The Application of ICF-based Functioning Data on Home Environment Adaptation for Persons with Disabilities

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ABSTRACT

Purpose: *This study illustrates how the International Classification of Functioning, Disability and Health (ICF) domains and qualifiers could be used to create functioning profiles of persons with disabilities in order to plan environmental changes. The outcome of the interventions can be measured by before-and-after comparisons of these profiles.*

Method: *33 persons with disabilities (11 each from three provinces), with an average age of 43 years, were interviewed between November 2011 and May 2012. 67% of them were male. The functioning profiles of all the subjects were used as guidelines for home environment adaptations.*

Results: *The data helped to understand the limitations of persons with disabilities and identified the areas that needed enhancement to improve their functioning. Modification lay-outs were provided for all 33 persons with disabilities.*

Conclusion and Implications*: It was demonstrated that the ICF framework could help create functioning profiles to guide modifications in the home environment. Future studies should examine whether ICF can measure actual changes that occur after the modifications.*

Key words*: ICF, functioning, persons with disabilities, home environment modification*

INTRODUCTION

Accessibility to physical environment, including housing, is one of the key elements of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) (United Nations, 2006). Enhancing access to the physical

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environment to increase safety, clarity and ease of use for persons with disabilities is also stated in the Incheon Strategy to Make the Rights Real for Persons with Disabilities in Asia and the Pacific (UNESCAP, 2011).

People with disabilities find it difficult to participate in activities at home and in their communities, due to ageing as well as unadapted home environments and surroundings. Ageing and a number of health problems significantly correlate with mobility limitations (Clarke et al, 2008). The environment additionally exerts an effect on the mental and physical health of older adults (Clarke & Nieuwenhuijsen, 2009). Persons with physical limitations are likely to experience difficulties in activities and participation, and to report unmet needs in home accessibility (Stineman et al, 2007). The magnitude of home accessibility problems is significantly related to healthy ageing, perceived functional independence and life satisfaction (Oswald et al, 2007). Supportive and barrier-free environments could minimise the risks of disability in an ageing population. Home modifications could enhance abilities in everyday life by decreasing the level of difficulties and increasing safety for the ageing population (Petersson et al, 2008). Helpers, assistive technology and environment adaptations could enhance performance in community dwellers with some difficulties (Dudgeon et al, 2008).

The World Health Organisation (WHO) developed the International Classification of Functioning, Disability and Health (ICF) in 2001 (WHO, 2001), suggesting interactions between body functions and body structures (b codes), activity and participation (d codes), environment factors (e codes) and personal factors. Member countries have been continuously encouraged to use the ICF to collect the functioning data of persons with disabilities. ICF provides a framework that views disability as the interactions of persons with environment factors rather than disability as a result of individual health conditions (Marguerite et al, 2003). The impact of environmental factors is such that they could either enhance or minimise functioning of persons with disabilities. The authors of this study are not aware of any previous work which reports the functioning profiles of persons with disabilities, using the combination between activities and participation dimensions and environmental factors. Functioning profiles of persons with disabilities affected by unadapted environments could be used as a guideline to eliminate the barriers and promote environmental facilitators.

A questionnaire was developed, based on the ICF concept and classification, by Tongsiri and Riewpaiboon (2013). This questionnaire was used in face-to-

face interviews with persons with disabilities living in the community. ICF codes related to activities and participation were selected for inclusion in the questionnaire, as shown in Table 1. These codes were chosen on the basis of common activities performed among community- dwellers, especially those in rural areas in Thailand. Levels of difficulties were represented by qualifiers ranging from 0 to 4. Thus, 0 represented no difficulties, 1 was mild, 2 was moderate, 3 was severe, and 4 was extremely difficult. For example, a person who suffered a spinal-cord injury with quadriplegia was bed-bound and unable to walk. The walking function of this person, as identified by the ICF code and qualifier, was d450.4. Qualifier 9 was used when the code was not applicable for the function of interest. By using information retrieved from the interview, a functioning profile of persons with disabilities could be built.

Table 1: Activities and Participation Codes used in the questionnaire

ICF Code	Body Function/ Activities
d310	Hearing
d315	Communication with nonverbal message (receiving)
d330	Speaking
d335	Communication with nonverbal message (producing)
d450	Walking
d510	Washing
d540	Dressing
d550	Eating
d5300	Regulating urination
d5301	Regulating defecation
d5302	Menstruation
d4101	Squatting
d4103	Sitting
d460	Moving around indoors
d4551	Climbing stairs
d465	Moving around outdoors using equipment

This research aimed to illustrate the possible application of the ICF-based functioning information of persons with disabilities to guide home and environment modifications, and to measure functions of these participants before and after the changes. The Universal Design Concept and Code of Practice, as well as the ICF-based functioning data of persons with disabilities, were applied to home environment adaptations. The authors were interested in finding out whether the ICF domains and qualifiers could be used together with architectural designs to measure changes, if any, in functional profiles of persons with disabilities after the home modifications.

METHOD

Community leaders and health personnel from the 3 provinces - Mahasarakham, Kalasin and Nongbualumpoo - in Thailand, recruited persons with mental or physical limitations who resided in poor housing conditions. The research team used the ICF-based questionnaire in face-to-face interviews with these persons or their family members, to measure and document functioning of persons with disabilities. Survey checklists and measurements of house conditions were also done. With the permission of participants, photos of the surrounding environment were taken in order to guide the indoor space design process. Team meetings were held with a physiatrist, two architects and one research assistant. The authors analysed the data and summarised the functioning profile of each person with disability. Environmental barriers were identified and changes in the home environments were suggested by the team, along with the architects, to support the rehabilitation programmes and enhance the functioning of persons with disabilities and their families.

RESULTS

Thirty-three persons with disabilities from the 3 provinces (11 from each province), with an average age of 43 years, were interviewed between November 2011 and May 2012. 67% were male. The functioning profiles of all 33 participants are presented in Table 2. Numbers in the Table are qualifiers representing the level of difficulties of each domain.

Table 2: Functioning Profiles of all 33 participants

id	d310	d315	d330	d335	d450	d510	d540	d550	d5300	d5301	d5302	d4101	d4103	d460	d4551	d465
Kae-Dam District																
1	0	9	0	9	4	4	4	0	4	4	9	4	4	4	9	4
2	0	9	3	9	3	4	4	1	4	4	9	3	3	0	9	2
3	0	9	0	9	2	2	2	3	0	0	0	3	1	1	9	0
4	0	9	3	9	4	4	4	4	3	3	9	4	4	0	9	4
5	0	9	3	9	4	4	4	4	4	4	9	4	4	4	9	4
6	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0
7	0	9	0	9	2	0	0	0	2	0	9	2	1	1	9	4
8	2	9	0	9	1	0	0	0	0	0	9	0	0	0	9	0
9	1	9	0	9	4	0	0	0	2	2	0	4	4	1	9	4
10	0	4	4	4	4	4	4	3	3	3	9	4	4	3	4	2
11	0	9	0	4	4	0	0	0	1	1	9	4	4	3	4	4
Kushi-Narai District																
12	0	3	4	3	3	3	3	4	2	2	9	4	3	1	2	2
13	0	9	0	9	4	0	0	0	4	4	9	4	1	0	9	0
14	0	9	2	9	3	0	0	0	0	0	0	4	1	2	2	2
15	0	3	4	4	4	4	4	4	4	4	9	2	3	3	4	2
16	0	9	0	9	4	1	1	0	2	2	9	4	1	0	4	0
17	0	9	0	9	4	0	0	0	0	0	9	3	3	4	9	4
18	0	0	0	0	3	0	0	0	4	4	9	4	1	0	9	0
19	0	9	0	9	2	0	0	0	4	4	9	4	1	2	9	2
20	0	9	0	9	4	3	3	0	2	2	9	4	4	4	4	4
21	0	9	0	9	3	0	0	0	0	0	9	4	4	0	9	4
22	0	9	0	9	4	1	1	0	3	3	9	4	2	2	9	2
Nongbua-Lumpoo Province																
23	0	9	0	9	0	0	0	0	0	0	9	0	0	0	9	9
24	0	9	0	9	4	4	4	4	4	4	9	4	4	4	4	4
25	0	9	0	9	0	0	0	0	0	0	9	0	0	0	0	0
26	0	9	0	9	4	0	0	0	2	0	9	4	4	0	9	0
27	0	9	0	9	2	0	0	0	0	0	9	2	2	1	9	2
28	0	9	0	9	0	0	0	0	0	0	9	0	0	0	0	9
29	9	9	4	9	4	4	4	0	4	4	9	4	4	4	9	9
30	0	9	0	9	1	0	0	0	0	0	9	0	0	0	9	9
31	0	9	0	9	2	0	0	0	0	0	9	2	0	0	9	0
32	0	9	0	9	1	0	0	0	1	1	9	1	0	0	9	9
33	3	9	0	9	0	0	0	0	0	0	9	0	0	0	1	9

The functioning profiles demonstrated the limitation of activities and participation of persons with disabilities in the community. After examining the functioning profiles, the home environment change plans were suggested, including the items or devices that should be given to individual persons with disabilities, as shown in Table 3. Details of two cases, including room layout plans, are presented here as examples. Expected changes in functioning after home modifications are summarised in Table 4.

Table 3: List of Environment Changes and Additional Items Suggested for Individual Persons with Disabilities

id	Uncluttering	Area Arrangement	Hand Rails	Toilet	Stairs	Ramp	Additional Rooms	Floor Lifting	Building New Home	Assistive Devices
1			●		●		●			
2	●	●	●	●						●
3		●	●	●						
4		●	●				●			●
5	●	●	●	●						
6			●	●			●			
7	●		●	●						
8			●				●	●		
9			●	●			●			
10		●	●				●			●
11			●				●			
12			●				●			
13			●							
14			●	●	●		●	●		
15		●	●	●						●
16	●		●	●						●
17			●						●	
18			●	●		●				
19		●	●				●			
20	●		●				●			
21			●				●			
22			●	●						●
23			●						●	
24			●		●		●	●		●
25			●						●	
26			●			●	●			
27			●				●			
28			●		●		●			
29	●		●	●			●			●
30		●	●	●			●			
31	●	●	●	●			●			
32			●				●		●	
33			●		●		●	●		

All persons with disabilities seemed to require handrails to prevent injuries from falling. Also recommended, for almost all of them, were additional rooms to enhance functions. Only two of them needed a ramp for mobility. The results suggested that more than one item should be recommended for persons with disabilities, and assistive devices along with home modifications play a major role in the improvement of functions. New houses were offered to some of the study participants because the majority of them had economic difficulties and were living in poor housing conditions.

Case No.1

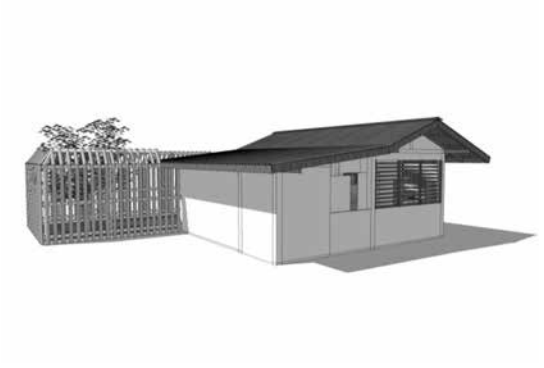
A 44-year-old male, who had suffered from psychosis for several years, with reasonably good medical compliance, was introduced by a home visit team of the Kushinarai Hospital, Kalasin province. This person was confined in a small one-room low-ceilinged house, and his mother provided food and clothes through cracks in the wooden walls. He could neither stand up nor walk about in that small house, and was not allowed to wander in the community due to his condition. The research team planned to improve his mobility functions by building fences around the house, so as to provide more space and allow more interaction with his mother. Home environment conditions and design for Case No.1 are shown in Figure 1.

Figure 1: Home environment conditions and modified design for Case No. 1

Overall house condition

Home modification design
(from the front)

Illustrations of indoor layout



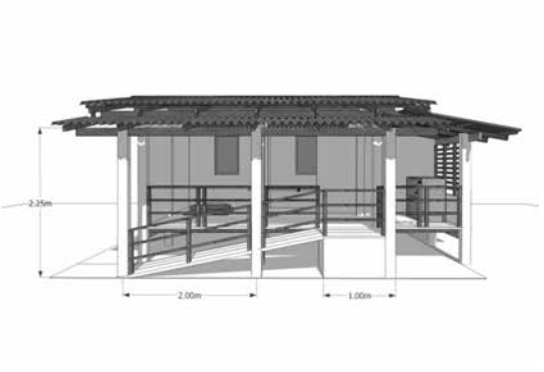
Home modification design
(from the back)

Case No. 2

A 46-year-old male, with mobility and vision difficulties, resided in a small one-room house with an outdoor toilet constructed approximately 50 metres away. Though unable to walk, he used to slide down from the house using a ramp on the floor, and then would crawl to the toilet. The team planned to move the toilet closer to the house to minimise his difficulties. Design for home environment modifications are shown in Figure 2.

Figure 2 : Home environment conditions and modified design for Case No.2

Overall house condition

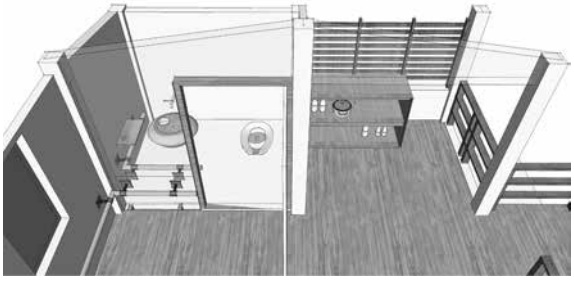


Home modification design
(from the front)

Illustrations of indoor layout

Home modification design (from the back)

Toilet (outside)



Layout of new kitchen and toilet

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Table 4: Expected Changes

id	d450		d4101		d4103		d460		d4551		d465	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Kae-Dam District												
1	4	4	4	4	4	4	4	2	9	9	4	2
2	3	2	3	2	3	2	0	0	9	9	2	2
3	2	2	3	2	1	0	1	0	9	9	0	0
4	4	4	4	2	4	1	0	0	9	9	4	4
5	4	4	4	3	4	3	4	2	9	9	4	2
6	0	0	0	0	0	0	0	0	0	0	0	0
7	2	2	2	1	1	1	1	0	9	9	4	2
8	1	1	0	0	0	0	0	0	9	9	0	0
9	4	4	4	2	4	2	1	0	9	9	4	2
10	4	4	4	2	4	2	3	2	4	9	2	2
11	4	4	4	2	4	2	3	2	4	9	4	2
	d450		d4101		d4103		d460		d4551		d465	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Kushi-Narai District												
12	3	3	4	2	3	2	1	0	2	9	2	2
13	4	4	4	2	1	0	0	0	9	9	0	0
14	3	3	4	2	1	1	2	0	2	9	2	2
15	4	4	2	2	3	2	3	2	4	9	2	2
16	4	4	4	2	1	0	0	0	4	9	0	0
17	4	4	3	0	3	0	4	0	9	9	4	0
18	3	3	4	2	1	0	0	0	9	9	0	0
19	2	2	4	2	1	0	2	0	9	9	2	0
20	4	4	4	4	4	4	4	4	4	9	4	4
21	3	3	4	2	4	2	0	0	9	9	4	2
22	4	4	4	2	2	0	2	0	9	9	2	0
	d450		d4101		d4103		d460		d4551		d465	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Nongbua-Lumpoo Province												
23	0	0	0	0	0	0	0	0	9	9	9	9
24	4	4	4	3	4	3	4	2	4	9	4	2
25	0	0	0	0	0	0	0	0	0	0	0	0
26	4	4	4	2	4	1	0	0	9	9	0	0
27	2	2	2	1	2	1	1	1	9	9	2	2
28	0	0	0	0	0	0	0	0	0	0	9	9
29	4	4	4	3	4	3	4	4	9	9	9	2
30	1	1	0	0	0	0	0	0	9	9	9	0
31	2	2	2	1	0	0	0	0	9	9	0	0
32	1	1	1	1	0	0	0	0	9	9	9	9
33	0	0	0	0	0	0	0	0	1	0	9	2

The most common functions that were expected to be enhanced after the home modifications included d4104 squatting (which represents a change in posture from lying on the floor to standing), followed by d4103 sitting (which represents a change from sitting on a chair or a bed to standing), d460 moving around indoors, d465 moving around outdoors using equipment, and d4551 climbing stairs. Qualifiers of these ICF codes were changed from having greater difficulties before home modifications to fewer difficulties after modification.

Fewer changes were observed in those living in Nongbua-Lumpoo province. Only one person exhibited improvement in d450 walking, from qualifier 3 to 2. Two of the participants (IDs 32 and 33) were unlikely to benefit from home modifications. The function of d4551 climbing stairs, in persons who exhibited some difficulties ranging from qualifiers 2 to 4 (IDs 10 -16), was expected to improve to qualifier 9, indicating that the persons with difficulties were unlikely to use stairs after the home modifications, for example, the building of a new room on the ground floor to avoid using stairs to access the rooms upstairs.

DISCUSSION

This is the first study to demonstrate how ICF codes and qualifiers can illustrate the functions of persons with disabilities and the magnitude of change after modifications to their homes and environment. Layout plans were also offered for individual home modifications of persons with disabilities. Difficulties related to mobility disabilities were elicited by the ICF-based questionnaire and were used to guide the plans for home environment modifications.

The most affected domains after the changes to the home environment were d4101 squatting, following by d4103 sitting, d460 moving around indoors, d465 moving around outdoors using equipment, and d4551 climbing stairs. This could be due to the lifestyle of people in this area where most of the daily household activities, including eating, sitting and sleeping, were performed on the floor. With age and mobility difficulties, people tend to be more dependent while performing daily activities. For instance, those suffering from paraplegia are most likely to have difficulty in climbing stairs to their bedrooms on the second floor. Elderly people tend to need more assistance in getting up from a seated position on the floor, and there could be more difficulty if they, in addition, have diseases such as cerebrovascular accident (CVA). Home environment modifications can ease their difficulties, as evidenced by the change of qualifiers from higher to lower levels of difficulties.

Dealing with the functioning profiles of children with disabilities is more challenging because the functions are likely to change gradually as they grow up. Home environment adaptations may temporarily enhance some of their functions. Since there are likely to be changes over the following 6–12 months, re-evaluations and additional modifications may again be essential.

Handrails were recommended for all participants. Additional rooms and toilets were the second and third most common recommendations respectively. This may indicate that mobility function was the most common difficulty elicited by the questionnaire. The questionnaire was originally designed to be a screening measure for activities and participation in the community, so other domains of activities and participation in daily activities at home have not yet been included. Further studies should be conducted to gain more insights into the functioning profiles of persons with disabilities and to understand the household activities which may be influenced by the local cultural context.

The ICF framework and classification scheme can help team members across different disciplines to work together in harmony. The results of the study demonstrate that cooperation is required between doctors and architects in the provision of home environment modifications for persons with disabilities. A holistic approach and multidisciplinary teamwork from healthcare and non-healthcare staff are both immensely important for functional improvements. ICF can be used as a common language to ease communication across different sectors.

It is to be noted that the activities and participation of persons with disabilities after home environment modifications, as shown in Table 4, were the functions that were expected to change. Future studies should investigate the actual outcomes of functioning profiles of persons with disabilities after the modifications. The same ICF questionnaire should be employed to study whether supportive and barrier-free housing environments truly enhance their functions. Together with home environment modifications, other factors such as cultural backgrounds, individual beliefs, autonomy and subjective well-being, should also be explored in future studies. Domains representing functions of other life areas related to community participation should be considered too.

CONCLUSION

ICF domains and qualifiers are effective in collecting functioning data of persons with disabilities, before and after the home environment modifications. This study illustrated that the functioning data could guide home environment adaptations. It is helpful to architects in the spatial design process as it gives a better understanding of the limitations of persons with disabilities, and helps them to identify which functions should be improved. Multidisciplinary work across different professions is also necessary to improve the functions of persons with disabilities.

While the ICF classification system can be used to develop the functions of persons with disabilities, some important issues and activities have not yet been included in the questionnaire used for the study.

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The authors declare that they have no competing interests.

REFERENCES

Clarke P, Nieuwenhuijsen ER (2009). Environments for healthy ageing: a critical review. Maturitas; 64(1): 14-19. http://dx.doi.org/10.1016/j.maturitas.2009.07.011. PMid:19695800

Dudgeon BJ, Hoffman JM, Ciol MA, Shumway-Cook A, Yorkston KM, Chan L (2008). Managing activity difficulties at home: A survey of Medicare beneficiaries. Archives of Physical Medicine and Rehabilitation; 89(7): 1256-1261. http://dx.doi.org/10.1016/j.apmr.2007.11.038 PMid:18534553 PMCid:3425800

Oswald F, Wahl HW, Schilling O, Nygren C, Fange A, Sixsmith A, Sixsmith J, Szeman Z, Tomsone S, Iwarsson S (2007). Relationships between housing and healthy ageing in very old age. Gerontologist; 47(1): 96-107. http://dx.doi.org/10.1093/geront/47.1.96 PMid:17327545

Petersson I, Lilja M, Hammel J, Kottorp A (2008). Impact of home modification services on ability in everyday life for people ageing with disabilities. Journal of Rehabilitation Medicine; 40(4): 253-260. http://dx.doi.org/10.2340/16501977-0160. PMid:18382820

Schneidert M, Hurst R, Miller J, Ustun B (2003). The role of environment in the International Classification of Functioning, Disability and Health (ICF). Disability and Rehabilitation; 25(11-12): 588-595. http://dx.doi.org/10.1080/0963828031000137090. PMid:12959332

Stineman MG, Ross RN, Maislin G, Gray D (2007). Population-based study of home accessibility features and the activities of daily living: clinical and policy implications. Disability and Rehabilitation; 29(15): 1165-1175. http://dx.doi.org/10.1080/09638280600976145. PMid:17653990

Tongsiri S, Riewpaiboon W (2013). Using the ICF to develop the capability-oriented database of persons with disabilities: a case study in Nakornpanom province, Thailand. Disability & Rehabilitation; 35(13): 1078-1086. http://dx.doi.org/10.3109/09638288.2012.720351. PMid:23020280

United Nations (2006). Convention on the Rights of Persons with Disabilities. New York, United Nations.

United Nations Economic and Social Commission for Asia and the Pacific (2012). Incheon Strategy to "Make the Rights Real" for persons with disabilities in Asia and the Pacific, Bangkok, UNESCAP. Available from: http://www.unescap.org/publications/detail.asp?id=1523

World Health Organisation (2001). International Classification of Functioning, Disability and Health. Geneva, Switzerland, WHO.