Functional Status and Its Related Factors in Residents of Long-Term Care Facilities in Taiwan

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Background and purposes: Falls and functional disability are common problems among residents in long-term care facilities (LTCF). The Functional Independence Measure (FIM) and balance ability of residents in 112 LTCF in Taiwan were assessed, and factors influencing the functional independence were investigated. **Methods:** A cross-sectional survey of residents in 112 licensed LTCF in Taiwan was carried out using stratified sampling method. Twenty-four physical therapists interviewed the randomly selected 437 residents in nursing homes (NH) and intermediate care facilities (ICF). The FIM and subset of Berg balance score were measured. **Results:** The FIM score of all participants (N = 437) was 76.42 ± 40.34, and the balance score was 14.05 ± 13.18. The stepwise multiple regression analysis indicated that the factors influencing the FIM scores in LTCF included balance ($p < 0.001$), location and ownership of facility ($p < 0.01$), type of facility and marital status ($p < 0.05$). **Conclusions:** Multiple factors contribute to the functional independence of residents in long-term care facilities. Balance score is one of the important factors that affects the functional independence. (FJPT 2004;29(4):217-224)

Key Words: Long-term care facility, Balance, Functional independence measure

The long-term care facilities (LTCF) play an important role in the service of geriatric population with or without chronic disease.[1-3] Several studies have shown that falls and functional disability are common problems among residents in LTCF.[4,5] However, the factors influencing the functional independence of residents in LTCF in Taiwan have not been well studied yet.

The health-related classification of disease was first proposed by World Health Organization (WHO) in 1980 as International Classification of Impairments, Disabilities, and Handicaps (ICIDH), which is also known as the disablement model (including disease, impairment, disability, and

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handicap).[6] The disablement model was modified by Nagi (sociologist), who introduced the concept of active pathology, impairment, functional limitation, and disability.[7,8] The high correlation between functional limitation and disability has been mentioned in patients with pulmonary disease.[9] According to the new version of ICIDH by WHO, the term "function" is viewed in a positive way.[10] This new ICIDH-2 or International Classification of Functioning model (ICF) emphasizes that the improvement of the function may increase the participation in activities, and vice versa. Furthermore, personal factors as well as environmental factors may affect function or participation.[10] Therefore, it is important to assess the functional status of residents in LTCF, and to analyze the influencing factors.

The study of Usuda et al. on stroke inpatients indicated that the Berg balance score was highly correlated with Barthel Index (i.e., functional score).[11] Juneja et al. also showed that there was a good correlation between Berg balance score and Functional Independence Measure (FIM) score at admission in acute rehabilitation inpatients.[12] Balance can be defined as the ability to keep the center of gravity within the base of support with or without external perturbation.[13] The Berg balance assessment is known to measure impairment or functional limitation, and has good reliability and validity.[13,14] The FIM was developed to assess the disability with good reliability and validity.[15,16] However, there is little information available for the relationship between balance and FIM for residents with chronic diseases in LTCF.

The functional statusn of residents in LTCF has been studied in South of Taiwan (Tainan),[17] and in Canada,[18] but the factors influencing functional status are not well documented. There are mainly two types of LTCF in Taiwan: nursing home (NH), and intermediate care facility (ICF).[2,19] Since residential care home (RCH) is mainly for healthy elderly who lives alone, the RCH is not officially considered as LTCF and is not included in this study. It is the responsibility of LTCF to provide care to maintain or attain the maximal functional capacity of residents.[18] The purposes of this study were to measure the balance and functional independence of subjects in licensed NH and ICF in Taiwan and to investigate the factors influencing the functional independence of the residents in these facilities.

METHODS

Subjects

This study was a cross-sectional, multi-institutional design to investigate the balance and functional status of residents in LTCF in Taiwan (including Northern, Central and Southern parts). This study was conducted from Oct. 1998 to June 1999 and the list of LTCF was from the publication of Long-Term Care Professionals in Taipei (TALTCP).[19] A sample of 347 residents (185 males and 162 females) was randomly selected from 112 LTCF (30 nursing homes and 82 intermediate care facilities) in Taiwan with stratification according to type (NH and ICF), geographic location (north, center and south) and district (urban and rural areas). The sampling rate for NH in each location was about 10%, and for the ICF was about 2%, so that the total number of sampled subjects in ICF was about twice of that in nursing homes. The randomly selected subjects signed written consent form and agreed to participate in this study. This study protocol was approved by the ethical committee of local medical institution.

Assessment Tools

The demographic information was obtained from the residents and/or the care-givers. The disability status was measured using the Functional Independence Measure (FIM). The usage of FIM was approved by the Centre for Functional Assessment Research, Uniform Data System for Medical Rehabilitation (UDS_{MR}) at the University of New York. The assessment procedures followed the instruction manual from the Centre for Functional Assessment Research, UDS_{MR}.[20] The FIM assessment form contained 18 items in 6 categories (including self-care, sphincter control, transfer, locomotion, communication and social cognition) with the score ranging from 1 to 7.[10,17] Score 1 indicated total assistance or not testable, and score 7 implied complete independence. The range of total score of FIM was 18-126.[20]

The Berg balance score was selected to measure balance.[13,21] The Berg balance score, originally developed in 1989, included 14 items graded on a five point ordinal scale of 0 to 4, where 1 indicated the inability to perform the task, and 4 represents independence.[13,21] In this study, only 9 items of the Berg balance score including sitting unsupported, sit-

ting to standing, standing to sitting, standing unsupported with eyes closed, standing unsupported with feet together, pick up object, turn 360°, standing with one foot in front, and standing on one leg were assessed. The range of total balance score was 0 to 36. The omitted items included standing unsupported for 2 minutes, transfers, reaching forward with outstretched arm, turning to look over shoulder, and stool touch. The reasons to omit those items were due to the consideration of safety, time consuming, and quantification device. However, the retained 9 items contain the basic construct of Berg balance score, such as: maintaining static position, changing position and diminishing base of support, thus the modified BBS version should still meet its original validity.[11]

Inter-Rater Reliability and Validity

Two physical therapists with five years of experience in geriatric physical therapy had reviewed the instruction manual of FIM and Berg balance score. Each of the therapists assessed the same subjects in the institution on the same day, with no knowledge of the result of the other therapist's assessment. The validity was assessed by comparing the score of Berg balance score (9 items) with the Tinetti gait score that had good validity of mobility and stability.[22]

Procedure

Four hundred and thirty-seven residents were interviewed and evaluated by 24 senior physical therapists (with 2-10 years experiences). The subject was selected randomly and the therapists visited the residents on a one-by-one basis in the residential room of the LTCF. Prior to the administration of balance and functional status measures, all of the physical therapists attended the training course and reviewed the instruction manual of FIM (UDSMR) and Berg balance assessing forms.[20,21]

Data Analysis

All the data were analyzed by SPSS 10.0 for Windows. The demographic data were analyzed using the descriptive statistics. The scores of balance and FIM were expressed as mean ± standard deviation (SD). The chi square was used to compare the difference of the demographic nominal and ordinal data. The interrater reliability was calculated by intraclass correlation coefficient (ICC) and the validity was calculated by Pearson correlation coefficient. The independent t-test was used to compare the difference of FIM and balance scores between NH and ICF. The stepwise multiple regression analysis was performed to analyze the important factors affecting FIM score. The significance level was set at $\alpha = 0.05$.

RESULTS

Interrater Reliability and Validity

For inter-rater reliability assessment of FIM and balance (9 items), a sample of 19 subjects (9 males, 10 females) was randomly selected from three LTCF in northern Taiwan. The mean age of the residents was 75.5 years old (range: 50-98 years old). The ICC of FIM and balance were 0.98 ($F = 95.65$, 95%C.I. = 0.95-0.99, $p < 0.01$), and 0.98 ($F = 96.23$, 95%C.I. = 0.95-0.99, $p < 0.01$), respectively, and high interrater reliability was demonstrated. The validity of Berg balance score (9 items) with Tinetti gait score was assessed by the Pearson correlation coefficient and the coefficient r was 0.92 ($p < 0.01$)

Demographic Data

The basic data of residents living in LTCF by stratification strategy are shown in Table 1.. The results indicated that there were more residents who only received elementary education, were unmarried, had multiple diseases, and were dependent, needed assistive device, and financially supported by children in NH, and more residents were financially supportedly social welfare supported (in ICF) in urban area. These phenomena were also observed in rural area except that the differences in education and assistive device were not significant. In general, most the subjects in LTCF were male, less than 80 years old, having elementary education, unmarried/widowed, with multiple diseases (such as: stroke, brain injury, Parkinsonism, diabetes, heart diseases and dementia etc.), dependent or assistive mobility, without fall recently, with more than one assistive devices, and financially supported by children or social welfare.

FIM and Balance Scores

The FIM score of total participants (N=437) was 76.42 ±40.34, and the balance score was 14.05±13.18 (Table 1.). Results of further analysis of the data according to the type (NH vs. ICF) and the location (urban vs. rural) of LTCF, indicated that the scores of FIM in NH were significantly ($p<0.001$) less than that in ICF both in urban and rural areas (Table 1.). The scores of balance in NH were significantly ($p<0.001$) less than that in ICF in urban area, so as in rural area ($p<0.01$) (Table 1.).

Regression Analysis

The influencing factors of FIM were analyzed by the stepwise multiple regression analysis. The results indicated that the inclusive variables were balance score, location (urban vs. rural), ownership (private vs. public), facility (NH vs. ICF), and marital status (unmarried vs. married) (Table 2.). The exclusive variables were education, financial source and poverty. The adjusted R^2 of balance scores was 0.7486 ($p<0.001$), which indicated that the balance score could explain about 75% of the total variance in FIM score (Table 2.).

DISCUSSION

This study showed that most the subjects at LTCF in Taiwan were single male elderly with multiple diseases. The study of Cheng on elderly at LTCF in Keelung also showed that 79.5% were male; 69.6% were single; 56.2% were 70-79 years old, and 71.0% were with multiple diseases.[23] Therefore, our results are in consistent with previous research findings and show that Taiwanese older adults were placed in a LTCF because they were very dependent or ill, or whom have no familily members to take care of.

The mean score of FIM of all the LTC facilities in Taiwan was 76.4±40.3 (median=79), which was slightly different from previous reports. Sandstrom et al.[24] indicated the median score of FIM for residents in LTC facilities residents was 65.5 (range 44-96). Oczkowski showed that the total score of FIM of stroke patients for institutionalization was below 40.[25] Most of the subjects in ICF were independent with or without assistive device, but most of the residents in NH were dependent. Furthermore, the FIM score in NH subjects was 54.13 for NH in urban area and 45.3 for NH in rural area, which were significantly less than those in ICF (Table 1.). Therefore, the functional status of subjects in NH was significantly less than that in ICF. At present, the government legislation for LTCF in Taiwan required at least one skilled nurse for 15 beds in a NH, and at least one nurse for 20 beds in a ICF.[2,3] However, the regulation about manpower of physical therapists and occupational therapists in LTCF has not been legislated yet. Results of this study suggest the need for physical therapists in NH was more than that in ICF.

The high correlation between functional limitation and disability has been mentioned.[9] The study of Usuda et al. on stroke inpatients also indicated that the Berg balance score was highly correlated with Barthel Index (i.e., functional score).[11] The functional status of 390 residents in licensed and unlicensed LTCF (n=21) in Tainan City (i.e. south of Taiwan) was assessed in 1999.[17] They measured Barthel index as the index of functional status, and the results indicated that subjects with better functional status were found in those who lived in licensed facilities, male, single, educated, lived alone before entering the facility, the age was not between 75-84 years, or who had no wounds, no catheter indwelling or no emotional disturbances. Therefore, several factors influence the functional status. However, they did not measure the FIM and balance score. Furthermore, the longitudinal outcome study of Richardson et al.[18] indicated that standing balance ability was an important factor for the prediction of the functional activity of residents in LTCF over a 12- month period. In this cross sectional study, the multiple regression analysis indicated that balance was the major influencing factor ($p<0.001$) of FIM (Table 2.). The location, ownership, facility type, and marital status also influenced FIM score, but were less significant. From the regression analysis, it indicated that the following residents would have higher functional ability (i.e., higher FIM score): having higher balance score, living in rural area, staying in public institutions, living in ICF, and single/widowed subjects (Table 2.). Therefore, some of the results were similar to previous findings by Yeh et al.[17] and Richardson.[18] The conclusions were the manpower and equip-

Table 1. Basic data of subjects in different facilities (N=437)

		Urban					Rural						
		NH(N=108)		ICF(N=159)			NH(N=36)		ICF(N=134)			Total(N=437)	
		N	%	N	%	p value	N	%	N	%	p value	N	%
Sex													
	Male	58	53.70	100	62.89		16	44.44	78	58.21		252	57.70
	Female	50	46.30	59	37.11		20	55.56	56	41.79		185	42.30
Age(yrs)													
	Mean(SD)	76.36	(10.61)	75.35	(9.57)		77.42	(9.66)	77.55	(10.33)		76.45	(10.09)
	<80	63	58.33	103	64.78		21	58.33	70	52.24		257	58.81
	≧80	45	41.67	56	35.22		15	41.67	64	47.76		180	41.19
Education						†							
	Elementary	69	63.89	127	79.87		28	77.78	95	70.90		319	73.00
	Middle and above	39	36.11	32	20.13		8	22.22	39	29.10		118	27.00
Marital status						‡					‡		
	Single/Widowed	55	50.93	139	87.42		13	36.11	104	77.61		311	71.17
	Married	53	49.07	20	12.58		23	63.89	30	22.39		126	28.83
Comorbidity						‡					*		
	None	1	0.93	14	8.81		0	0.00	6	4.48		21	4.80
	Single	17	15.74	74	46.54		5	13.89	45	33.58		141	32.2
	Multiple	90	83.33	71	44.65		31	86.11	83	61.94		275	62.93
Morbility						‡					‡		
	Dependence	57	52.78	39	24.53		24	66.67	31	23.13		151	34.55
	Assistance	34	31.48	27	16.98		10	27.78	22	16.42		93	21.28
	Independence	17	15.74	93	58.49		2	5.56	81	60.45		193	44.16
Fall													
	None	56	51.85	101	63.52		24	66.67	70	52.24		251	57.44
	Within three months	8	7.41	14	8.81		3	8.33	25	18.66		50	11.44
	Three months ago	39	36.11	42	26.42		8	22.22	39	29.10		128	29.29
	Missing	5	4.63	2	1.26		1	2.78	0	0.00		8	1.83
Assistive device						‡							
	None	32	29.63	82	51.57		8	22.22	50	37.31		172	39.36
	≧1	76	70.37	77	48.43		28	77.78	84	62.69		265	60.64
Financial source						‡					‡		
	Own income	17	15.74	14	8.81		0	0.00	9	6.72		40	9.15
	Spouse income	3	2.78	1	0.63		3	8.33	2	1.49		9	2.06
	Children or friends	81	75.00	29	18.24		26	72.22	39	29.10		175	40.05
	Social welfare	4	3.70	106	66.67		1	2.78	73	54.48		184	42.10
	Unknown	1	0.93	6	3.77		0	0.00	6	4.48		13	2.98
	Missing	2	1.85	3	1.89		6	16.67	5	3.73		16	3.66
FIM	Mean(SD)	54.13	(33.97)	86.72	(39.29)	¶	45.31	(24.64)	90.54	(37.69)	¶	76.42	(40.34)
Balance	Mean(SD)	7.39	(10.11)	17.75	(13.57)	¶	5.36	(8.34)	17.37	(12.84)	‖	14.05	(13.18)

H: nursing home, ICF: intermediate care facility
*$p<0.05$, †$p<0.01$, ‡$p<0.001$, when data were compared between nursing home and intermediate care facility by chi square
§$p<0.05$, ‖$p<0.01$, ¶$p<0.001$, when data were compared between nursing home and intermediate care facility by independent t-test
SD: standard deviation

Table 2. Stepwise multiple regression analysis for factors influencing the FIM score for subjects in LTC facilities

variable		β	standard error	p value
intercept		30.75	6.17	‡
Facility	(NH=0)	7.09	2.91	*
Location	(urban=0)	6.26	2.26	†
Ownership	(private=0)	8.15	2.61	†
Marital status	(single/widowed=0)	-4.88	2.45	*
Education	(elementary=0)	-1.06	2.39	
Financial source	(own income=0)			
	spouse income	-11.72	7.70	
	children or friends	-1.68	3.79	
	social welfare	2.49	5.28	
Poverty	(unknown=0)			
	no	-0.43	5.87	
	yes	7.17	4.52	
Balance		2.40	0.08	‡
	$R^2=0.755$			
	Adjusted $R^2=0.749$			

*$p<0.05$, †$p<0.01$, ‡$p<0.001$; Variable excluded: sex, age.

ment supply should be adjusted to provide good quality of care. Furthermore, the balance training would be an important factor for improving the functional independence of residents in LTCF.

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台灣長期照護機構院民功能狀況與影響功能之因素分析

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背景與目的：長期照護機構在老人的照護方面佔重要的角色，跌倒與功能變差是院民常見的問題。本研究的目的是調查院民獨立自主功能與平衡能力，並分析影響院民功能獨立自主之因素。**方法**：本研究採橫斷面調查，由台灣各地區112家立案的長期照護機構分層抽樣，由護理之家與養護機構共隨機選出437位院民。由24位物理治療師到各機構，個別評估功能獨立自主量表分數(18項)與柏格氏平衡量表分數(選14項中之9項)。**結果**：院民(N＝437) 之功能獨立自主(FIM)分數是76.42±40.34，平衡是14.05±13.18。不管是鄉村或都市，在護理之家的功能與平衡分數明顯低於養護機構。按多變項逐步迴歸分析顯示影響院民功能獨立自主之因素包括：平衡($p<0.001$)、地區與公私立立案($p<0.01$)、機構別和婚姻狀況($p<0.05$)。下列特徵的院民會有較高的功能分數：平衡分數較高、住於鄉村、住於公立機構、住於養護機構、以及未婚或喪偶的老人。**結論**：在護理之家院民的功能明顯低於養護機構。多重因素影響長期照護機構院民功能獨立自主之能力。平衡能力是影響功能獨立自主之重要因子。(物理治療2004;29(4):217-224)

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