. To sum up, we calculated that the minimum sample size was 340 in this study.

2.4 Participants

In this study, we recruited 1006 consecutive inpatients for functional independence and disability assessment from the Department of Rehabilitation in 24 hospitals. For the purpose of this study, we only selected patients who were more than 18 years old, who were diagnosed with cerebral hemorrhage, cerebral infarction, spinal cord injury, postoperative brain tumors, brain trauma, and other disorders causing functional disabilities, and who were willing to sign the informed consents. Those who suffered from mental illness, serious cognitive dysfunction and inability to understand the images shown in the Longshi Scale were excluded. All patients' cognitive status was assessed by a nurse using the Mini-Mental State Examination (MMSE) before the disability evaluation [14]. In this study, we excluded patients suffering from a mental illness and cognitive dysfunction ($MMSE \leq 9$) because the LS is a pictorial scale, and patients with MMSE scores ≤ 9 were unavailable to undergo LS assessment. Additionally, patients who participated simultaneously in other clinical studies were excluded.

In this study, the formal caregivers were selected according to the patients they cared of. The inclusion criteria for informal caregivers in the study were adults who take care of their patients without any pay, including patients' families, relatives, friends, or colleagues. Those who were hired as formal caregivers were excluded. Non-Mandarin-speaking caregivers were also excluded because of a lack of translation services.

In this study, 18 healthcare professionals were willing to participate. They were randomly divided into six groups of three each, including one therapist and two interns. Before the assessment, all professionals were given a brief, half-day training sessions on how to accurately score the Longshi Scale. Each evaluator interviewed patients independently of each other, and all assessments were conducted on the same day.

2.5 Data Collection

The sociodemographic information of the patients and informal caregivers were collected by nurses. The functional independence and disability were assessed using Longshi Scale by patients and informal caregivers, respectively. All data were recorded and uploaded in the Mike website by a special account. Mike is an online form production website, which can collect, store, and management data[23]. First, one nurse logged into the Mike account and asked patients or their proxies to provide signed informed consent. Then, the nurses used two online forms to collect the basic information of the patients and informal caregivers, separately. After that, healthcare professionals and informal caregivers scored the Longshi Scale by interviewing the patients face-to-face. After the assessment, all the data were reviewed and recorded by the study assistants. Any record with missing information was excluded from the study.

2.6 Instruments

The Longshi Scale assessment was divided into three steps. First, all patients were allocated to the bedridden, domestic, or community groups, which depended on their ability to move out of the bed, move outdoors, and return indoors. Second, patients in each group were evaluated using a 3-point Likert subscale (form), including: 1) Bedridden group subscale (Form 1, including bladder and bowel management, feeding, and leisure activities); 2) Domestic group subscale (Form 2, including toileting, grooming, and housework); and 3) community group subscale (Form 3, including community mobility, shopping, and social participation). Third, we calculated the total score of each subscale (minimum independence = 3 and maximum independence = 9) (Figure 2).

2.7 Data Analysis

Statistical analyses were conducted using SPSS (version 22.0; IBM Corp., Armonk, NY, USA). Demographic characteristics were presented as numbers. Demographic characteristics included age,

gender (male and female), marital status (such as married, unmarried, divorced, and widowed), ethnicity (Han and minority), living pattern (such as living alone, living with family, living with tender, living in nursing institution, and other), annual household income (less than 50,000, 50,000–100,000, 100,000–150,000, and more than 150,000 yuan), and degree of education (primary and lower, high school, college, and higher). Religion and retirement were coded as “yes” and “no,” respectively.

Descriptive statistics (i.e., frequency, percentage, mean, and standard deviation) were calculated. The Kolmogorov–Smirnov test was used to examine the normal distribution of the data. The chi-square test or McNemar-Bowker test was used to compare the nominal variables in the three groups (bedridden, domestic, and community). Kruskal-Wallis test was used to compare the differences of the age among the groups. Mann-Whitney test was performed to determine the statistically differences between the Longshi Scale scores of three groups. The level of significance was set at <0.05 .

The healthcare professionals’ scores served as reference standards. As a special type of correlation coefficient, Cohen’s kappa statistic was used as a standardized measure of agreement. All items were scored on an ordinal scale with more than two alternatives, and the weighted kappa coefficient was used. A kappa value above 0.75 was considered to indicate strong agreement, values within the range 0.40–0.75, fair to good agreement, and values less than 0.40, poor agreement[24]. The marginal homogeneity test was used to test asymmetry bias.

3 Results

3.1 Characteristics of Participants

A total of 1006 patients were invited to participate in the study. Of these, 59 were excluded because of refusing to participate ($n=18$), missing survey data ($n=26$) or duplicate data ($n=15$). There were 947 eligible patients and their caregivers were included in this study. Among all the patients, 419 (44.2%), 298 (31.5%), and 230 (24.3%) were classified into the bedridden, domestic, and community groups, respectively. The average age in the bedridden group, domestic group and community group were 65.70 ± 13.588 , 65.42 ± 12.987 and 62.55 ± 11.372 years. The majority of them were male ($n=628$, 66.3%), Han ethnicity ($n=946$, 99.9%), had a secondary school educational level ($n=544$, 47.4%), had retired ($n=556$, 58.7%), and had a family annual income of ¥ 50–100 thousands ($n=446$, 47.1%). Patients’ characteristics are summarized in Table 1.

The social demographer characteristics of informal caregiver was summarized in Table 2. The average age were 46.07 ± 11.715 years. The majority of them were female ($n=575$, 60.7%), Han ethnicity ($n=925$, 97.7%), had a secondary school educational level ($n=370$, 39.1%), had more than 36 months of working experience ($n=625$, 66.0%), had a family annual income less than ¥ 50 thousands ($n=632$, 66.7%) and had a rural household register ($n=567$, 59.9%). Approximately, 42.8% ($n=405$) of informal caregivers were patients’ spouse.

3.2 Scores of LS in Healthcare Professionals and Informal Caregivers

The distributions of LS scores in bedridden, domestic, and community groups are presented as boxplots in Figure 3. For healthcare professionals, the mean scores were 5.14 ± 1.946 , 4.77 ± 1.421 and 7.55 ± 1.959 , respectively. The mean scores were 5.00 ± 1.936 , 5.37 ± 1.656 and 7.18 ± 2.055 in the bedridden, domestic, and community groups, respectively. The mean score of each item was also compared, and there were no differences between healthcare professionals and informal caregivers in each item of the three groups ($p \geq 0.05$).

3.3 Reliability Analysis

All of the LS items had a kappa coefficient above 0.50, which illustrated fair agreement between healthcare professionals and informal caregivers' scores. For community mobility and shopping, the kappa coefficient was higher than 0.70, indicating a strong agreement (Table 3). The caregivers scored lower on the "grooming and bathing" item than the healthcare professionals, for the marginal homogeneity test less than 0.03.

Considering that an education degree is an important factor influencing LS evaluation, we compared the LS scores between non-professional caregivers and informal caregivers at different education levels. The results showed that no statistically significant differences existed in the secondary school or above groups. In the primary school group, the sum scores of LS differed significantly between healthcare professionals and informal caregivers (Table 4).

Figure 4 shows the difference between the healthcare professionals' and informal caregivers' sum scores on LS. No significant bias was existed, as the caregivers scored slightly higher than the professionals ($p \geq 0.05$). The scatter showed that there were 6, 3, and 1 data point out of the range in the bedridden, domestic, and community groups ($\text{Mean} \pm 2\text{SD}$), respectively. These findings implied a fair or better agreement between healthcare professionals' and informal caregivers' scores on evaluating patients with moderate or mild functional disability.

4 Discussion

Informal caregivers represent the most abundant personnel resource in looking after people with disabilities in society [13]. Training them to make a skilled assessment of functional independence is helpful in lightening the burden of nursing staff and ease the effects of unbalanced medical resources. These results from this study indicated fair or better agreement between healthcare professionals' and informal caregivers' scores on the Longshi Scale items and their sum scores. A few disagreements can be explained by within-patient variability due to day-to-day variation [3]. The items of grooming and bathing demonstrated the poorest agreement (kappa 0.504), which might be related to variation in personal

cleanliness due to insufficient bathing, contributing to a higher within-patient variation in this particular item.

Ordinarily, informal caregivers might be able to observe functional decline in their patients [25]. Presumably, other informal caregivers, such as home helpers, could also be trained to score ADL reliably and evaluate functional independence accurately after a short introductory course [26]. In the current study, the informal caregivers worked in teams, together with the healthcare professionals, therefore the scores may have been biased. Even if they were instructed not to communicate about the scores, the confounding bias was inevitable. If informal caregivers could be used to observe and evaluate the ability of ADL, their organization into groups together with healthcare professionals is recommended. In a previous study of the BI, scoring by a physician from patient interviews was not reliable [3, 27, 28]. The results of this study indicate that the ability of ADL assessed by informal caregivers is a better method to detect decline in functioning, particularly among stroke survivors in the subacute and recovery stages, than the doctor's interview about ADL tasks. The results obtained from the informal caregivers in this study are not suitable for the assessment of patients suffering from mental illness, because their scores might be biased [13, 14].

In addition, our results implied a fair or better agreement between healthcare professionals' and informal caregivers' scores, especially for moderate or mild functional disability patients. This might be associated with the ceiling effect of the Longshi Scale. Similarly, Barthel Index is known to have a ceiling effect that makes it insensitive to slight functional impairments in previously well-functioning patients [29]. Although a significant ceiling effect was found in the bedridden group in our previous study, the internal consistency of all three groups was acceptable for group comparison [3]. However, Barthel Index quantifies ADL on an ordinal, hierarchical scale that ranges from 0 to 100, which limits interpretation of numeric changes in total score. As for informal caregivers, it is difficult to understand how much score change is significant [30]. A distinct feature of the Longshi Scale is the categorization and scoring system, which facilitates the understanding of patients' functional independence by informal caregivers [14]. Moreover, the pictorial scale may allow a much simpler and more inclusive assessment across all populations, especially for people with aphasia and reading difficulties [31]. In this study, we found that except for people under primary school education, there were no statistically significant differences between the two groups. Future research should focus on interventions to make reliable assessments of Longshi Scale in informal caregivers with a low degree of education.

This study, which included 947 patients from 24 clinical settings in 11 cities, was a nationally representative study. In addition, to our knowledge, our study is the first to address the reliability of pictorial-based Longshi Scale for informal caregivers to evaluate the functional independence and disability of inpatients. We believe that these findings provide insights into future medical resource allocation. Healthcare strategies for functional disability may integrate healthcare professionals with informal caregivers to improve the effectiveness of rehabilitation.

However, the interpretation of these results also needs to consider the following limitations. First, the cross-sectional design of this study restricted the drawing of the association as a causal relationship to functional independence. Second, the sampling method was non-random, and the included hospitals were collaborative organizations with our departments. Although the inherent bias could be unavoidable, our study covered over 24 hospitals in 11 cities to ensure generalizability. Moreover, note that our study only selected patients aged over 18 years, which may be inapplicable to the populations under 18. Finally, the majority of variables were measured by self-report; thus, we invited experienced investigators to assess functional disability and combine medical records to reduce recall bias as much as possible.

5 Conclusions

There is fair or better agreement between healthcare professionals' and informal caregivers' scores on Longshi Scale items and their sum scores. It is reliable to use Longshi Scale to assess the functional independence by informal caregivers.

Declarations

Data Availability Statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethical considerations

The study protocol was approved by the Medical Ethics Committees of the Shenzhen Second People's Hospital (project identification code: 20201105004). Written informed consent was obtained from all patients or their proxies, who agreed to participate in the study.

Author Contributions

Conceptualization, X.L. and Y.W. (Yulong Wang); Methodology, X.L.; Software, J.Z.(Jingpu Zhao); Validation, Y.G. and M.Z.; Formal Analysis, X.L., M.Z. and L.W.; Investigation, Y.G. and M.Z.; Resources, Y.W.(Yulong Wang); Data Curation, L.W.; Writing – Original Draft Preparation, X.L.; Writing – Review & Editing, Y.G.; Visualization, J.Z.(Jingpu Zhao); Supervision, G.N.; Project Administration, Y.W. (Yulong Wang). All authors approved the final version of the manuscript for submission and publication.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Abbreviations

BI, Barthel Index; mRS, modified Rankin Scale; ADL, Activities of Daily Living; MMSE, Mini-mental State Examination.

References

1. Bethge M, von Groote P Fau - Giustini A, Giustini A Fau - Gutenbrunner C, Gutenbrunner C: **The World Report on Disability: a challenge for rehabilitation medicine.** *Am J Phys Med Rehabil* 2014, **93**(1):S4-11.
2. Shakespeare T Fau - Officer A, Officer A: **World report on disability.** *Disabil Rehabil* 2011, **33**(17-18):1491.
3. Wang Y, Guo S, Zheng J, Wang QM, Zhang Y, Liang Z, Zhang L, Yang Y, Zhai H, Chen M *et al*: **User testing of the psychometric properties of pictorial-based disability assessment Longshi Scale by healthcare professionals and non-professionals: a Chinese study in Shenzhen.** *Clin Rehabil* 2019, **33**(9):1479-1491.
4. Wang YL. Function assessment rehabilitation program. Beijing, China: People's Medical Publishing House, 2013.
5. Gao Y, Wang Y, Li D, Zhao J, Dong Z, Zhou J, Fu G, Zhang J: **Disability assessment in stroke: Relationship among the pictorial-based Longshi Scale, the Barthel Index, and the modified Rankin Scale.** *Clin Rehabil* 2021, **35**(4):606-613.
6. Prodingier B, O'Connor Rj Fau - Stucki G, Stucki G Fau - Tennant A, Tennant A: **Establishing score equivalence of the Functional Independence Measure motor scale and the Barthel Index, utilising the International Classification of Functioning, Disability and Health and Rasch measurement theory.** *J Rehabil Med* 2017, **49**(5):416-422.
7. Madara Marasinghe K: **Assistive technologies in reducing caregiver burden among informal caregivers of older adults: a systematic review.** *Disabil Rehabil Assist Technol* 2016, **11**(5):353-360.

8. Young ME, Lutz BJ, Creasy KR, Cox KJ, Martz C: **A comprehensive assessment of family caregivers of stroke survivors during inpatient rehabilitation.** *Disabil Rehabil* 2014, **36**(22):1892-1902.
9. Dombestein H, Norheim A, Lunde Husebo AM: **Understanding informal caregivers' motivation from the perspective of self-determination theory: an integrative review.** *Scand J Caring Sci* 2020, **34**(2):267-279.
10. Verbakel E, Tamlagsrønning S, Winstone L, Fjær EL, Eikemo TA: **Informal care in Europe: findings from the European Social Survey (2014) special module on the social determinants of health.** *Eur J Public Health* 2017, **27**(1464-360X (Electronic)):90-95.
11. Ansah JP, Matchar DB, Malhotra R, Love SR, Liu C, Do Y: **Projecting the effects of long-term care policy on the labor market participation of primary informal family caregivers of elderly with disability: insights from a dynamic simulation model.** *BMC Geriatr* 2016, **16**:69.
12. Wang Q, Zhou Y, Ding X, Ying X: **Demand for Long-Term Care Insurance in China.** *Int J Environ Res Public Health* 2017, **15**(1).
13. Ranhoff AH: **Reliability of nursing assistants' observations of functioning and clinical symptoms and signs.** *Aging Clin Exp Res* 1997, **9**(5):1-4.
14. Zhao J, Liu X, Wan L, Gao Y, Huang M, Zha F, Long J, Li D, Nie G, Wang Y: **A novel Longshi Scale measured activity of daily living disability in elderly patients affected by neurological diseases: a multi-center cross-sectional study in China.** *BMC Geriatrics* 2021, **21**(1).
15. Li J, Li LSW: **Development of Rehabilitation in China.** *Phys Med Rehabil Clin N Am* 2019, **30**(4):769-773.
16. Cid-Ruzafa J, Damián-Moreno J: **Disability evaluation: Barthel's index.** *Rev Esp Salud Publica* 1997, **71**(2):127-137.
17. Banks JL, Marotta CA: **Outcomes validity and reliability of the modified Rankin scale: implications for stroke clinical trials: a literature review and synthesis.** *Stroke* 2007, **38**(3):1091-1096.
18. Chen R, Liou TH, Miao NF, Chang KH, Yen CF, Liao HF, Chi WC, Chou KA-O: **Using World Health Organization Disability Assessment Schedule 2.0 in people with schizophrenia: a 4-year follow-up.** *Eur Arch Psychiatry Clin Neurosci* 2020, **270**(3):301-310.
19. Theou O, Andrew M, Ahip SS, Squires E, McGarrigle L, Blodgett JM, Goldstein J, Hominick K, Godin J, Hougan G *et al*: **The Pictorial Fit-Frail Scale: Developing a Visual Scale to Assess Frailty.** *Can Geriatr J* 2019, **22**(2):64-74.
20. Tomlinson D, von Baeyer CI Fau - Stinson JN, Stinson Jn Fau - Sung L, Sung L: **A systematic review of faces scales for the self-report of pain intensity in children.** *Pediatrics* 2010, **126**(5):e1168-1198.

21. Hadjistavropoulos T, Herr K, Prkachin KM, Craig KD, Gibson SJ, Lukas A, Smith JH: **Pain assessment in elderly adults with dementia.** *Lancet Neurol* 2014, **13**(12):1216-1227.
22. Akena D, Joska J, Stein DJ: **Sensitivity and specificity of the Akena Visual Depression Inventory (AVIDI-18) in Kampala (Uganda) and Cape Town (South Africa).** *Br J Psychiatry* 2018 **212**(5):301-307.
23. MikeCRM Co., Ltd., <https://www.mikecrm.com/>
24. Guggenmoos-Holzmänn I, Vonk R: **Kappa-like indices of observer agreement viewed from a latent class perspective.** *Stat Med* 1998, **17**(8):797-812.
25. Blanco V, Vazquez FL, Guisande MA, Sanchez MT, Otero P: **Identification of non-professional caregivers with high resilience using sociodemographic, care, and personal and social development variables.** *Aging Ment Health* 2020, **24**(7):1088-1097.
26. Tam JW, Schmitter-Edgecombe M: **A caregiver educational program: A video program to promote aging services technologies awareness.** *Geriatr Nurs* 2019, **40**(1):78-83.
27. Liu F, Tsang RC, Zhou J, Zhou M, Zha F, Long J, Wang Y: **Relationship of Barthel Index and its Short Form with the Modified Rankin Scale in acute stroke patients.** *J Stroke Cerebrovasc Dis* 2020, **29**(9):105033.
28. MacIsaac RL, Ali M, Taylor-Rowan M, Rodgers H, Lees KR, Quinn TJ: **Use of a 3-Item Short-Form Version of the Barthel Index for Use in Stroke.** *Stroke* 2017, **48**(3):618-623.
29. Sarker SJ, Rudd AG, Douiri A, Wolfe CD: **Comparison of 2 extended activities of daily living scales with the Barthel Index and predictors of their outcomes: cohort study within the South London Stroke Register (SLSR).** *Stroke* 2012, **43**(5):1362-1369.
30. Zhou M, Liu X, Zha F, Liu F, Zhou J, Huang M, Luo W, Li W, Chen Y, Qu S *et al*: **Stroke outcome assessment: Optimizing cutoff scores for the Longshi Scale, modified Rankin Scale and Barthel Index.** *PLoS One* 2021, **16**(5):e0251103.
31. Quinn TJ, Langhorne P, Stott DJ: **Barthel index for stroke trials: development, properties, and application.** *Stroke* 2011, **42**(4):1146-1151.

Tables

Table 1. The sociodemographic characteristics of surveyed patients

Items	Category	Bedridden Group		Domestic Group		Community Group		χ^2	P-value
		n	%	n	%	n	%		
Gender	Male	278	29.4	204	21.5	146	15.4	1.440	0.487
	Female	141	14.9	94	9.9	84	8.9		
Ethnicity	Han	419	44.2	297	31.4	230	24.3	2.180	0.336
	Minority	0	0	1	0.1	0	0		
Marriage	Married	387	40.9	286	30.2	223	23.5	13.156	0.041
	Unmarried	6	0.6	5	0.5	3	0.3		
	Divorce	4	0.4	3	0.4	0	0		
	Widowed	22	5.3	4	1.3	4	1.7		
Living status	Living alone	10	1.1	9	1.0	2	0.2	25.536	0.001
	Living with family	366	38.6	269	28.4	224	23.7		
	Living with tender	22	2.3	12	1.3	4	0.4		
	Living in nursing institution	10	1.1	7	0.7	0	0		
	other	11	1.2	1	0.1	0	0		
Religion	Yes	41	4.3	24	2.5	10	1.1	6.031	0.049
	No	378	39.9	274	28.9	220	23.2		
Education level	Primary school	112	11.8	66	7.0	53	5.6	13.707	0.090
	Secondary school	233	24.6	179	18.9	132	13.9		
	University	52	5.6	44	4.6	42	4.4		
	Graduate school	22	2.3	9	1.0	3	0.3		
Retirement	Yes	245	25.9	168	17.7	143	15.1	1.818	0.403
	No	174	18.4	130	13.7	87	9.2		
Family annual income	Less than ¥50 thousands	86	9.1	63	6.7	29	3.1	53.897	0.000
	¥50-100 thousands	222	23.4	145	15.3	79	8.3		
	¥100-150 thousands	71	7.5	69	7.3	81	8.6		
	¥150-200 thousands	31	3.3	15	1.6	31	3.3		
	More than ¥200 thousands	9	1.0	6	0.6	10	1.1		
mRS	Grade 0	2	0.2	2	0.2	27	2.9	707.753	0.000
	Grade 1	2	0.2	24	2.5	83	8.8		
	Grade 2	13	1.4	46	4.9	60	6.3		
	Grade 3	20	2.1	142	15.0	23	2.4		
	Grade 4	269	28.4	65	6.9	4	0.4		
	Grade 5	113	11.9	19	2.0	33	3.5		
Total		419	44.2	298	31.5	230	24.3		

Table 2. The sociodemographic characteristics of surveyed informal Caregivers

Items	Category	N	Percentage (%)
Gender	Male	372	39.3
	Female	575	60.7
Ethnicity	Han	925	97.7
	Minority	22	2.3
Census register	Urban	380	40.1
	Rural	567	59.9
Education level	Primary school	266	28.1
	Secondary school	370	39.1
	High School	176	18.8
	University	126	13.3
	Graduate school	9	1.0
Family annual income	Less than¥50 thousands	632	66.7
	¥50-100 thousands	193	20.4
	¥100-150 thousands	65	6.9
	¥150-200 thousands	27	2.9
	More than¥200 thousands	30	3.2
Relationship with patient	Spouse	405	42.8
	Offspring	196	20.7
	Parent	114	12.0
	Siblings	126	13.3
	Other kinsfolk	85	9.0
	Colleague/Friend	21	2.2
Total		947	100.0

Table 3. Agreement between scoring by healthcare professionals and informal caregivers

Item	Agreement number of scoring	Total number	Agreement rate (%)	Weighted Kappa coefficient
Bladder and bowel management	381	518	73.6	0.549
Feeding	402	518	77.6	0.657
Entertainment	386	518	74.5	0.566
Toileting	119	161	73.9	0.553
Grooming and bathing	117	161	72.7	0.504
Housework	138	161	85.7	0.553
Community mobility	89	103	86.4	0.719
Shopping	92	103	89.3	0.786
Social participation	87	103	84.5	0.630

Table 4. Results of Longshi Scale evaluated by informal caregivers with different education levels

Education Levels	Healthcare Professionals			Informal caregivers			MNB †	P Value
	Bedridden Group	Domestic Group	Community Group	Bedridden Group	Domestic Group	Community Group		
Primary school	179	64	23	194	46	26	8.759	0.013
Secondary school	239	79	52	240	80	50	0.707	0.872
High School	96	51	29	95	51	30	2.175	0.537
University	53	45	28	61	40	25	4.714	0.194
Graduate school	2	2	5	1	4	4	3.000	0.223
Total	569	241	137	591	221	135	7.413	0.060

† McNemar-Bowker Test was used to analyze.

Figures

龙氏日常生活能力评定量表

LONGSHI ASSESSMENT SCALE OF ACTIVITIES OF DAILY LIVING

使用手册

姓名 Name 性别 Gender 年龄 Age 电话 Telephone Number 诊断 Diagnosis

评定流程 Evaluation Flow

表1 Form 1

人群 (Group)	评定内容 (Evaluation Contents)						得分 (Score)		
 床上人 Bedridden Group 评分细则 Assessment Rules	大小便控制 (Toileting)		1分 1 Point		2分 2 Points		3分 3 Points		
		进食 (Feeding)		1分 1 Point		2分 2 Points			3分 3 Points
			娱乐 (Amusement)		1分 1 Point		2分 2 Points		
	评定结果 (Assessment Results)	床上人 ☐ <4分 生活完全不能自理 ☐ 4-9分 生活基本不能自理 ☐ 总分 <input type="text"/>							
	评定者 (Evaluator) : _____ 评定日期 (Date) : _____								

表2 Form 2

人群 (Group)	评定内容 (Evaluation Contents)						得分 (Score)		
 家庭人 Domestic Group 评分细则 Assessment Rules	如厕 (Toileting)		1分 1 Point		2分 2 Points		3分 3 Points		
		个人卫生 (Personal hygiene)		1分 1 Point		2分 2 Points			3分 3 Points
			家务 (Housework)		1分 1 Point		2分 2 Points		
	评定结果 (Assessment Results)	家庭人 ☐ <4分 生活小部分自理 ☐ 4-9分 生活大部分自理 ☐ 总分 <input type="text"/>							
	评定者 (Evaluator) : _____ 评定日期 (Date) : _____								

表3 Form 3

人群 (Group)	评定内容 (Evaluation Contents)						得分 (Score)		
 社会人 Community Group 评分细则 Assessment Rules	小区散步 (Walking in the community)		1分 1 Point		2分 2 Points		3分 3 Points		
		购物 (Shopping)		1分 1 Point		2分 2 Points			3分 3 Points
			运动参与 (Participating in sports)		1分 1 Point		2分 2 Points		
	评定结果 (Assessment Results)	社会人 ☐ <4分 生活基本自理 ☐ 4-9分 生活完全自理 ☐ 总分 <input type="text"/>							
	评定者 (Evaluator) : _____ 评定日期 (Date) : _____								

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Figure 1

Longshi Scale for assessing the activities of daily living

Figure 2

Flow chart of assessment using Longshi Scale

First step of Longshi Scale is to assess if subjects belong to bedridden, domestic, or community groups according to whether they can transfer out of bed or outdoors and return. Each subject will then be further evaluated using the corresponding form (subscale) of Longshi Scale. Finally, calculate the total score of each form (subscale).

Figure 3

Scores of Longshi Scale in healthcare professionals and informal caregivers

Healthcare professionals and informal caregivers used Longshi Scale to evaluate functional independence and disability. The mean scores of Longshi Scale items in bedridden group (a), domestic group (b), and community group (c) were compared using t-tests. Level of significance was <0.05 .

Figure 4

Difference in Longshi Scale sum score scored by healthcare professionals and informal caregivers

The difference in Longshi Scale sum score scored by healthcare professionals and informal caregivers were compared. Outlier points were determined as outside the range (mean $\pm 2SD$) in bedridden group, domestic group, and community group.