

The utilization of personal mobility in an Aging Society and Quality of Life

: from the view point of ICF Activities and Participation dimensions

Chizuru Nagata¹⁾

Abstract

Aim : : The aim of this study is to clarify the effect on QOL of the utilization of an electric scooter (Monpal) by elderly people to continue with their participation in social activities, when they find it difficult to walk for a long distance or time.

Methods : There were 12 participants, consisting of a physically handicapped person in her 20s, a housewife in her 40s and 10 elderly persons, all of whom agreed to participate in this study. From October to December, 2010 participants were provided with an electric scooter to support their daily activities.

QOL was evaluated with the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) and the ICF (International Classification of Functioning, Disability and Health) Activities and participation dimensions with a semi-structured interview.

The results compared the QOL scores from before and after using Monpal.

Results : Although there was a limitation of the study due to the small number of subjects, there was a significant improvement in the ICF Activities and Participation dimensions with Monpal use, but not in SF-36 score. Additionally there was no correlation between the ICF and the SF-36.

Conclusion : Monpal can respond to expectations sufficiently as a safe and secure transportation device which maintains the QOL of the elderly. It would be useful to support the establishment of opportunities for activities using Monpal, and with long-term utilization of Monpal, the elderly can expect behavioral changes and an increase in their daily activities.

Key words : personal mobility, QOL, activities and participation, ICF

Introduction

In an aging society, even if physical function declines in old age, there is a social need to secure and organize a means to allow people to move on their own so that they can

live as self-reliantly as possible.

Personal mobility vehicles, such as an electric scooter that uses clean energy, are generally sold to support movement by the elderly, but the use of these is generally limited to younger people with relatively

1) Faculty of Life Science, Kumamoto University

serious disabilities and cannot be said to be used by most people.

In Kumamoto Prefecture, in fiscal 2010, "Substantiative research on providing chargers that use solar power and new ways to use electric scooters, etc." was conducted as a green decentralization reform promotion project by the Ministry of Internal Affairs and Communications to study a new method for utilizing personal mobility and to identify the impact on quality of life (QOL)^{1)~2)}. The Japan Red Cross Society Kumamoto Health Management Center became the investigative research representative for this research project, which was conducted in cooperation with Kumamoto Prefecture, Kumamoto University, and Honda Motor Co., Ltd., as an industry-government-academia collaboration research project. This is a report of the case study results supervised by this project.

The aim of this study is to clarify the effect on QOL of the utilization of an electric scooter (Monpal) by elderly people to continue with their participation in social activities, when they find it difficult to walk for a long distance or time.

Research on the quality of mobility (QOM) to improve QOL has been studied^{3)~6)}, and personal mobility, such as by using Monpal, has been reported to contribute to maintaining and improving the QOL of the elderly⁷⁾. But we have not found any research verifying the affect on QOL by personal mobility from a nursing perspective. For this reason, we wanted this time to use case studies to verify the affect on QOL from the ICF "activity" and "participation" perspective and study the significance for gerontological nursing.

Methods

Participants

There were 12 participants, consisting of a physically handicapped person in her 20s, a housewife in her 40s and 10 elderly persons, all of whom agreed to participate in this study. (See Table 1)

Measures

QOL was evaluated with the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) and the ICF (International Classification of Functioning, Disability and Health) Activity and participation dimensions with a semi-structured interview. The results compared the QOL scores from before and after using Monpal.

ICF suggests application-specific research tools for measuring QOL for all persons regardless of whether or not they have an illness or disability, so we determined that these tools are suitable to use as a QOL evaluation index for the subjects of this research. Monpal is used as a means of transportation, so it was deemed to be especially suitable for evaluation the ICF composition elements of "activity" and "participation." However, to date an international standard for the evaluation of "activity" and "participation" has not been set⁸⁾.

For this reason, we proposed an interview guide with the advice of specialists based on 9 classification items from the ICF "activity: individual performance of problems or actions" and "participation: engagement in life and life situations." From these 9 classification items we created 13 questions (See Table 2) as follows: 2 questions on "learning and

Table 1. Subject attributes

	Sex	Age	Residence	Long-term care services in use	Required level of care	Status of use Monpal
A	M	60-69	own home	care prevention project	—	He can freely ride Monpal by himself. He is using Monpal and the car together.
B	M	60-69	own home	care prevention project	—	He can freely ride Monpal by himself. He is using Monpal and the car together.
C	M	60-69	own home	care prevention project	—	He can freely ride Monpal by himself. He is using Monpal and the car together.
D	M	70-79	own home	care prevention project	—	He can freely ride Monpal by himself. He is using Monpal and the car together.
E	F	40-49	own home	—	—	She can freely ride Monpal by herself. She is using Monpal and the car together.
F	F	80-89	own home	day-service	assisted level1	She drive Monpal inside of the special nursing home with care staff.
G	F	80-89	own home	day-service	assisted level2	She drive Monpal inside of the special nursing home with care staff.
H	F	20-29	own home	—	—	She can freely ride Monpal by herself. She is using Monpal and the car together.
I	M	70-79	care home	—	needed level1	He can freely ride Monpal by himself.
J	F	80-89	care home	—	needed level2	She can freely ride Monpal by herself.
K	M	80-89	care home	—	—	He drove Monpal only once with care staff of the care home. He is using his car usually.
L	M	80-89	care home	—	—	He drove Monpal only once with care staff of the care home. He is using his car usually.

applying knowledge," 2 questions on "general tasks and demands," 1 question on "communication," 1 question on "mobility," 1 question on "self-care," 1 question on "domestic life," 2 questions on "interpersonal interactions and relationships," 1 question on "major life areas," and 2 questions on "community, social and civic life." Then on November 15, 2010, we revised this based on the comments from 4 subjects during a joint pre-interview held after using Monpal for approximately 1 month and completed the interview guide.

Using the interview guide, the researcher held individual semi-structured interviews with 12 subjects and used the three-answer

selection method (Ex: Yes/ NO/ Neither) for the 13 questions to perform a subjective evaluation and then asked the subjects to state the basis for their answers and their opinions or impressions. The semi-structured interview time was 30 min or less per person including other items, the interviews were recorded with the permission of the subjects, and the data was written on the interview guide form. The semi-structured interview period was from November 30 to December 20, 2010.

Data analysis

For the analysis method, responses were

Table2. Question and answer

No	Question	Yes	No or Neither
1	Did you practice to master of driving Monpal positively?	83.3%	16.7%
2	Did you undertake very enthusiastically tasks, or come to carry out tasks after using Monpal?	41.7%	58.3%
3	Did you become easily carrying out tasks, such as daily routine after using Monpal?	33.3%	66.7%
4	Did you carry out new daily routine after using Monpal?	50.0%	50.0%
5	Did you increase opportunities of communication with family, friend, neighbor, etc., after using Monpal?	83.3%	16.7%
6	Did you increase the frequency of going out or moving your body after using Monpal? Did you increase going to the place which you have never been until now after using Monpal?	50.0%	50.0%
7	Did you become easily going to the neighborhoods, such as hospital after using Monpal?。	50.0%	50.0%
8	Were you charged with the household errands after using Monpal?	25.0%	75.0%
9	Did you get new company after using Monpal?	41.7%	58.3%
10	Did your family bonds deepen after using Monpal?	25.0%	75.0%
11	Did you get work anything after using Monpal?	8.3%	91.7%
12	Did you get playing a social role after using Monpal?	16.7%	83.3%
13	Did you increase enjoying recreation and leisure after using Monpal?	16.7%	83.3%

obtained using the three-answer selection method for the 13 ICF questions, and to score the responses 2 points were assigned to a "Yes" answer, and 0 points were assigned to the "Neither" and "No" responses, and simple tabulation was used for these scores to confirm the correlation with SF36. In addition, an interview was used to ask the subjects to state the basis for their answers and their opinions or impressions regarding the same as well as to answer other questions, and these responses were organized word-for-word and used as data for analyzing the impact on QOL.

As an ethical consideration, the research purpose, method, and that no information that could be linked to individuals would be made public, that there would be no detriment to the subjects, and that they could cancel their participation even after the start of the research was explained to the subjects in advance in written and they were asked to

sign an agreement. When necessary, a signed agreement was also obtained from the family. In addition, this research was also approved by the Medical Ethics Committee of the Japan Red Cross Society Kumamoto Health Management Center on October 1, 2010.

Results

This study was limited by the low number of subjects. This time we used SF36, which comprehensively evaluates QOL, we were unable to demonstrate a QOL improvement effect of introducing Monpal in to daily life as an environmental factor.

The ICF "activity" and "participation" QOL evaluations suggested QOL improvement for "learning and applying knowledge," "general tasks and demands," "communication," "mobility," "self-care," and "interpersonal interactions and relationships" (See Table 3). Unlike

the scoring for a comprehensive evaluation index like SF36, the contents allowed changes that affected part of the individual's lifestyle, such as "I can go out and enjoy the scenery in a way not possible while riding in a car (See Case A)," "It brought us closer as a couple. Having physical limitations means we have to help each other (See Case K)," "I go out more now even when not using Monpal (See Cases E, K)", a person who didn't do well playing with the grandchildren said, "I could talk about the Monpal with my grandchildren and play with them (See Case B)," "I'm glad I found Monpal (See Case I)," or "My eating habits really changed (See Case E)." On the other hand, only a small affect was found on "major life areas" and "community, social, and civic life."

The subjective QOL evaluation total score from the Monpal usage conditions for "I can

freely ride by myself" averaged 13.25 points for 8 people, "I cannot ride freely by myself" averaged 5.0 points for 4 people, and the t-test found a significant difference ($p < 0.05$). Therefore, we can expect a greater improvement in QOL if the individual is able to operate Monpal by himself/herself and if the environment allows the individual to move around freely. The 12 subjects all had the ability to operate Monpal, but the environment did not allow free movement because the family would not allow it or the subjects were afraid to go to crowded locations without being accompanied by an assistant.

Additionally there was no correlation between the ICF and the SF-36.

Table3 Score of ICF Activity and Participation dimensions

	Learning and applying knowledge		General tasks and demands		communication	Mobility	Self-care	Domestic life	Interpersonal interactions and relationships		Major life areas	Community, social and civic life		total
	1	2	3	4	5	6	7	8	9	10	11	12	13	
A	2	0	2	0	2	0	2	0	2	0	0	0	0	10
B	2	0	0	2	2	2	2	2	2	2	0	0	0	16
C	0	0	0	0	0	0	2	0	0	0	0	0	0	2
D	2	2	2	2	2	2	2	2	0	0	0	0	0	16
E	2	2	2	2	2	2	0	0	2	2	0	2	2	20
F	2	0	0	0	0	0	0	0	0	0	0	0	0	2
G	0	0	0	0	2	0	0	0	0	0	0	0	0	2
H	2	2	0	0	2	2	2	0	2	0	0	0	0	12
I	2	2	2	2	2	2	2	2	2	0	2	2	2	24
J	2	0	0	2	2	0	0	0	0	0	0	0	0	6
K	2	2	0	2	2	2	0	0	0	2	0	0	0	12
L	2	0	0	0	2	0	0	0	0	0	0	0	0	4
total	20	10	8	12	20	12	12	6	10	6	2	4	4	126

Case A

Classification items for ICF activities and participation	Question items	Narrative contents
Positive		
Learning and applying knowledge	Acquiring skills	I practiced driving Monpal for 1hour. It was easy.
General tasks and demands	Makes carrying out daily routines easier	Monpal made going to facilities of care prevention projects, easier. I can go out and enjoy scenery in a way not possible while riding in a car.
Communication	Increased opportunities for communication	I increased the opportunity to talk while driving the Monpal with a neighbor because Monpal runs at 6 km/h. I don't talk with my family about Monpal.
Self-care	Makes moving around the neighborhood easier	Monpal can drive through areas a car can't pass through. It is convenient that Monpal can drive on the sidewalk like a pedestrian.
Interpersonal interactions and relationships	Relations with a new people	I came to talk with Monpal users about Monpal .
Negative		
Learning and applying knowledge	New tasks	I have only changed my personal mobility to Monpal from a car when I go to facilities of care prevention projects, to the hospital, and shopping.
Domestic life	New family role	Grocery shopping was my role previously.
Other : <ul style="list-style-type: none"> • I don't mind parking the Monpal, and I can go through narrow streets. • It become cold, so a car is better than Monpal. October is the best climate for Monpal. I don't think I will use Monpal in the rain. • It is inconvenient to go to a long way. Monpal is just good for traveling about a quarter of an hour. • In front of the hospital, the patient said "It looks useful, I want one", "Yes, it's useful" I answered. • I'm using both of a car and Monpal. I use Monpal when I go to facilities of care prevention projects, it takes 15 minutes from my home, then I use a car when it takes 30 minutes. 		

Case B

Classification items for ICF activities and participation	Question items	Narrative contents
Positive		
Learning and applying knowledge	Acquiring skills	I practiced driving Monpal willingly because I was anxious. I got accustomed to driving Monpal soon.
General tasks and demands	New daily routine	Using Monpal, I went up a hill, through the dark way, and challenged various things. Although I would ride on Monpal in the rain, I thought, "It's heavy and if Monpal stops along the way, then I will have to give up." I became worried that Monpal would stop along the way if handicapped person is driving.
Communication	Increased opportunities for communication	I heard about using Monpal from residents who were concerned. I went to the park with the grandchildren while riding Monpal. Although I have difficult interacting with children, I could talk about the Monpal with my grandchildren and play with them, and that gave me pleasant memories.
Mobility	Increased opportunities for going out	I went out in the morning using Monpal to a place I do not normally walk to. I thought that I might be able to go there by Monpal, and I was.
Self-care	Makes moving around the neighborhood easier	Monpal is more useful than a car when I go to a nearby place. I don't mind parking the Monpal. It was convenient to collect survey forms using Monpal, when the national census was conducted.
Domestic life	New family role	I am taking care of my grandchild, and talk about Monpal.
Interpersonal interactions and relationships	Relations with new people	Children often come to play to see Monpal.
	Family bonds	Ties with grandchildren deepened.
Negative		
Learning and applying knowledge	New tasks	If I use Monpal to go where I want to travel, I won't get any exercise.
Other : The most positive thing for me was learning about Monpal. I had a good experience using Monpal, and I'm glad I can try it now because I wouldn't be able to later if I waited until I was suddenly disable when I'm older. I'm able to say from my experience that anyone can drive Monpal. I had thought that Monpal was not necessarily what I would use when getting old. It is useful at the hospital.		

Case E

Classification items for ICF activities and participation	Question items	Narrative contents
Positive		
Learning and applying knowledge	Acquiring skills	I practiced driving Monpal after the 30-minute explanation. I soon became used to driving Monpal.
	New tasks	I now take walks with my dog. Although I have been going out less because my son is suffering from asthma, we are willing to go out to see Monpal because he is pleased with Monpal.
General tasks and demands	Makes carrying out daily routines easier	I take my dog for walks because the speed of Monpal is the same as walking.
	New daily routine	I now drive Monpal, and take walks with my son.
Communication	Increased opportunities for communication	I became interested in ecology after using Monpal, and talk about it with community residents, even if they are unfamiliar people. I have noticed that it is ecological just to use Monpal.
Interpersonal interactions and relationships	Relations with new people	I often talk about Monpal with community residents, even if they are unfamiliar people.
	Family bonds	Our topics have increased very much, we talk about recipes that were taught by community residents, and about ecology in addition to the topic of Monpal.
community, social and civic life	New social role	I came to care about my health, and go to the gym for health promotion. I got to know many people through Monpal, then go to the gym or have lunch together.
	Increased opportunities for recreation and leisure	I now do health promotion activities. I am now interested in ecology and eating habits, and I also changed where I shoe, etc.
Other :		
<ul style="list-style-type: none"> • I am now interested in ecology, and the eating habits of my family became healthier. I was taught many things by the dietitian. • I think that the difference between a car and Monpal is ecology. Parents of children suffering from asthma are glad if an electric car replaces a gasoline car. • An electric wheelchair has a dark image, because, there is the impression that handicapped people have been reluctant to ride them. Monpal changed that image, for example the lovely girl riding on it, the design and a color are smart, and there is a high-class feeling. The surrounding people also are easy to speak to and to care for. I think Monpal leads to mental barrier-free. 		

Case I

Classification items for ICF	Question items	Narrative contents
activities and participation		
Positive		
Learning and applying knowledge	Acquiring skills	It is easy to drive Monpal.
	New tasks	I now shop nearby.
General tasks and demands	Makes carrying out daily routines easier	I usually go to play Shogi at a place 2 km from here by Monpal.
	New daily routine	I drive Monpal every day. I am travel the community by Monpal as planned.
Communication	Increased opportunities for communication	I now play Shogi or Go with users of facilities for the elderly, then I talk with unfamiliar person after starting to use Monpal.
Mobility	Increased opportunities for going out	I made a map of this area and traveled by Monpal as planned.
Self-care	Makes moving around the neighborhood easier	I can go now to place riding Monpal that I could not go to before using a wheelchair.
Domestic life	New family role	I became the leader of the Karaoke group in the care home after starting to use Monpal.
Interpersonal interactions and relationships	Relations with new people	I got new friends in the Karaoke, Shogi, and Go, groups after starting to use Monpal.
Major life areas	New work	I got the opportunity to teach the games of Go and Shogi.
Community, social and civic life	New social role	I got a new social role of teaching the games of Go and Shogi, became a leader of the Karaoke group, and checkup on the community roads.
	Increased opportunities for recreation and leisure	I would like to travel all of my residential area by Monpal. Now I'm investigating the best roads for elderly people living alone when they go to shopping.
Other : Since I can't drive a car any more, I consider Monpal as my main means of mobility now. I can completely take care of myself with Monpal. I'm glad I found Monpal. I think that I want to drive Monpal at 12 km/h. Although a car is safer than Monpal, Monpal is more useful than a wheelchair. It is good for reducing my stress.		

Case J

Classification items for ICF activities and participation	Question items	Narrative contents
Positive		
Learning and applying knowledge	Acquiring skills	I was interested in Monpal before, and had a test drive at first. I wanted to learn to drive Monpal soon and to save the cost of riding a taxi.
General tasks and demands	New daily routine	My new daily routine is undertaking the social experiment of Monpal. I undertook the social experiment hard as a duty, since it would cost money.
Communication	Increased opportunities for communication	I often came to talk about Monpal subjects, for example, about poor access, bad sidewalks, and useless times, etc.
Negative		
Learning and applying knowledge	New tasks	I undertook the social experiment because I was curious. I undertook this social experiment with my theme because I wanted to know the problems related to Monpal compared with those of a silver car (a walking stroller used by the elderly).
General tasks and demands	Makes carrying out daily routines easier	Nothing. I spent my precious time on Monpal. I have less time reading books. When I went to an art museum, the access from the parking lot was poor, so I have to walk a long way to the hall after getting off of Monpal. Since I strained myself, I had to get a painkilling injection.
Mobility	Increased opportunities for going out	I can't go by Monpal to unfamiliar places. I don't have an adventurous spirit to go there.
Major life areas	New work	I spent one day on the report for the Monpal social experiment.
<p>Other :</p> <ul style="list-style-type: none"> • Since I have the fear of becoming bedridden, it is necessary to make an effort to walk as much as possible. • When using Monpal, the access from the parking lot was poor, anywhere. When I go to the hospital by Monpal, I can't walk into a hospital from the parking lot. It became more fearful, as I drove Monpal, it is not a problem with Monpal but a problem of the road structure. I was made to recognize that it has become a motorized society which is not pedestrian friendly. I accept the use of Monpal, and I think that combined use of a Monpal and silver car is good. When I drive to a busy area by Monpal, I have to use my nerves, and when I descend to a different level while riding Monpal, it jolts very much. Since Monpal does not save time compared to a silver car, it is not necessary to use it. 		

Case K

Classification items for ICF activities and participation	Question items	Narrative contents
Learning and applying knowledge	Acquiring skills	I practiced driving Monpal and test drove it immediately. Although driving Monpal was easy and I learned fast, I was fearful in busy areas when people bumped into the Monpal.
	New tasks	I now pay more attention to roads after using Monpal. I think about whether Monpal can drive along the road, or turn at a right angle, or get down from a level difference, or maybe fall down on the sloped road.
General tasks and demands	New daily routine	After using Monpal, I think it will be pleasant to go out, and I would like to carry out to new places. Even if I don't have a purpose, I would like to go out on a walk, and Monpal lets me do that.
Communication	Increased opportunities for communication	My opportunities to talk with wife increased. We discussed that when I ride on Monpal, if I meet my friends, they will think that I have become handicapped.
Mobility	Increased opportunities for going out	I go out more now even when not using Monpal. The opportunities to go out together with my wife increased. I accompany my wife to the hospital or she accompanies me.
Interpersonal interactions and relationships	Family bonds	The bond with my wife deepened. It brought us closer as a couple. Having physical limitations means we have to help each other. I found the feeling of being a disabled person only after I used Monpal.
Other :		
I would like to go anywhere in the near future using an electric scooter like Monpal. Although, when I could no longer drive a car, I considered only using public transportation or walking until now. Monpal gives me peace of mind.		

Discussion

Affect on QOL Found by the Case Studies

The case studies showed sufficient reason to expect that people will be able to use Monpal as a means of transportation in their daily lives and that knowing about Monpal will allow it to be selected as a future means of transportation without worry, and thus Monpal is a safe and secure means of transportation for maintaining the QOL of the elderly.

Regarding cases C, F, G, J (See Case J), and L for which the ICF QOL evaluation total score was low, 4 people other than case C were in an environment that did not allow them to ride freely by themselves. C was in an environment that allowed the Monpal to be ridden freely, and so C often rode it and had no complaints about Monpal, but the score was low. The reason for this was the mother and spouse, who had initially showed interest in participating in the research, later declined to participate. J had the highest expectations for Monpal, but became discouraged with the poor access at destinations when using Monpal to go out. The opinion and impression of J are of great value to the research team. Specifically, the Monpal performance information about the mechanical issues, such as the jolting when descending bumps or negotiating tilted sidewalks, can be used to ask the manufacturer to make improvements and to request that governments improve access, and since the research found such a result, it is the responsibility of the researchers to inform the related organizations of the problems hindering the means of transportation of the elderly and disabled.

This affirms the significance of an industry-government-academia collaboration research.

In addition, the ICF only found slight improvement in "major life areas" and "community, social, and civic life." This was because 6 of the elderly subjects had been driving their own car for transportation, so the use of Monpal did not expand their range of activity. Further, changing the behavior of the elderly and expanding their range of activity (lifestyle) will require long-term use of Monpal together with some means of support, such as providing activities where Monpal can be used.

The Elderly and Mobility from the Perspective of Gerontological Nursing

It is known that physical factors, psychological factors, and social factors all contribute to houseboundness in the elderly. The physical factors include walking disabilities, seeing and hearing disabilities, and language disabilities;⁹⁾ psychological factors include depression;¹⁰⁾ and social factors include not having friends⁹⁾ and not having supported when going out.¹¹⁾ On the other hand, it has been reported that the harmful effects of being housebound included deterioration of walking ability, life functions, cognitive functions, and it has been pointed out that being housebound leads to dementia and being bedridden. In other words, the ability for the elderly to move about is closely related to their state of health¹²⁾⁻¹⁴⁾.

Therefore, when the elderly suffer a decline in their ability to move around, a new means of transportation must be given to them to maintain their health. When walking becomes difficult, they can use welfare equipment,

such as a cane, silver car (a stroller like device that is pushed for support but also has a seat the elderly can sit on to rest), walker, wheelchair, etc. In addition, they can also be provided with an assistant for going out. We propose using Monpal as one option for a substitute means of transportation including when it is difficult to get around using a bicycle or automobile.

Suggestions for a Future Study

This research found that even if the QOL improved in terms of ICF activity and participation, it did not improve the comprehensive QOL as determined using SF36, which is an issue that needs to be pursued in the future.

In addition, this time we had considered focusing on elderly subjects who were gradually losing the use of their legs and lower back, but including the participation of young people in their 20s and 40s as well as relatively healthy elderly that do not require the use of Monpal suggested the following. First, younger people lose their resistance to using Monpal after they have experienced them. Second, generating interest in eco activities increase the locations and activities where Monpal are used. Third, recognizing Monpal as a future means of transportation will provide a sense of relief and security to the elderly. It is, therefore, desirable that this research be continued in the future.

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