Original Article

Validation of a novel nutrition risk screening tool in stroke patients

Ying Xie MSc[1,2†], Qian Liu BSc[1,2†], Hongmei Xue PhD[1,2], Yujia Wei MSc[1], Jing Wang MSc[3], Zengning Li PhD[1,2]

[1]*Department of Nutrition, The First Hospital of Hebei Medical University, Shijiazhuang, Hebei, China*
[2]*Hebei Province Key Laboratory of Nutrition and Health, Shijiazhuang, Hebei, China*
[3]*Health Management Center, The First Hospital of Hebei Medical University, Shijiazhuang, Hebei, China*
[†]*Both authors contributed equally to this manuscript*

Background and Objectives: We aimed to apply a novel nutrition screening tool to stroke patients and assess its reliability and validity. **Methods and Study Design:** Cross-sectional data among 214 imaging-confirmed stroke patients were collected between 2015 and 2017 in two public hospitals in Hebei, China. Delphi consultation was conducted to evaluate the items in the NRS-S scale. Anthropometric indices including body mass index (BMI), triceps skin fold thickness (TSF), upper arm circumference (AMC) and mid-arm muscle circumference (MAMC) were measured. Internal consistency reliability, test-retest reliability, construct validity and content validity were assessed. In order to estimate content validity, two rounds Delphi consultation of fifteen experts were conducted to evaluate the items in the Nutrition Risk Screening Scale for Stroke (NRS-S). **Results:** High internal consistency was indicated by Cronbach's alpha of 0.632 and a split-half reliability of 0.629; test-retest reliability of NRS-S items ranged from 0.728 to 1.000 ($p<0.0001$), except for loss of appetite (0.436, $p<0.001$) and gastrointestinal symptoms (0.213, $p=0.042$). Content validity index of 0.89 indicated robust validity of the items. Regarding construct validity, the Kaiser-Meyer-Olkin value was 0.579, and the result of the Bartlett test of sphericity was 166.790 ($p<0.001$). Three factors were extracted by exploratory factor analysis, which contributed to 63.079% of the variance. Confirmatory factor analysis was performed on the questionnaire, finding the *p*-value of the model to be 0.321, indicating a high model fitting index. **Conclusions:** A novel stroke-specific nutritional risk screening tool demonstrated a relatively high reliability and validity in its clinical application.

Key Words: nutritional risk screening, stroke, rehabilitation, reliability, validity

INTRODUCTION

Stroke, the second leading cause of death in the world, can significantly affect the autonomy and patient ability to feed properly.[1] Malnutrition after stroke increases the length of stay in hospital, increases mortality and aggravates disability.[2] Nutritional support, a therapeutic that can be useful in the management of strokes and during the rehabilitation period, may help to reduce the occurrence of complications due to the physical dependence associated with this condition.[2,3] Hence, it is of very importance to screen malnutrition timely and correctly in clinical practice among post-stroke individuals.

To date, many nutrition screening tools (NSTs) for the identification of malnutrition of patients at admission, like Subjective Global Assessment (SGA)[4] and Patient-Generated Subjective Global Assessment(PG-SGA),[5] Mini-Nutrition Assessment (MNA),[6] Malnutrition Universal Screening Tool (MUST),[7] Nutritional Risk Screening 2002 (NRS 2002),[8,9] and the Global Leadership Initiative on Malnutrition (GLIM)[10] have been recommended by the European Society for Clinical Nutrition and Metabolism,[8,9] the American Society of Parenteral and Enteral Nutrition,[4] the British Society of Parenteral. These tools all have their emphasis and limitations: SGA was originally designed to predict complication risk following general surgery;[11] MNA served as screening and assessment tools to identify nutritional risk in the elderly;[6] MUST was designed for the general patient group in non-specific healthcare setting;[7] NRS is a strong and independent risk score for malnutrition associated mortality and adverse outcomes over 180 days;[12] GLIM standard was proposed as an international consensus standard for the diagnosis of malnutrition;[10] PG-SGA is often referred to as the "gold standard" for the diagnosis of malnutrition.[13] However, there has been no consensus on the best NST for assessing nutrition status of stroke patients. Based on practical evidence, a clinically corroborated stroke-specific nutrition screening tool is on pressing demand.

Corresponding Author: Prof Zengning Li, Department of Nutrition, The First Hospital of Hebei Medical University, Shijiazhuang, Hebei, China.
Tel: +86 18633889888
Email: lizengning@126.com
Manuscript received 18 November 2022. Initial review completed 07 December 2022. Revision accepted 09 January 2023.
doi: 10.6133/apjcn.202303_32(1).0004

NRS-S is a NST used to quickly and accurately evaluate the nutritional status of patients with stroke. It was derived based on some of the most sensitive factors that could affect the nutritional status of stroke patients. The researcher's team acquired the eight items (Table 1) from linear regression analysis between different risk factors and the results of NSTs. We have applied the tool to clinical stroke patients and have achieved ideal effect.

In view of the vital importance of nutritional status to the rehabilitation of stroke patients, the NRS-S is a promising screening instrument. Until now, the NRS-S remains unvalidated. The aim of the present study was to examine the validity and reliability of the novel scale in stroke patients.

METHODS

Participants

This cross-sectional study was conducted in two public hospitals (The First Hospital of Hebei Medical University and Xingtai People's Hospital) in Hebei, China, between January 2015 and March 2017, which aimed to a develop novel nutrition risk Screening tool for stroke patients. Inclusion criteria for the present study: stroke patients are diagnosed in accordance with the diagnostic guidelines of cerebral apoplexy and cerebral vascular diseases approved on The Fourth National Cerebrovascular Disease Conference (1995) in China,[14] and confirmed by the transcranial CT or MRI examination. Participants suffering from stroke for the first time (course of disease: 2-8 weeks) aged 40-90 years old were included. Patients with malignant disease, rapid disease progression and/or life-threatening situation at any time were excluded from further study. As described in detail previously,[15,16] A minimum of 178 subjects would thus be needed for the validity study. The study was approved by the Ethics Committee of the First Hospital of Hebei Medical University (Approved No. 2015075), complying with the Declaration of Helsinki. All participants signed informed consent form prior to participating in the study.

A total number of 214 stroke patients were recruited in our study voluntarily. Of these, fifteen participants were excluded from final report due to incomplete data, yielding 199 patients eligible for statistical analysis. Among them, 102 stroke patients received NRS-S assessment at the time of admission, and a total of 91 valid questionnaires were obtained. Another 112 stroke patients underwent NRS-S evaluation at admission to obtain confirmatory factor analysis (CFA), and a total of 108 valid questionnaires were obtained.

Measurements

Nutrition Risk Screening Scale for stroke

The NRS-S consists of eight statements screening the nutritional status in stroke patients. The researcher's team acquired the eight items (Table 1) from linear regression analysis between different risk factors and the results of NSTs. Assessment: (1) stroke patients who are positive for one or more criteria in category A, or two or more criteria in category B, should be referred immediately to doctors and nutritionists for follow-up treatment; (2) if patients show none of category A criteria and one or less criteria in category B, they should be recommended for appropriate nutrition guidance, personalized treatments and further care. The category "age >70 years old" was assigned as one point in our NRS-S system although only NRS2002 considered the age factor. Older people were at risk of malnutrition due to reduced activity and food intake, body composition changes, physical and mental illness, disability and lack of mobility.[17] It has been reported that up to 80% of hospitalized stroke patients could not swallow safely.[18,19] Swallowing dysfunction and disturbance of consciousness not only have a high prevalence, but are also found to be significantly associated with reduced ingestion, metabolic disorders and protein malnutrition. The linear relationship analysis of nutritional assessments Body Composition Analysis (BCA), NRS2002, MNA, SGA, and MUST revealed an additional five items that can aggravate malnutrition.

Procedures

One hundred and two participants with stroke were assessed with NRS-S on admission to the hospital, with demographic and clinical variables of the objects collected by qualified staff. Parameters include age, sex, height, weight, body mass index (BMI), triceps skin fold thickness (TSF), upper arm circumference (AMC), mid-arm muscle circumference (MAMC), albumin (Alb) and hemoglobin (Hb). For One week later, follow-up test was performed with NRS-S.

Anthropometric measurements were performed by trained medical workers according to the standard procedures at baseline. Body weight and height were measured in light indoor clothing without shoes, to the nearest 0.1 kg and 0.1 cm, respectively. BMI is then calculated as weight (kg)/height $(m)^2$. Weight and height were each averaged on the basis of two measurements. Triceps skinfold thickness was measured from the left side of the body to the nearest 0.1 mm, using a skinfold caliper, at the flowing sites: halfway between the acromion process and the olecranon process. Hematological indexes were carried out by the clinical laboratory of the participating

Table 1. Nutrition risk screening scale for stroke†

Category	Items		Items	
A	Age >70 years old	□	Swallowing dysfunction	□
	Disturbance of consciousness	□	Dependence (or half-reliance) on the mode of feeding	□
B	Decreased activity	□	Upper limb muscle strength decline	□
	Loss of appetite	□	Gastrointestinal symptoms	□

†Assessment: 1) stroke patients who are positive for one or more criteria in Category A, or two or more criteria in Category B, should be referred immediately to doctors and nutritionists for follow-up treatment; 2) if patients show none of Category A criteria and one or less criteria in Category B, they should be recommended for appropriate nutrition guidance, personalized treatments and further care.

hospital.

In order to estimate content validity, two rounds Delphi consultation of fifteen experts were conducted to evaluate the items of the NRS-S scale. Members of the panel gave a viewpoint to each item: 1 = strongly disagree; 2 = disagree; 3 = agree; and 4 = strongly agree. Finally, the content validity index was calculated by the percentage of 3 or 4 scoring experts.

Statistical analysis

The statistical analysis was conducted using IBM SPSS Statistics 23.0 (New York, the United States) and Amos 6.0. All *p*-values were two-tailed, and statistical significance was indicated by a p-value of less than or equal to 0.05.

Demographic and clinical variables of the objects were summarized using descriptive analysis. Parameters include age, sex, height, weight, BMI, TSF, AMC, MAMC, Alb and Hb. These parameters were checked for normality using the Shapiro Wilk normality test and visualized using the Q-Q plot. Normally distributed continuous variables were analysed by two-tailed independent t-test.

The content validity index (CVI) was computed based on the scores produced by the expert panel.

Reliability was determined by internal consistency using Cronbach's alpha and stability was determined using the split-half coefficient value with Spearman-brown correction. Test-retest reliability was assessed by calculating Spearman's rank correlation for two retest intervals: on admission and at one week. Exploratory factor analysis (EFA) (with Orthogonal Rotation-Varimax with Kaiser Normalization) and CFA (Amos 6.0) were used to estimate the construct validity.

RESULTS

Patient information

One hundred and two participants with stroke were assessed with NRS-S on admission to the hospital. Among them, 91 patients were effectively evaluated, including 40 men and 51 women. The average age of the patients was 62.8 years (62.8±11.4) and the average weight was 69.2 kg (69.2±8.9). The triceps skinfold thickness (TSF), mid arm circumference (MAC), upper arm muscle circumference (MAMC), haemoglobin (HB) and total protein were also investigated (Table 2).

Reliability

Reliability reflects the stability of tools, which is most commonly assessed using methods such as test-retest reliability, split-half reliability, and internal consistency reliability. Internal consistencies (Cronbach's alpha) for the NRS-S were 0.632; split-half reliabilities of the total scores were moderate, r=0.630 for Spearman-brown corrected correlations. Test-retest correlations were independent reliability measurements from internal consistency.[20] The NRS-S demonstrated medium-high stability over an interval of one week (Table 3).

Validity

The overall CVI of the NRS-S determined by the provisional expert committee was 0.89. Regarding construct validity, the Kaiser-Meyer-Olkin value was 0.579, and the result of the Bartlett test of sphericity was 167 (p<0.001). Since both parameters met the significance

Table 2. Characteristics of the patients (n=91)

Parameter	Mean±SD
Age, years	62.8±11.4
Male	59.1±12.3
Female	67.8±9.8
Gender	
Male (n=40, 43.96%)	61.7±13.4
Female (n=51, 56.04%)	68.0±9.9
Weight, kg	69.2±8.9
BMI, kg/m^2	23.5±2.7
TSF, mm	12.4±3.3
MAC, cm	27.8±3.26
MAMC, cm	24.8±3.27
Hb, g/L	133.4±16.0
Total protein, g/L	64.3±6.47
Alb, g/L	38.0±5.73

SD: standard deviation; BMI: BMI= Weight (kg)/height^2 (m^2); TSF: triceps skinfold thickness; MAC: mid arm circumference; MAMC: upper arm muscle circumference; Hb: haemoglobin; Alb: albumin.

Table 3. Reliability of the NRS-S. Test-retest reliability of the items and the total score (n = 91)

Items	Test-retest reliability coefficient	*p* values
Age >70 years old	1.000	<0.0001
Swallowing dysfunction	0.884	<0.0001
Disturbance of consciousness	0.844	<0.0001
Dependence (or half-reliance) on the mode of feeding	0.888	<0.0001
Decreased activity	0.771	<0.0001
Upper limb muscle strength decline	0.914	<0.0001
Loss of appetite	0.436	<0.0001
Gastrointestinal symptoms	0.213	0.042
Total	0.728	<0.0001

Table 4. Construct validity: calculated Spearman correlation coefficients between the items

Items	A1	A2	A3	A4	B1	B2	B3	B4	Total
A1	1.000	0.136	0.180	0.405	0.185	0.100	0.236	0.038	0.256*
A2	0.136	1.000	0.288	0.705	0.258	0.241	-0.014	0.085	0.262*
A3	0.180	0.288	1.000	0.311	0.106	0.095	0.005	0.001	0.153
A4	0.405	0.705	0.311	1.000	0.282	0.264	0.143	0.052	0.281**
B1	0.185	0.258	0.106	0.282	1.000	0.676	-0.036	0.035	0.601**
B2	0.100	0.241	0.095	0.264	0.676	1.000	-0.004	-0.063	0.524**
B3	0.236	-0.014	0.005	0.143	-0.036	-0.004	1.000	0.203	0.254*
B4	0.038	0.085	0.001	0.052	0.035	-0.063	0.203	1.000	0.159
Total	0.256	0.262	0.153	0.281	0.601	0.524	0.254	0.159	1.000

A1: Age >70 years old; A2: Swallowing dysfunction; A3: Disturbance of consciousness; A4: Dependence on the mode of feeding; B1: Decreased activity; B2: Upper limb muscle strength decline; B3: Loss of appetite; B4: Gastrointestinal symptoms.
* p<0.05, ** p<0.001.

Table 5. Construct validity: Factor loading matrix of the items in the 3-factor solution confirmatory principal component analysis with Varimax rotation for NRS-S (n=91)

Item	Factor 1	Factor 2	Factor 3
Age >70 years old	0.400	NG	0.493
Swallowing dysfunction	0.803	NG	NG
Disturbance of consciousness	0.663	NG	NG
Dependence (or half-reliance) on the mode of feeding	0.834	NG	NG
Decreased activity	NG	0.900	NG
Upper limb muscle strength decline	NG	0.904	NG
Loss of appetite	NG	NG	0.815
Gastrointestinal symptoms	NG	NG	0.616

NG: not given.

levels, factor analysis was applied for further examination. Three common factors were extracted to explain 24.6%, 21.7% and 16.7% of the total variance, respectively, yielding a total contribution of 63.1% by the standard of characteristic root >1. The factor loads of the items were 0.400-0.904 (Tables 4 and 5). For the remaining 108 questionnaires, CFA analysis showed p-value of the model was 0.321, and the fitting model was obtained (Figure 1). The fitting indexes of the model were higher (Table 6). Most fit indicators have reached the ideal standard with indexes as follows: $\chi2$=19.1, χ^2/df=1.13, Root Mean Square Error of Approximation (RMSEA)=0.034, Comparative Fit Index (CFI)=0.989, Tueker-Lewis Index (TLI)=0.982. Only Standardized Root Mean Square Residual (SRMR) appeared slightly less than ideal, but remained within acceptable limits.

DISCUSSION

High prevalence of malnutrition in stroke patients has been reported ranging from 6-62%.[21, 22] Risk of malnutrition is an independent predictor of mortality, length of hospital stays and hospitalization costs in stroke patients. As stroke patients are likely to experience poor outcomes, timely nutrition risk screening is essential. In this study the validity and reliability of NRS-S were analysed in a sampled population of hospitalized stroke patients. This

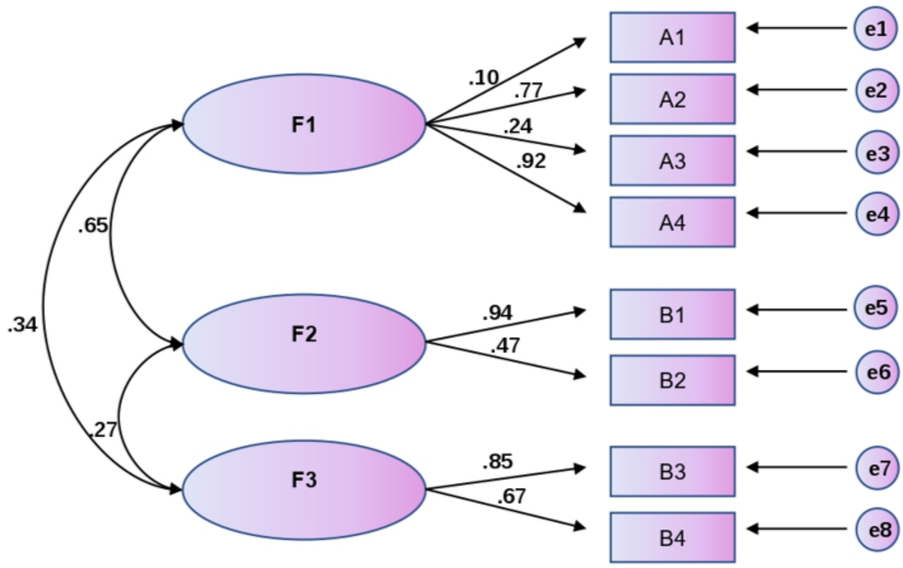


Figure 1. Standardized regression weights of the NRS-S (n=108).

Table 6. Comparation of model fit indexes of the NRS-S with index criteria (n = 108)

Items	χ^2	df	χ^2/df	*p*	CFI	TLI	RMSEA	SRMR
Value	19.128	17	1.125	0.321	0.989	0.982	0.034	0.053
Criterion			<2	>0.05	>0.90	>0.90	<0.05	<0.08

study confirms the high prevalence of nutritional risk (71.9%) in hospitalized stroke patients according to NRS-S. NRS-S holds considerable potential for practical clinical use for nutrition risk screening among stroke patients.

The internal consistency of NRS-S was determined by Cronbach's alpha coefficient and split-half reliability.[23] The split-half reliability of 0.630 indicated adequate consistency between the two parts of the criteria of the scale. And a Cronbach's alpha coefficient of 0.632 was considered to be satisfactory. Cronbach's alpha was first introduced in psychological research and widely accepted thereafter as an important validity indicator in scientific and medical areas. Nunnally (1967) recommended 0.50 to 0.60 for the early stages of research. The starting level was increased to 0.70 in later versions.[24-26] A Cronbach's alpha coefficient between 0.70 and 0.90 is the recommended value for an instrument but the authors also pointed out that instruments consisted of causal indicators are not crucial to have high degree of homogeneity, the reason being that causal indicators could define the underlying construct solely by their presence.[27] The NRS-S consists of early stages of research investigating risk factors for malnutrition which could potentially be causal indicators; thus, a Cronbach's alpha coefficient of 0.632 was deemed adequate. The test-retest reliability reflects consistency of instruments across time. A one-week interval between tests is generally considered to be appropriate. This is sufficiently short to minimize attrition due to change in clinical condition but long enough to prevent recall bias. The intra-class correlation coefficient (ICC) of 0.728 obtained for the test-retest of the two total NRS-S scores showed competent stability. The ICCs between the test and retest of the NRS-S items varied between 0.213 and 1.000, representing fair agreement to nearly perfect agreement.[28] The test-retest reliability results showed that all the correlation coefficients were statistically significant; however, the coefficients of two items, loss of appetite and gastrointestinal symptoms, were relatively low. One possible explanation for the low values is that the signs of loss of appetite and gastrointestinal symptoms are not only more readily noticed but also amendable to drugs or treatments in a relatively short treatment period.

A fine content validity has been indicated by a CVI of 0.89 achieved by the expert panel assessment.[29] The construct validity of the NRS-S was estimated by EFA and CFA. Ideal factor analysis suggests that each item should only have a higher load value on one of the common factors compared to the remainder. The larger the factor load, the closer the relationship between items and the common factor was (reference, absolute value >0.4).[30] The cumulative variance contribution ratio of the common factors is at least 40%.[31] The exploratory factor analysis model of the NRS-S had three common factors. Table 6 shows that all items had relatively high loads on one corresponding common factor exclusively of the remaining two. The communality of each item ranged from 0.496 to 0.905, and the total explained variance was 63.1% (reference, >40%), indicating that the NRS-S had moderate construct validity.

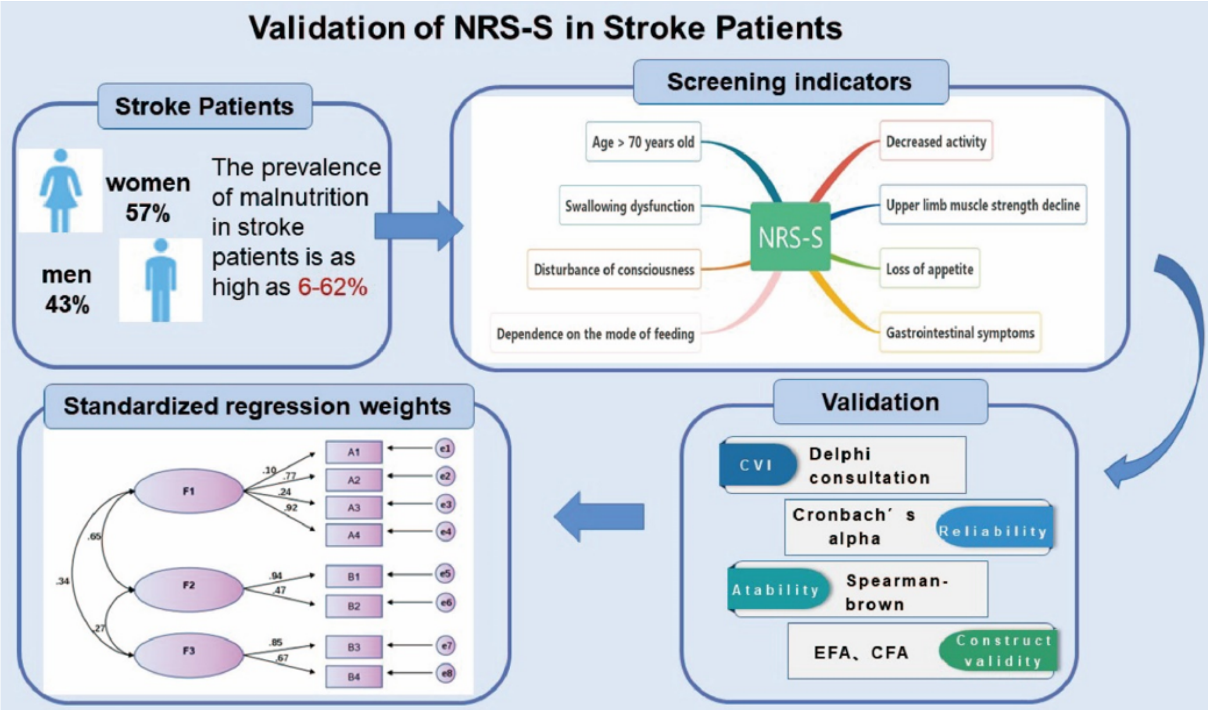
Concluding from the above indicators, our model fit well with the hypothesis. Except for "age >70 years old and disturbance of consciousness", most of the standardized path coefficients of each scale reached 0.40. In NRS2002, "age >70 years old" yielded one point while the severity of stoke disease progression results in two points. We believed that it would be appropriate to keep the age factor in the scale. Disturbance of consciousness directly lead to dependence on the mode of feeding which caused the patient to be prone to protein malnutrition and metabolic disturbances.

The clinical significance and further application of our study might be limited by several factors. Most importantly, our study sampled from hospitalized patients only and thus the findings are specific to such population. The statistics may or may not apply to patients outside of hospital. Other modes of participant recruitment such as telephone or mail questionnaire could be employed in conjugation with current methods. Such protocol enables the collection of data from patients unwilling/unable to attend hospitalization or receiving family nutrition care at home. Development of sound and unbiased sampling methods would help draw meaningful conclusions for the general stroke patient population. Secondly, the validity of a scale is usually done against a gold standard. The joint paper issued by the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition proposed six characteristics for adult nutrition assessment completely independent of any biochemical tests.[32] During further development and construction of an integral nutrition screening tool, these parameters could be taken into account as co-operating diagnostic tools.

The NRS-S had demonstrable validity and reliability for nutritional risk screening in hospitalized patient population suffering from stroke. The scale may help nurses to correctly and timely screened stroke patients at risk of malnutrition, and help dietitian comprehensive nutrition assessment and appropriate nutritional intervention decision-making. In addition, whether nutritional intervention would improve outcome in stroke patients at malnutrition risk (according to NRS-S) also needs to be investigated. We remain optimistic about the potential application of our novel nutrition screening tools specifically designed for stroke patients.

Conclusion

High internal consistency was indicated by Cronbach's alpha of 0.632 and a split-half reliability of 0.629; test-retest reliability of NRS-S items ranged from 0.728 to 1.000 (p<0.001), except for loss of appetite (0.436, p<0.001) and gastrointestinal symptoms (0.213, p=0.042). Content validity index of 0.89 indicated robust validity of the items.



Graphical abstract.

The overall CVI of the NRS-S determined by the provisional expert committee was 0.89. Regarding construct validity, the Kaiser-Meyer-Olkin value was 0.579, and the result of the Bartlett test of sphericity was 166.790 ($p<0.001$). Three factors were extracted by exploratory factor analysis, which contributed to 63.1% of the variance. For the remaining 108 questionnaires, CFA analysis showed that the *p* value of the model was 0.321, indicating that the fitting index of the model was high.

We evaluated the internal consistency reliability, test-retest reliability, construct validity and content validity of NRS-S, and showed that NRS-S showed relatively high reliability and effectiveness in clinical application, which means that NRS-S is allowed to be prioritized as a tool for nutritional risk screening of stroke patients. NRS-S has important significance for rapid diagnosis of malnutrition in stroke patients.

ACKNOWLEDGEMENTS

We would like to thank Xingbo Li for online searches and writing style advice. Li provided voluntary help as a current PhD candidate at The University of Auckland, Auckland, New Zealand.

AUTHOR DISCLOSURES

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.

This work was supported by Medical science research project of Hebei Provincial Health Commission (No.20190476), Cooperative project of Sun Yat sen University (HZ201701).

REFERENCES

1. GBD 2019 Stroke Collaborators. Global, regional, and national burden of stroke and its risk factors, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet Neurol. 2021;20:795-820. doi: 10.1016/S1474-4422(21)00252-0.
2. Gomes F, Emery PW, Weekes CE. Risk of malnutrition is an independent predictor of mortality, length of hospital stay, and hospitalization costs in stroke patients. J Stroke Cerebrovasc Dis. 2016;25:799-806. doi: 10.1016/j.jstrokecerebrovasdis.2015.12.017.
3. Johansen N, Kondrup J, Plum LM, Bak L, Nørregaard P, Bunch E, Baernthsen H, Andersen JR, Larsen IH, Martinsen A. Effect of nutritional support on clinical outcome in patients at nutritional risk. Clin Nutr. 2004;23:539-50. doi: 10.1016/j.clnu.2003.10.008.
4. Detsky AS, McLaughlin JR, Baker JP, Johnston N, Whittaker S, Mendelson RA, Jeejeebhoy KN. What is subjective global assessment of nutritional status? JPEN J Parenter Enteral Nutr. 1987;11:8-13. doi: 10.1177/0148607118701100108.
5. Bauer J, Capra S, Ferguson M. Use of the scored Patient-Generated Subjective Global Assessment (PG-SGA) as a nutrition assessment tool in patients with cancer. Eur J Clin Nutr. 2002;56:779-85. doi: 10.1038/sj.ejcn.1601412.
6. Cereda E. Mini nutritional assessment. Curr Opin Clin Nutr Metab Care. 2012;15:29-41. doi: 10.1097/MCO.0b013e32834d7647.
7. Stratton RJ, Hackston A, Longmore D, Dixon R, Price S, Stroud M, King C, Elia M. Malnutrition in hospital outpatients and inpatients: prevalence, concurrent validity and ease of use of the 'malnutrition universal screening tool' ('MUST') for adults. Br J Nutr. 2004;92:799-808. doi: 10.1079/bjn20041258.
8. Kondrup J, Allison SP, Elia M, Vellas B, Plauth M; Educational and Clinical Practice Committee, European Society of Parenteral and Enteral Nutrition (ESPEN). ESPEN guidelines for nutrition screening 2002. Clin Nutr. 2003;22:415-21. doi: 10.1016/s0261-5614(03)00098-0.
9. Kondrup J, Rasmussen HH, Hamberg O, Stanga Z; Ad Hoc ESPEN Working Group. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. Clin Nutr. 2003;22:321-36. doi: 10.1016/s0261-5614(02)00214-5.
10. Cederholm T, Jensen GL, Correia MITD, Gonzalez MC, Fukushima R, Higashiguchi T, Baptista G, Barazzoni R,

Blaauw R, Coats AJS, et al; GLIM Core Leadership Committee, GLIM Working Group. GLIM criteria for the diagnosis of malnutrition - A consensus report from the global clinical nutrition community. J Cachexia Sarcopenia Muscle. 2019;10:207-17. doi: 10.1002/jcsm.12383.

11. Foley NC, Martin RE, Salter KL, Teasell RW. A review of the relationship between dysphagia and malnutrition following stroke. J Rehabil Med. 2009;41:707-13. doi: 10.2340/16501977-0415.
12. Hersberger L, Bargetzi L, Bargetzi A, Tribolet P, Fehr R, Baechli V et al. Nutritional risk screening (NRS 2002) is a strong and modifiable predictor risk score for short-term and long-term clinical outcomes: secondary analysis of a prospective randomised trial. Clin Nutr. 2020;39:2720-9. doi: 10.1016/j.clnu.2019.11.041.
13. Jager-Wittenaar H, Ottery FD. Assessing nutritional status in cancer: role of the Patient-Generated Subjective Global Assessment. Curr Opin Clin Nutr Metab Care. 2017;20:322-9. doi: 10.1097/MCO.0000000000000389.
14. Wu C, Liu B. The Fourth National Academic Conference on cerebrovascular diseases. China Medical News. 1996;6:1.
15. Jones JM. Validity of nutritional screening and assessment tools. Nutrition. 2004;20:312-7. doi: 10.1016/j.nut.2003.11.005.
16. Jones JM. Reliability of nutritional screening and assessment tools. Nutrition. 2004;20:307-11. doi: 10.1016/j.nut.2003.11.012.
17. Corish CA, Bardon LA. Malnutrition in older adults: screening and determinants. Proc Nutr Soc. 2019;78:372-9. doi: 10.1017/S0029665118002628.
18. Takizawa C, Gemmell E, Kenworthy J, Speyer R. A systematic review of the prevalence of oropharyngeal dysphagia in stroke, Parkinson’s disease, Alzheimer’s disease, head injury, and pneumonia. Dysphagia. 2016;31:434-41. doi: 10.1007/s00455-016-9695-9.
19. Dennis M. Nutrition after stroke. Br Med Bull. 2000;56:466-75. doi: 10.1258/0007142001903102.
20. McCrae RR, Kurtz JE, Yamagata S, Terracciano A. Internal consistency, retest reliability, and their implications for personality scale validity. Pers Soc Psychol Rev. 2011;15:28-50. doi: 10.1177/1088868310366253.
21. Gilleard C. Old age in ancient Greece: Narratives of desire, narratives of disgust. J Aging Stud. 2007;21:81-92.
22. Nip WF, Perry L, McLaren S, Mackenzie A. Dietary intake, nutritional status and rehabilitation outcomes of stroke patients in hospital. J Hum Nutr Diet. 2011;24:460-9. doi: 10.1111/j.1365-277X.2011.01173.x.
23. Charter RA. Confidence interval formulas for split-half reliability coefficients. Psychol Rep. 2000;86:1168-70. doi: 10.2466/pr0.2000.86.3c.1168.
24. Bentler PM. Alpha, dimension-free, and model-based internal consistency reliability. Psychometrika. 2009;74:137-43.
25. Streiner DL. Starting at the beginning: an introduction to coefficient alpha and internal consistency. J Pers Assess. 2003;80:99-103. doi: 10.1207/S15327752JPA8001_18.
26. Henson R. Understanding internal consistency reliability estimates: A conceptual primer on coefficient alpha. Measurement and Evaluation in Counseling and Development. 2001;34:177-89.
27. Streiner DL, Norman GR, J C. Geographies of health and development. Aust N Z J Public Health. 2016;40:294. doi: 10.1111/1753-6405.12493.
28. Zou GY. Sample size formulas for estimating intraclass correlation coefficients with precision and assurance. Stat Med. 2012;31:3972-81. doi: 10.1002/sim.5466.
29. Shi J, Mo X, Sun Z. Content validity index in scale development. J. Cent. South. Univ. 2012;37:152-5. (In Chinese)
30. Lou Y, Lu L, Li Y, Liu M, Bredle JM, Jia L. Reliability and validity of the Chinese version of FACIT-AI, a new tool for assessing quality of life in patients with malignant ascites. J Palliat Med. 2015;18:829-33. doi: 10.1089/jpm.2015.0061.
31. Gao H, Söderhamn U, Zhang L, Cui HX, Liu K. Reliability and validity of the Chinese version of the Nutritional Form For the Elderly. Public Health Nutr. 2015;18:2559-64. doi: 10.1017/S1368980014003267.
32. Becker P, Carney LN, Corkins MR, Monczka J, Smith E, Smith SE, Spear BA, White JV; Academy of Nutrition and Dietetics; American Society for Parenteral and Enteral Nutrition. Consensus statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition: indicators recommended for the identification and documentation of pediatric malnutrition (undernutrition). Nutr Clin Pract. 2015;30:147-61. doi: 10.1177/0884533614557642.