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Analysis of nursing assessment terminology for neurological conditions and its cross-mapping with the International Classification of Functioning, Disability and Health (ICF): A multi-centre cross-sectional study

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Abstract

Aim: To analyse the application status of nursing assessment terminology for neurological conditions and determine whether the International Classification of Functioning, Disability, and Health (ICF) covers nursing assessment.

Design: A multi-centre cross-sectional study.

Methods: Four researchers extracted all nursing problems from the patients of three different hospitals and formed a pool of nursing terminology from the electronic nursing records, self-reports, family reports, medical examinations, and clinical records for all patients. The ICF Linking Rules were then used to map the nursing assessment terminology of neurological conditions with the ICF.

Results: Though 37.5% of nursing assessment terms were closely related to neurological diseases, this does not appear in the existing electronic nursing assessment records. The unrecorded rate of 9 (16.1%) terms ranged from 40%–50%, while the unrecorded rate of 8 (14.3%) terms was more than 80%. Overall, 96.4% of nursing assessment terms could be described by the corresponding categories of the ICF, with 37 (66.1%) of the "same" concepts, 9 (16.1%) "similar" concepts, 6 (10.7%) "narrower" concepts (the nursing assessment terms were more specific than the ICF categories), and 2 (3.6%) "broader" concepts (the nursing assessment were less specific than the ICF categories).

KEYWORDS
neurological conditions, nursing informatics, terminology

1 | INTRODUCTION

The nervous system has the most delicate and complex structure and function in the human body. Neurological damage can lead to chronic diseases and disability with high morbidity. (Pringsheim et al., 2014) According to a Chinese epidemiological study, stroke is the leading cause of death and puts a huge burden on patients and health professionals. (Sun et al., 2013) The latest report from the American Heart Association (Benjamin et al., 2019) indicates that about 90% of stroke patients have varying degrees of dysfunction, which seriously affects the patients' psychological status, social function, and quality of life. Moreover, neurological conditions have become a global concern.

Nursing assessment is an important part of the diagnosis and treatment of patients with neurological diseases from beginning to end. It also allows medical staff to fully understand the psychological status and social function of their patients. This assessment accurately reflects the patients' current functional status as well as any changes and provides an objective basis for diagnosis and treatment. Patients with nervous system disorders with an accurate nursing assessment may experience an improved prognosis and promotion of health. In the development of nursing informatics, the standardization of nursing data terminology and the integration of health care terms are the focus of the international nursing field. (Koutsogeorgou et al., 2014) Standardized nursing terminology is the basis for improving work communication and promoting patient information sharing. The electronic nursing information system (e-NIS) is product of this standardized terminology. The e-NIS is widely used in clinical practice and, is helpful for improving work efficiency. Some studies have indicated that the lack of uniform terminology has led to different e-NISs being implemented in different hospitals in China, which affects the accuracy and the sharing of nursing information. (Lin, 2014).

The comparability of information is essential to ensure that the widest range of information is available for any decision-maker at all levels of the health system. The content and methods of collecting health information often vary by setting and challenge the comparability of health information at different times, individuals, or populations. Therefore, a uniform, accurate, and efficient evaluation information system is urgently needed.

The World Health Organization (WHO)'s International Classification of Functioning, Disability and Health (ICF) constitutes a unified and standard language that is suitable as a reference for the classification of health information. (Cieza et al., 2019) The goal of the classifications was to improve health status and care of populations at the local, national, and international levels. (Madden et al., 2007) The ICF is one of the comprehensive sets belonging to the WHO Family of International Classifications, which is a multipurpose classification system used across different disciplines with a unified, standard language and framework, (World Health Organization, 2001) also identified as a multidimensional "biological-psychological-social" ecological model. (Lin, 2014) The ICF provides an effective systematic tool for the comprehensive analysis of physical, psychological, social, and environmental factors affecting the function of patients and their health status (Kim & Coenen, 2011) Some studies have suggested that the ICF has a more comprehensive terminology system related to function, disability, and health to accurately express various health statuses. (Kostanjsek, 2011; Wiegand et al., 2012).

China has begun to introduce ICF systems in medical practice. The Chinese version of ICF has been published in the official ICF website. (Zhuoying et al., 2008) The China Cooperation Center has also collaborated with the ICF sub-centre of the German Cooperation Center to develop a series of related tools, and has established an ICF classification data management platform based on the Classification Markup Language. (Heerkens et al., 2018) The data management platform has been applied to clinical settings, education, social services, social policies, disability statistics, and other fields, and the effects are remarkable. Additionally, China has established a dictionary of rehabilitation terms by referring to the terminology system of the ICF. However, the application of the ICF in clinical nursing practice is mainly in the field of rehabilitation nursing and focuses on nursing diagnoses and interventions in Europe. (Boldt et al., 2005) There is no study of ICF cross-mapping with nursing terms in China and it is unclear whether ICF is suitable for Chinese nursing assessment terminology. However, due to the systemic nature of neurological diseases and their high requirements for nursing records, patients with neurological diseases are in urgent need of an accurate and comprehensive nursing assessment terminology. (Dieplinger et al., 2017).

Thus, the purpose of this multi-centre, cross-sectional study was to investigate the application status of neurological nursing assessment terms and determine whether the ICF covers nursing assessment. The study included patients from three hospitals that use different care systems and mapped their evaluation information is mapped to the ICF. The evaluation efficiency of each system and the effect of ICF on the assessment of patients with neurological diseases were analysed. The findings of the study may help explore the prospects of ICF in the clinical practice of patients with neurological disease assessment.

2 | 2.METHODS

2.1 | Study design

A multi-centre, observational, cross-sectional study led by the Sir Run Run Shao Hospital Zhejiang University School of Medicine was conducted. The study was approved by the ethics committee of the Zhejiang University School of Medicine (Protocol #: 20151215-2). All participants provided written, informed consent before participation.

2.2 | Study participants and data collection

Three hospitals from the different cities of Zhejiang province in China were invited to participate in this study. They all signed the research agreement. All participants were recruited and case documents were collected between January 2016 and December 2016. Three research staff travelled to each hospital to evaluate the patients who met the inclusion criteria and to collect their care documents. Eligible participants were: (1) patients diagnosed with a neurological condition (according to ICD-10); (2) patients who received first-grade nursing (for patients with serious illness or unstable disease after surgery, who were unable to take care of themselves and required more complicated care) or intensive nursing (for end-stage patients with a changeable condition who might have needed emergency rescue at any time. After major surgery, these patients were guarded by 24-hr personnel.); (3) patients

who had capacity and consented to receive a comprehensive physical assessment; (4) patients able and willing to provide written informed consent; and (5) patients older than 18 years. Potential participants were excluded if they: (1) were unable to read and understand Chinese; (2) were unconsciousness; (3) had non-neurological diseases; (4) were incomplete cases; or (4) had been transferred to other relevant departments for further treatment due to the sudden onset of other diseases.

2.3 | Identification of terminology

The ICF Clinical Checklist (ICC; World Health Organization, 2001) is designed for clinical use. The ICC (version, 2.1a) includes 125 categories that represents the most relevant dimensions of individual health status at the primary and secondary classifications levels along with patient demographics (e.g. age, gender, weight, height, education, profession, diagnosis). The ICC uses a variety of information sources such as self-reports, medical examinations, clinical records, and family member reports. In order to reduce bias, the examiner included as many patients as possible in the hospitalization period to avoid selection bias due to the severity of the patient's condition. Furthermore, the data extraction tool used was an internationally recognized functional disability health checklist developed by the World Health Organization and is recognized internationally. In addition, the three team members responsible for the field data were trained in the documentation of standardized neurological disease cases, and the reliability and consistency of data collection were ensured through course training, simulated case documents, and assessment. The examiner made clinical judgments based on this information from different sources. For accurate evaluation of patients, this study refined the checklist to include a third level and provided a detailed explanation of each category according to the Chinese version of the ICF. New categories were added if they were covered by the ICC during the evaluation process, the new category is added.

2.4 | ICF linking and analysis with current electronic assessments

First, we set up a research team consisting of a chief nurse, a postgraduate nurse, and two nurses who had been clinically active in neurology for more than 10 years. The research team leader of the research conducted a one-week-long theoretical and practical training for team members. The training programme included understanding the concept of standardized nursing terminology, the concept and intention of ICF, and how to use ICC. Three members then used the ICC to conduct an on-site assessment of patients who experienced first-degree nursing or specialty nursing in the neurology and neurosurgery departments at

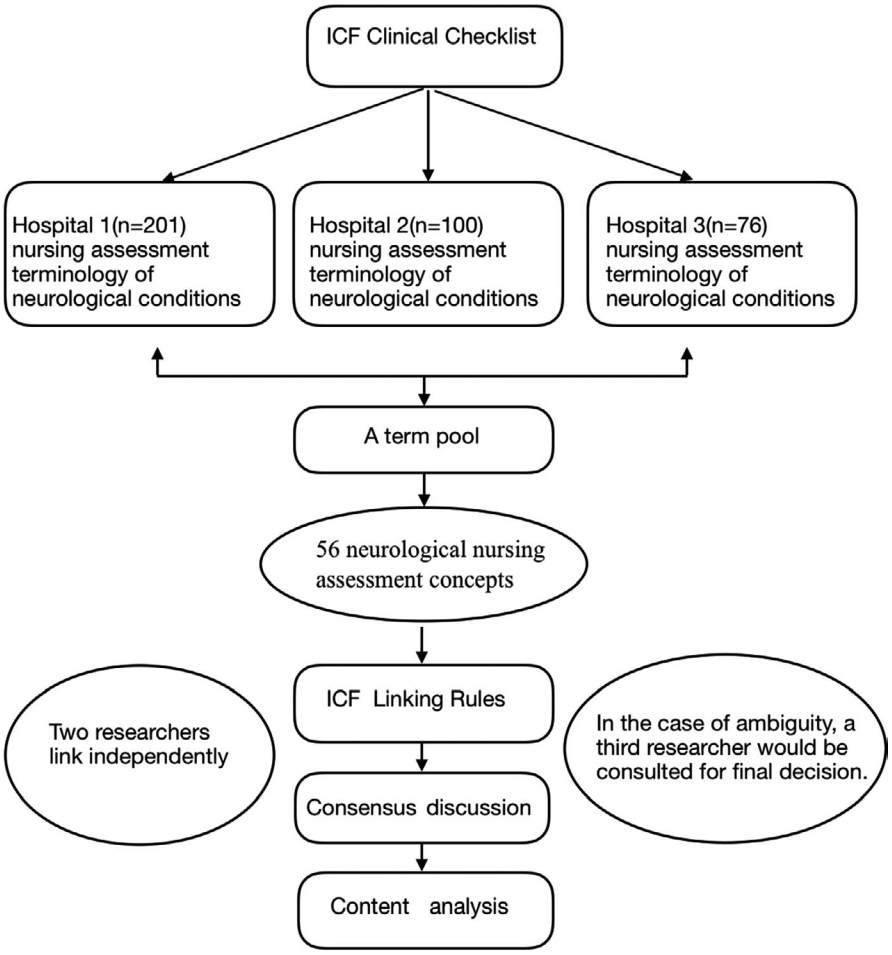

FIGURE 1 Process of nursing assessment terminology of neurological conditions/International Classification of Functioning, Disability and Health (ICF) mapping exercise

three tertiary general hospitals over the course of one year. The collection included electronic nursing evaluation records, medical records, self-reports, family members' reports, medical examinations, and clinical records. From this information, nursing assessment terms related to neurological conditions were extracted to form a terminology pool. Next, we mapped the nursing assessment terminology with the ICF based on well-established ICF Linking Rules. (Cieza et al., 2019) Two researchers familiar with the ICF and the ICF Linking Rules were appointed to link the identified sources of information independently to the ICF. Their linking was then compared and contrasted with one another. In the case of ambiguity, a third researcher was consulted for the final decision on the most appropriate linking. If nursing assessment terms contained more than one concept, each concept was linked to the ICF, such that one nursing assessment terms could be linked to more than one ICF category. Finally, content analysis was used to analyse the current status of the electronic nursing assessment terminology for neurological disorders. In addition to the ICF Linking Rules, (Cieza et al., 2019) the closeness of the match in respect of comparable concepts was described by using "same," "similar," "broader," and "narrower," as adopted from a previous study. (Zielstorff et al., 1998) Figure 1 illustrates the mapping exercise process. Figure 2 depicts the entire linking decision process.

2.5 | Statistical analyses

Statistical analysis was performed using the IBM SPSS Statistics for Windows, version 23.0 (Armonk, NY: IBM Corp). For the baseline characteristics, continuous variates were calculated the mean and standard deviation were calculated for continuous variables while proportion and quantity were calculated for classifications. Descriptive statistics were used to examine the frequency of ICF categories were linked to the direct or indirect assessments. The results of the age were expressed as the mean (standard deviation) and those of other clinical variables were expressed as a percentage. Calculations were as follows: evaluation rate = sample size of actual evaluation/the total sample size; nursing record rate = sample size of nursing record/the total sample size; and unrecorded rate = sample size of those evaluated but not recorded/sample size of actual evaluation. The actual evaluation was performed by three team members. The clinical nurse observed and recorded the data each morning when assessing the patients. All statistical data came from direct collection or algorithmic calculation.

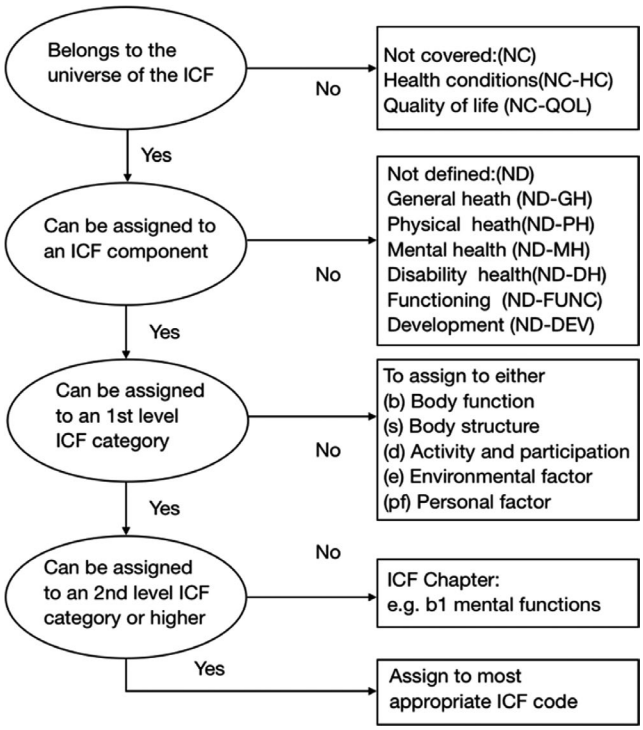

FIGURE 2 Linking decision tree

3 | 3.RESULTS

3.1 | Participant characteristics

A total of 377 patients participated in this study, with 189 participants from the neurology department and 188 from the neurosurgery department. This study included 60 types of neurological disease-related. Participants' demographics, medical conditions, and characteristics are presented in Table 1. Most patients were unable to complete their basic self-care. Functional rehabilitation is a long and arduous process, and providing adequate care is a time consuming and tedious task, which the families have to perform in addition to bearing high medical expenses.

3.2 | Result of ICF linking and analysis with current electronic assessments

Definitions and examples of closeness of matched categories are presented in Table 2. A total of 56 neurological nursing assessment concepts were linked. Of these, 54 (96.4%) concepts matched the corresponding ICF categories. The mapping exercise demonstrated similarities and differences, with 37 (66.1%) "same" concepts and 9 (16.1%) concepts of "similar" granularity; furthermore 6 (10.7%) concepts were more specific ("narrower") and 2 (3.6%) concepts were less specific ("broader") than the ICF categories. 2 (3.6%) nursing assessment terms concepts could not be linked to a specific ICF category, and were thus labelled as "not matched". The actual mapping results of the nursing assessment terminology have been provided in Table 3.

3.3 | Status of nursing assessment terminology for neurological conditions

The three hospitals involved in the study used different assessment systems. One hospital applied the Clinical Care Classification (CCC)

TABLE 1 Participant characteristics ($N = 377$)

Variable	Mean (*SD*) or percentage
Gender	
Male	211 (58.6%)
Female	156 (41.4%)
Age	58.18 (15.62)
Profession	
Remunerated work	230 (61%)
Retire	73 (19.4%)
Unemployed (health reason)	43 (11.4%)
Freelance	23 (6.1%)
Work at home	5 (1.3%)
Student	3 (0.8%)
Education	
Illiteracy	54 (14.3%)
Elementary school,	122 (32.4%)
Junior high school	121 (32.1%)
Senior high school	50 (13.3%)
University	30 (7.9%)
Medical diagnosis	
Stroke	131 (34.7%)
Head trauma	19 (5.0%)
Dizziness	16 (4.2%)
Intracranial hypotension	15 (4.0%)
Intracranial space-occupying lesion	13 (3.4%)
Myelopathy	10 (2.7%)
Hydrocephalus	10 (2.7%)
Skull defect repair	8 (2.1%)
Dementia	5 (1.3%)
Others	150 (39.8%)
Co-morbidities	
Hypertension	132 (35%)
Diabetes	35 (9.3%)
Cardiovascular disease	24 (6.4%)

into e-NIS and had an independent daily electronic nursing assessment form allowing the nurses to assess the patient's physical function and health daily. Another hospital used the North American Nursing Diagnosis Association (NANDA), while the final hospital used the Nursing Intervention Classification (NIC). However, while CCC mainly involves nursing diagnosis, nursing intervention, and nursing outcomes, NANDA includes only nursing diagnosis and NIC includes only nursing intervention. All three classifications do not involve nursing assessment, resulting in hospital electronic nursing assessment records varying by language.

The evaluation rate of 4 (75%) neurological nursing assessment concepts were 100% (377). The evaluation rate of "Dizziness" was 95.5% (360). The evaluation rate of 10 (17.9%) concepts ranged from 50%–90%. There were 37.5% (21) nursing assessment concepts closely related to neurological conditions, but they did not appear in the existing electronic nursing assessment records. The unrecorded rate of 9 (16.1%) categories ranged from 40%–50%, while the unrecorded rate of 8 (14.3%) concepts was more than 80%. Of these concepts, the unrecorded rate of "orientation, ""muscle tension, "fine motor skill," and "blepharoptosis" were all more than 90%. The evaluation rate of "quality of sleep" was 100%, but the evaluation rate of the sub-concepts including "on set of sleep," "maintenance of sleep" and "functions involving the sleep of cycle" were only 53.3%. No case evaluated and recorded the "memory." Major nursing assessment languages and frequency in patients with neurological diseases are presented in Table 3.

4 | DISCUSSION

The three hospitals involved in the study used different assessment systems. Therefore, the situation of the three hospitals is different in terms of language uniformity, record integrity and assessment accuracy.

TABLE 2 Mapping: Definitions and examples of closeness of matched categories

Closeness of matched categories	Definition	Example nursing assessment terms	ICF linked categories
Same	The term in the nursing assessment languages of neurological is nearly identical in wording and concept to the ICF term	Consciousness	b1100 State of consciousness
Similar	The term is comparable: or "alike in substance"	Language/voice	b310 Voice functions b320 Articulation functions
Broader	The term is larger in scope, or less specific, or can be considered to encompass the term in the ICF	Pain (part, quality, time, control method)	b280 Sensation of pain b2800 Generalized pain b2801 Pain in body part b2802 Pain in multiple body parts
Narrower	The term is smaller in scope, or more specific, or can be considered to be encompassed by the ICF term	Quality of sleep	b134 Sleep function b1340 Amount of sleep b1341 Onset of sleep b1342 Maintenance of sleep b1343 Quality of sleep b1344 functions involving the sleep of cycle

TABLE 3 Result of mapping nursing assessment languages for neurological diseases with the ICF, and the evaluation rate, nursing record rate, and unrecorded rate from 377 case documents

Clinical nursing records	ICF code/category	Evaluation rate	Nursing record rate	Unrecorded rate
Consciousness[a]	b110 Consciousness functions b1100 State of consciousness	100% (377)	53.8% (203)	46.2% (174)
Orientation[a]	b114 Orientation functions	100% (377)	2.70% (10)	97.3% (367)
State of mental[d]	b122 Global psychosocial functions	100% (377)	79.8% (301)	20.2% (76)
Quality of sleep[d]	b134 Sleep functions			
	b1340 Amount of sleep	100% (377)	53.3% (201)	46.7% (176)
	b1341 Onset of sleep	53.3% (201)	53.3% (201)	No
	b1342 Maintenance of sleep	53.3% (201)	53.3% (201)	No
	b1343 Quality of sleep	100% (377)	100% (377)	No
	b1344 functions involving the sleep of cycle	53.3% (201)	53.3% (201)	No
Pupil[b]	b2150 Functions of internal muscles of the eye	100% (377)	57.8% (218)	42.2% (159)
Language[b] /communication	b167 Mental functions of language d330 Speaking	100% (377)	15.1% (57)	84.9% (320)
Language/voice[b]	b310 Voice functions b320 Articulation functions	89.9% (339)	9.02% (34)	89.97% (305)
Power of muscles[a]	b730 muscle power functions b7302 Power of muscles of one side of the body b7304 Power of muscles of all limbs	100% (377)	55.7% (210)	44.3% (167)
Muscle tension[a]	b735 Muscle tone functions	79.8% (301)	3.98% (15)	95.0% (286)
Dizziness[a]	b2401 Dizziness	95.5% (360)	58.4% (220)	38.9% (140)
Giddiness[b]	b2401 Dizziness	55.7% (210)	55.3% (201)	4.29% (9)
Function of balance[d]	b2351 Vestibular function of balance	no	no	No
	b2402 Sensation of falling	100% (377)	100% (377)	No
	b770 Gait pattern functions	100% (377)	100% (377)	No
Weak[b]	b1300 Energy level b4552 Fatigability	100% (377)	55.2% (208)	44.8% (169)
Ringing in ears[a]	b2400 Ringing in ears or tinnitus	55.7% (210)	55.7% (210)	No
Hearing[d]	b230 Hearing functions	100% (377)	58.4% (220)	41.6% (157)
Seeing[d]	b210 Seeing functions	100% (377)	58.4% (220)	41.6% (157)
Eye opening[b]	b2703 Sensitivity to a noxious stimulus b7501 Reflexes generated by noxious stimuli	15.1% (57)	15.1% (57)	No
Motor response[a]	b750 Motor reflex functions	100% (377)	15.1% (57)	84.9% (320)
Temperature[a]	b2700 Sensitivity to temperature b5500 Body temperature	100% (377)	100% (377)	No
Blood pressure[a]	b420 Blood pressure functions	100% (377)	100% (377)	No
Convulsions[b]	b7650 Involuntary contractions of muscles b7651 Tremor b7652 Tics and mannerisms b7653 Stereotypies and motor perseveration	100% (377)	13.3% (50)	86.7% (327)
Appetite[a]	b1302 Appetite	100% (377)	56.0% (211)	44.0% (166)
Pain[c] (part, quality, time, control method)	b280 Sensation of pain b2800 Generalized pain b2801 Pain in body part b2802 Pain in multiple body parts	100% (377)	100% (377)	No
Salivation[a]	b5104 Salivation	3.98% (15)	3.98% (15)	No
Swallowing function[a]	b5105 Swallowing	7.96% (30)	7.96% (30)	No

(Continues)

TABLE 3 (Continued)

Clinical nursing records	ICF code/category	Evaluation rate	Nursing record rate	Unrecorded rate
Nausea and vomiting[a]	b2403 Nausea associated with dizziness or vertigo b5106 Functions of expelling the contents of the stomach, oesophagus or pharynx b51060 Vomiting b51061 Regurgitation	62.1% (234)	62.1 (234)	No
Hemp feeling[d]	b265 Touch function	54.9% (207)	54.9% (207)	No
Stiffness[a]	b7800 Sensation of muscle stiffness	2.56% (10)	2.56% (10)	No
Fine motor skill[a]	d440 Fine hand use d4400 Picking up d4401 Grasping d4402 Manipulating d4403 Releasing	100% (377)	0.8% (3)	99.2% (374)
Blepharoptosis[a]	b2151 Functions of the eyelid	100% (377)	0.8% (3)	99.2% (374)
Oedema[nm]	b849 Functions of the skin, other specified and unspecified	100% (377)	58.1% (219)	41.9% (158)
Heart rate[a]	B4100 Heart rate	100% (377)	100% (377)	No
Heart rhythm[a]	B4101 Heart rhythm	79.6% (300)	53.3% (201)	26.3% (99)
Respiration function[a]	b440 Respiration functions b4400 Respiration rate b4401 Respiratory rhythm b4402 Depth of respiration	100% (377)	100% (377)	No
Cough[nm]		79.6% (300)	53.3% (201)	26.3% (99)
Memory[a]	B144 Memory functions	no	no	No
Bladder control[a]	d5300 Regulating urination b6201 Frequency of urination b6202 Urinary continence	100% (377)	100% (377)	No
Stool control[a]	d5301 Regulating defecation b5252 Frequency of defecation b5253 Faecal continence	100% (377)	100% (377)	No
Have meals[a]	d550 Eating d560 Drinking	100% (377)	100% (377)	No
Washing[a]	d510 washing oneself	100% (377)	100% (377)	No
Making up[a]	d520 Caring for body parts	100% (377)	100% (377)	No
Dressing[a]	d540 Dressing	100% (377)	100% (377)	No
Toilet[a]	d5300 Regulating urination d5301 Regulating defecation d5302 Menstrual care	100% (377)	100% (377)	No
Bed and chair transfer[a]	d4200 Transferring oneself while sitting d4201 Transferring oneself while lying	100% (377)	100% (377)	No
Walking[a]	b770 Gait pattern functions d450 Walking	100% (377)	100% (377)	No
Climbing steps[b]	d4551 Climbing b455 Exercise tolerance functions	100% (377)	100% (377)	No
Moisture[c]	b5252 Frequency of defecation b5253 Faecal continence b6201 Frequency of urination b6202 Urinary continence	100% (377)	100% (377)	No
Activity ability[b]	b455 Exercise tolerance functions d455 Moving around d465 Moving around using equipment	100% (377)	100% (377)	No
Mobility capability[a]	d410 Changing basic body position d420 Transferring oneself	100% (377)	100% (377)	No

(Continues)

TABLE 3 (Continued)

Clinical nursing records	ICF code/category	Evaluation rate	Nursing record rate	Unrecorded rate
Nutrition[a]	d5701Managing diet and fitness	100% (377)	100% (377)	No
Friction and shear forces[a]	b2702 Sensitivity to pressure	100% (377)	100% (377)	No
Education[a]	d810-d839Education	100% (377)	100% (377)	No
Profession[a]	d840-d859Work and employment	100% (377)	100% (377)	No
Religion[a]	d930 Religion and spirituality	100% (377)	100% (377)	No
Caregiver[a]	e310 Immediate family e340 Personal care providers and personal assistants	100% (377)	100% (377)	No
Medical insurance[a]	e580 Health services, systems and policies	100% (377)	100% (377)	No

Note: a: Same, b: Similar, c: Broader, d: Narrower. According the ICF Linking Rules, concepts were assigned "not matched (nm)," when they were assigned to an ICF component but could not be linked to an ICF category and were clearly not personal factors. Evaluation rate = sample size of the actual evaluation/the total sample size, nursing record rate = sample size of nursing record/the total sample size, unrecorded rate = sample size evaluated but not recorded/sample size of actual evaluation.

A total of 10 (17.9%) concepts were not included in the electronic nursing assessment form or e-NIS, resulting in a range of evaluation rates were range from 50%–90%. We found that 37.5% (21) nursing assessment terms were closely related to neurological conditions, but did not appear in the existing electronic nursing assessment records. A total of 8 (14.3%) concepts were unrecorded by more than 80%. The evaluation rate of "orientation" and "fine motor skill" were both 100%, while their unrecorded rates were 97.3% and 99.2%, respectively. Looking back at the categories with a record rate of 100%, we found that they were all included in the e-NIS. Those categories with a high evaluation rate but low record rates were often related to the nervous system, but they are not included in the e-NIS. This result indicates that the nursing assessment related to functional status is incomplete and electronic nursing assessment terms still lack unified standards in China. This situation has led to a failure in fully reflecting the content of nursing work and thus these terms fail to reflect the value of nursing. The International Council of Nurses (ICN) has clearly stated: "Without its own language, the role of nursing in the health system cannot be noticed, and its value and importance cannot be recognized and rewarded."(Gingerich, 2005) A comparative study showed that standardized nursing records are more informative, comprehensive, and knowledge-intensive than unstandardized. This promotes nursing records to meet legal requirements and improve patient safety (Törnvall et al., 2009).

A total of 54 (96.4%) concepts matched with a corresponding ICF category, with 37 "same" concepts (66.1%) and 9 (16.1%) concepts of "similar" granularity; this indicates that ICF is able to describe the nursing assessment terms of neurological conditions. There were 6 (10.7%) concepts related to nursing assessment terms that were more specific than the ICF ("narrower"), such as the "b134 Sleep function" term in the ICF, which can be described by the amount of sleep, onset of sleep, maintenance of sleep, quality of sleep, and functions involving the sleep of cycle. This means that the original ICF categories do cover electronic nursing assessment language. It is important to emphasize the individual's function and disability, which is not only the result of the disease itself but also the result of the interaction between health conditions, environment, and personal factors. (Chigweremba et al., 2014) Therefore, the ICF is a multidimensional "biological-psychological-social" ecological model that can comprehensively assess the functional and health status of patients.

As the participating hospitals used different assessment systems, they differed in terms of language uniformity, record integrity, and assessment accuracy. With the advent of the era of big data, medical information management has entered the information age. Traditional paper records of nursing documents have been gradually replaced by electronic nursing records. The key programmes for the reform of the national medical and health system, (State Council 2016a) the National 13th Five-year Science and Technology Innovation Program, (State Council 2016b) and the National Health Service System Planning Outline. (State Council 2015) all emphasize that it is important to promote the standardization of medical information. The e-Health Governance Initiative, founded by the European Union, has worked to establish a common structure for e-health within Europe to facilitate quality healthcare within countries and across borders. (eHealth Network, 2016) The standardization of nursing information involves the standardization of nursing terminology, nursing workflows, and the standardization of nursing data. It forms the basis for the sharing of nursing information and guarantee for the development of a national medical information database.

The standardization of nursing terminology forms the basis for the development of nursing disciplines and the key to the standardization of nursing information. (Liu et al., 2015) The e-NIS is an inevitable outcome of the standardization of nursing information, and it is also the most convenient and effective tool in nursing field. It can greatly improve the work efficiency of nurses, effectively reduce errors, and support clinical decision-making. Currently, China's e-NISs are mostly limited to a certain nursing terminology field or limited to a single medical institution, which makes the information

system unable to fully reflect the importance of nursing assessment. This has, to a certain extent, hampered the dynamic observation of patients' condition and the information exchange among the nursing profession and other professionals.

The ICF is a theoretical framework for describing and measuring health at the level of the individual or in groups. (Stamm et al., 2005) It is a versatile classification system involving both different disciplines and different fields. Implementing neurological nursing assessment language standardization based on the ICF can help standardize nursing assessment records in nursing information systems. This work can guide nurses to fully and effectively evaluate the functional status of patients and to improve patient outcomes, improve nursing service quality, and nursing effectiveness. More importantly, it can also promote nursing information resource sharing, provide reference for the continuous improvement of the nursing information system, and accelerate the process of the globalization of information sharing in the age of big data. (Hoang-Kim et al., 2014).

5 | LIMITATIONS

This study may be limited depended on the region. As Zhejiang Province is one of the fastest growing provinces on e-NIS in China; it is likely that the status of the nursing assessment terminology in other provinces is worse than in Zhejiang. Therefore, it is a necessary to carry out the standardized of terminology as soon as possible.

6 | CONCLUSION

We found that the ICF can comprehensively assesses patients' functional and health status. Implementing neurological nursing assessment language standardization based on the ICF can help standardize nursing assessment records in nursing information systems.

7 | RESEARCH PROSPECTS

In the next phase, the research team intends to build a terminology system for the nursing assessment of neurological conditions, based on the ICF, that meets China's national conditions. The team will also collaborate with software engineering developers to embed it into the e-NIS and apply it to clinical practice to verify its scientificity and practicality.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

AUTHOR CONTRIBUTIONS

Hongying Pan (3191016@zju.edu.cn) and Zhihong Ye (yezh@zju.edu.cn) wrote this paper. Shani Ding (dingsn@srrsh.com), Xiaona Liu (na2so40225@163.com), Zhaojun Zou (zouzj@srrsh.com) and Qunli Xu (xuql@srrsh.com) collected and analysed the data.

DATA AVAILABILITY STATEMENT

Some or all data, models, or code generated or used during the study are available from the corresponding author by request.

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