



Original Article

Information on functioning found in the medical records of patients with stroke

HAEJUNG LEE, PhD¹⁾, SUNGHWHA SEO, PhD²⁾, JUMIN SONG, PhD^{1)*}

¹⁾ Department of Physical Therapy, Silla University: San 1-1, Gwaebop-dong, Sasang-gu, Busan 617-736, Republic of Korea

²⁾ Department of Health and Medical Tourism, Gyeongju University, Republic of Korea

Abstract. [Purpose] To explore data on functioning in the medical records of patients with stroke by linking them to the ICF. [Subjects and Methods] The admission and discharge summaries of patients' electronic medical records (EMRs) were investigated. Information on functioning included in the summaries were mapped into the ICF. Each of the linked categories of ICF was analyzed using frequency and percentage analysis. [Results] Thirty stroke patients' records were evaluated. A total of 1,832 items on functioning in the EMRs were found to be linked to eighty-five categories of the ICF. The majority of those categories (52.9%) belonged to the body function domain, whereas only 8.2% were environment factors. Categories in the domain of activity and participation, and body structure were found to be 22.4% and 16.5% respectively. In each domain, the most frequently found categories were muscle power function (b730), structure of brain (s110), walking (d450), and products or substances for personal consumption (e110). [Conclusion] It was found that the admission and discharge summary in the current medical records of patients with stroke contained much noticeable information on functioning and the data on functioning may be linked to the ICF. Further study is needed to adapt ICF in Korean clinical settings.

Key words: ICF, Medical records, Stroke

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INTRODUCTION

Medical records are used for communication among healthcare professionals to ensure continuity of patient care and to organize planning of treatment strategies. They are not only used for clinical decision-making to document patient's problems and establish an appropriate plan of care, but also as legal documents for medicolegal cases^{1, 2)}. Electronic medical recording system is common in clinical settings in Korea. It is composed of clinical information of patients that commenced at their point of contact with the health care system and done by all involved health care professionals making the information available across the continuum of care³⁾. It includes biological and physiological factors, often applied as a routine clinical assessment, focusing on the function of cells, organs, and organ systems. Patient's symptoms and functional status which are taken from the subjective assessment, joint structures and muscle strength assessment, and daily activities are also included⁴⁻⁶⁾. In the documents, information is organized into groups according to the professionals' treatment or management plans e.g., medical doctor's order, nursing records, rehabilitation records. These groups of data are similarly available in the structured document (e.g., admission and discharge summary of patient's medical records).

The ICF is one of the WHO's family of international health classifications. It classifies information on functioning and provides a globally agreed and standard classification system for multidimensional health related domains. It includes body functions and structures, activities and participation, environmental and personal factors⁷⁾. It aims to describe the health status. It can be used as a common language that facilitates communication between and among health professionals, as a reference for existing health status measures that allows comparison of data across countries and as a systematic coding

*Corresponding author. Jumin Song (E-mail: jmsong@silla.ac.kr)

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scheme for health information systems⁸). Therefore, it can be used for measuring patient's quality of life, environmental factors, in assessing treatments with specific conditions, and in evaluating rehabilitation outcome.

Stroke is one of the most disabling conditions resulting to impairments of body functions and structures, limitation of activities and restriction of participation due to loss of neurological function⁹⁻¹¹). The admission and discharge summary in the medical record provides comprehensive information or description of the patient's over-all clinical presentation. Therefore, the purpose of the study was to explore information on functioning from the admission and discharge summary of the current medical records of patients with stroke by linking them to the ICF.

SUBJECTS AND METHODS

This study was a multicenter cross-sectional study conducted in three university medical centers in South Korea: Busan National University Hospital, Kyungbuk National University Hospital, Wonkwang University Hospital. The admission and discharge summaries from electronic medical records of patients with stroke under neurosurgery, neurology and rehabilitation were collected. They include operations/managements, chief complaints, current and past medical history, treatments, examination results, prescription and plan for discharge. This present study was approved by the ethics committee of each university hospital.

Functioning information in the admission and discharge summary was explored by linking them to the ICF. To do this, two major steps were undertaken: first, items on functioning in the admission and discharge summary were identified and its meaningful concepts were analyzed. Then, each meaningful concept was linked to the best fitting ICF category that was reflective of the concept¹²). Linking was performed by two experts who had a related research and thus, the experience in the linking procedure. The selected ICF categories from each expert were then compared and any variance were discussed to assure quality, and to verify concepts and categories. If there are any discrepancies and/or data in the EMRs that were not clearly linked to the ICF codes, relevant professionals including physician, physical therapist, speech therapist and psychologist were invited to determine whether they can be conceptually linked or not.

The number of items and sub-items, meaningful concepts, ICF codes and their distribution over the ICF components were reported for each section to make a basis for describing the full contents. When a structured form was used for medical recordings, only patient's related contents and items were included. Repeated information were selected as an independent item e.g., X-ray and MRI, which was then used for same structure investigation. Both of which were linked to the ICF codes separately. In the meantime, a set of test, e.g., routine laboratory test for urine and blood test was coded as one item based on the purpose of the test. With regard to conventional clinical tools like Mini-Mental State Examination, Modified Barthel Index, Berg's balance scale and modified Rankin scale, each item of the tools was linked to the ICF categories. Two-levels of the ICF code were employed for the linkage. Frequency analysis and percentage of distribution were performed.

RESULTS

Thirty patients with stroke using the admission and discharge summaries of the EMR were examined. All of the university hospitals were using a structured form for the admission and discharge summaries. The structured forms were found to be similar across hospital EMR systems. They contained sub-sections of operations/managements, chief complaints, current history, past history, treatments, examination results, discharge plan and prescription for discharge. A total of 1,832 items from 30 patients were selected as functioning related data and these items were linked to 85 ICF categories. It was found that most data obtained were related to the body function domain. More specifically, 52.94% of the data on functioning was linked to categories in the body function domain, 22.35% of them were related to categories in the activity and participation domain, and items related to the body structure and the environmental factors domains were 16.47% and 8.24% respectively. The most commonly reported information in the EMR was related to pain, prescribed drugs/medication, utilized health services including referrals, brain structures reflected in imaging investigations such as CT, MRI, and difficulties in walking.

Information on functioning of the sub-section of the admission and discharge summaries was presented with a percentage of the ICF domain in [Table 1](#). Majority of these information was related to the body function domain in the sub-sections of operations/management, chief complaints, current history, treatments, examination results and discharge plan, whereas functioning information in the sub-sections of past history and prescription for discharge was mostly linked to the environmental factor domain. The linked ICF items in each sub-section were presented in [Table 2](#).

Linking data on functioning in the EMR to ICF categories was based on the purpose of the data and was performed by a concept linkage. Examples were presented in [Table 3](#). Only four conventional measurement tools were found to describe patients' conditions from the EMRs. Tools used were MMSE, Rankin scale, Modified Barthel Index and Berg's balance scale, and the items in each scale were linked to the ICF categories ([Table 4](#)).

DISCUSSION

Functioning information from thirty patients with stroke who were admitted at three university hospitals in South Korea were investigated using the admission and discharge summaries of their EMR system. A structured form of the summaries

Table 1. Percentage of the ICF domain in each of the sub-section of the admission and discharge summary in the medical recordings (Unit: %)

Sub-section	The ICF domain			
	Body function	Activity & Participation	Environmental factors	Body structures
Operations/managements	51.6	0.0	1.1	47.3
Chief complaints	91.0	8.9	0.0	0.0
Current history	58.4	10.2	27.3	4.1
Past history	11.3	29.9	58.8	0.0
Treatments	43.4	8.9	31.9	15.8
Examination results	68.3	4.8	3.3	23.6
Prescription for discharge	0.0	0.0	100.0	0.0
Plan	46.3	9.0	31.8	13.0

Table 2. The ICF categories presented in the sub-sections of the admission and discharge summary in the medical recordings

Sub-sections in the admission and discharge summary	ICF categories (listed in order of frequency of mention)
Operations/managements	s110, b415, b410, b430, b540, b110, b435, b545, b730, e110, s530
Chief complaints	b730, b265, b330, b415, d450, b110, b134, b210, b240, b280, b410 e580, b730, e110, b330, d450, b265, b280, s110, b510, b270, b210, b240, e310, b760, d230, b230, b535, b620, b167, b410, b415, s710, b110, b215, b555, d410, b134, b144, b505, b755, b770, d465, b114, b140, b156, b172, b320, b660, b840, d550, s430, s730, b115, b152, b164, b260, b420, b440, b525, b545, b550, d415, d445, d455, d850, d855, d920, e115, e120, e545, s760
Current history	e110, e580, b620, d410, d450, d465, d850, b510, d855, b525, d230, b280, b330, b415 e580, e110, b730, s110, b415, b280, b110, b320, b430, d450, d230, b167, b410, d550, b114, b144, b172, s410, b140, b156, d420, d455, d465, d510, d520, d530, d540, d560, b265, b710, d410, b330, b525, b620, b840, d445, b134, b215, b270, b420, b510, b755, d415, e580, s110, s730, s730, b152, b210, b260, b430, b450, b550, b580, b730, b735, d115, d230, d450, d850, e115, s430, s530, s540
Past history	b730, b410, b760, b750, s110, b430, b415, d415, b265, b215, b280, b735, b110, d410, b270, b540, e110, s410, b420, b320, b620, b167, b330, b210, b440, e580, b114, b144, b260, s730, s750, s760, b152, b525, b710, d450, d455, d510, d540, d550, b755, b770, d530, s430, s560, b435, b450, s610, b140, b156, b172, b545, b555, d770, s530, s540, s580, s740
Treatments	e110, e580
Examination results	e110, e580, b730, b280, s110, b710, b550, b525, b420, b320, b110
Prescription for discharge	
Discharge plan	

was utilized and the most frequently recorded information was found to be related to muscle power functions, prescribed medication, health service system, brain structure, heart and/or blood vessel functions, and walking. Strokes resulting from blood vessel problems that have affected areas of the brain were not functioning properly. Therefore, brain structures and blood vessel functions were typically examined using imaging data e.g. MRI for medical diagnosis¹³). The main clinical presentation of stroke includes weakness in one side of the patient's body resulting to walking difficulties¹⁴).

A total of 1,832 items were selected as functioning data and were linked to 85 ICF categories (Table 3). It was found that the largest number of information belonged to the body function domain. Because the medical diagnostic procedures on patients were based on physiological data of body systems which are needed to draw a medical diagnosis and the medical doctors were in charge of medical recordings in the EMR system, it is likely that treatments given were also based on the results of these procedures. Neurological surgery, neurology and rehabilitation departments were most relevant to stroke patients and consultation with other departments within the hospital was found to be quite common. Worth noting is that none of the participants in the study had a single stroke diagnosis. All of them had various concurrent health conditions, such as renal artery infection, cardiac disease, complications of diabetes, dyslipidemia, hepatitis, hypertension, thyroid problems and/or gastrointestinal bleedings. Consequently, consultation information due to these concurrent health conditions comprised a major proportion of the patient's data in the admission and discharge summaries. The consultation reports by specialists contained relevant physiological investigation data with prescribed medications. These results are consistent with other studies^{3, 6}).

Information related to functions and body structures were found to be used in parallel. For example, if data on movement

Table 3. Examples of EMR information linking to ICF categories

EMR information	Concept	ICF codes
Mental status	Consciousness status	b110 consciousness function
Touch, numbness, sensation	Sensory	b265 touch function, b270 sensory functions related to temperature and other stimuli
Headache, pain intensity	Pain	b280 sensation of pain
Slurred speech	Speaking	b330 fluency and rhythm of speech function
Neck CT angio	Blood flow test	b415 blood vessel functions
Blood pressure, hypertension	Blood pressure control	b420 blood pressure functions
Complete blood cell count, activated partial thromboplastin time, IgM, IgG	Blood test	b430 hematological system functions b435 immunological system functions
Urination control	Urination function	b620 urination functions
Range of motion	Mobility of joints	b710 mobility of joint functions
Limb weakness	Muscle power	b730 muscle power functions
Brunnstrom stage	Muscle tone, voluntary movement	b735 muscle tone functions, b760 control of voluntary movement functions
Deep tendon reflex	Deep tendon reflex	b750 motor reflex function
X-ray, CT, MRI: brain, trunk and pelvic area, lower limbs	Corresponding structures	s110, s740, s750, s760
Supine to sitting	Changing position	d410 changing body position
Gait disturbance	Walking	d450 walking
Medication	Medication	e110 products or substances for personal consumption
Clinic, emergency center visiting	Medical center	e580 health services, systems and policies

Table 4. The conventional clinical tools and its corresponded ICF categories

Clinical tools	Linked ICF codes
Modified Barthel Index	b525, b620, d420, d450, d455, d465, d510, d520, d530, d540, d550, d560
Mini-Mental State Examination	b114, b144, b172, b140, b167, b210
Berg's balance scale	b410, b415, b420
modified Rankine scale	b620, d230, d410, d450, d465, b525, e580

related functions such as muscle power functions of upper and lower limbs were reported, information on their structural correlates, i.e., structures of upper and lower limbs were frequently identified. Identified correlates and data in the study include brain structure and mental functions, structures of cardiovascular, immunological and respiratory systems with their systemic functions, and structures related to movement and movement related functions. Meanwhile, sensory functions and pain-related information such as seeing functions, articulation and speech functions were not always found to be correlating with structural data. These results were found to be consistent with those found in previous studies^{3, 6}.

Very few data were found to be related to the environmental factors. They included health services and system, medication, ambulance service, assistive device for ADL and mobility, and family support. One of the reasons for choosing university hospitals was to seek further expert investigations from medical specialists. Patients either had a referral from private clinics or other hospitals to a university hospital or they were directly visiting the university hospitals' emergency room and/or using ambulance services. Once patient's acute condition was controlled, patients should be discharged from the university hospitals with reservation for follow-up check-ups and/or transferring to other hospitals for continued management. This shows valuable information about the health care delivery system in Korea¹⁵.

Separate from conventional measurement tools regarding functional activities in daily living, majority of patients specifically reported their difficulties in walking¹⁴. As a result, information about the use of assistive devices for walking such as wheelchair was frequently found. Information regarding carrying out of daily routines, walking, changing and maintaining body position, transferring, moving around with/without equipment, self-care and employment belonged to activity and participation domain of the ICF. These were taken from conventional measurement tools such as Modified Bathel Index and Modified Rankin Scale^{16, 17}, whereas patient's employment status was collected as personal factors e.g., smoking, alcohol, and religion. Meanwhile, information related to social participation such as interpersonal relationships and engaging in hobbies were nonexistent in the current EMRs. These results were similar to the previous studies⁵. Participation information

should be included to understand patient's functioning level so that appropriate management can be suggested^{18, 19}).

Since the ICF was published as a common language for describing health-related functioning, many studies have been conducted in order to try to utilize the ICF framework as the basis for standardized health and disability assessment^{20, 21}. The current study also tried to link data on functioning from the admission and discharge summary in the current EMRs of stroke patients to the ICF. The results showed that information on functioning was contained in the EMRs and the data on functioning could be linked to the ICF. To adapt the ICF health classification in Korea, data on functioning from the different healthcare establishments, e.g., specialized clinics, community-based health centers and various city health facilities will be needed for further studies.

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