

Psychological Effects of Use of Electric Scooter

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ABSTRACT

A questionnaire survey and interviews were conducted with users of electric scooter in order to determine the psychological effect of using these vehicles. It was found that there was a significant increase in the level of satisfaction reported by respondents in going shopping, running household errands, and traveling between their house and fields after they commenced using an electric scooter. Forty-five percent (45%) of respondents indicated that they felt less fatigued when leaving the house since they began using a scooter. In addition, more than 40% of respondents answered that the use of an electric scooter had increased their confidence when they left the house, even if they went out alone. Prior to purchasing an electric scooter, most respondents had lost the means of mobility that they had used previously, and were experiencing trouble walking. This can be considered to have resulted in a decline in their feelings of self-efficacy and self-esteem. After beginning to use an electric scooter, survey subjects recovered feelings of self-efficacy and self-esteem, and regained self-confidence. It can therefore be concluded that electric scooters are able to contribute to the maintenance or enhancement of the quality of life (QOL) of the elderly.

1. Introduction

For the elderly, leaving the house is of great significance not merely in terms of performing activities necessary to daily life, but also in terms of leading a physically and psychologically healthy and independent life. Many experts warn that becoming housebound is the preliminary stage of becoming bedridden^{(1), (2)}. When an elderly person becomes housebound, their level of physical activity is reduced, they have less contact with sources of visual stimulation, and their exchanges with other people are limited. This results in a decline in performance of activities of daily living (ADL) and in intellectual activity, and the occurrence of symptoms associated with disuse syndrome (muscular atrophy, contracture of joints, and reduction of cardiopulmonary function due to a lack of physical activity). This situation can easily lead to a transition to a bedridden state. A 2005 survey by the Cabinet Office showed that the number of times that elderly citizens left the house per day declined with advancing age, with the average number of times for the latter-stage elderly (75 and older) approximately 60%

of the figure for the early-stage elderly (aged 65-74)⁽³⁾. Behind these figures lie reductions in reasons and opportunities to leave the house as the elderly individual's role in society and the family changes, the loss of former means of mobility with declines in physical ability, and, as a result of these factors, a decline in desire to leave the house^{(4), (5)}. What is required, therefore, is to find a means of increasing the desire of elderly citizens to leave the house, to provide them with support to do so, and to provide an environment that enables unhindered mobility when they do so.

Taking Japan's aging society into consideration, in 1999 Honda commenced marketing the Monpal ML100, a four-wheeled electric scooter. The year 2006 saw the second-generation of the vehicle, the Monpal ML200, based on a concept of compact packaging and stylish design. As an individual increases in age, the choices of means of mobility available become narrower, and an electric scooter can be viewed as a highly serviceable mode of transport that elderly people can use with confidence^{(6), (7)}.

Electric scooters (JIS specifications: Total length: 120

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cm; Total width: 70 cm; Total height: 109 cm; Turning radius: approximately 110-160 cm) are classified with pedestrians in the road trucking vehicle law, and are classified as wheelchairs by the nursing care insurance system. Their maximum speed is limited to no more than 6 km/hr by the road trucking vehicle law. The JIS standards established for the vehicles require that they are appropriate for outdoor use, able to climb a 10 degree slope, ride over a stepped rise of 4 cm (with a running start), and cross a gap of 10 cm in width.

User surveys, by questionnaire and interview, have been conducted as part of the normal development loop, to enable the product to be refined and further evolved. However, while these questionnaires and interviews have elucidated the type of users purchasing electric scooters and potential points for enhancement in the products, they have not made clear how the use of a scooter has enhanced users' quality of life (QOL).

2. Purpose of Research

For a manufacturer of machines that increase human mobility, it is important to understand the ways in which the products that are offered affect the mobility and lifestyles of elderly users. Achieving such an understanding can enable the manufacturer to present enhanced products. However, to date there have not been any reports in the literature that clarified the psychological effects of using an electric scooter on elderly users. The research discussed in this paper therefore set out to study the psychological effects on users of using an electric scooter, in order to clarify the contribution made by the vehicles to QOL.

3. Questionnaire Survey

3.1. Purpose of Survey

The purpose of the questionnaire survey conducted in this project was to determine what types of individuals made use of electric scooters, how they came to use the vehicles, what they used them for, and whether the use of the vehicles had changed their experience of activities outside the house and their feelings regarding those activities.

3.2. Method

In June 2007, a questionnaire was distributed to 1000 users of the Monpal ML200 electric scooter; 458 of these surveys were completed and returned (Response rate: 45.8%). The questionnaires were distributed by staff members of regional vendors of the Monpal ML200. The questionnaires were distributed and collected either directly or by mail, as decided by the individual vendors. The ratio between male and female survey subjects was 50-50, with 88% of subjects aged 70 and above (Fig. 1). In terms of means of mobility prior to using the Monpal,

Table 1 How subject learned about electric scooter

I saw a user	50% (229)
I saw an electric scooter in a shop	21% (94)
I saw a leaflet	12% (53)
I saw an advertisement in the newspaper	12% (53)
I saw an advertisement in a magazine	5% (25)
I saw a TV commercial	4% (19)
I saw one on the internet	4% (19)
Other	21% (94)
No response	3% (15)
N = 458	

51% of survey subjects had driven cars or ridden motorbikes, 32% had ridden bicycles, and 16% had walked. Seventy-three percent (73%) of subjects were first-time purchasers of an electric scooter, while 20% had owned an electric scooter previously.

3.3. Results and Considerations

When asked by the questionnaire how they had come to learn about electric scooters, half (50%) of respondents indicated that they had seen the scooters being used (Table 1). It may be conjectured that many elderly individuals would view operating an electric scooter as too difficult for them, but that seeing other elderly people using the vehicles can prompt them to feel that they could operate the vehicles without being anxious because their speed is low, or to feel, for example, "If that person can do it, then so can I."

When asked what prompted them to purchase an electric scooter, many subjects responded in terms of

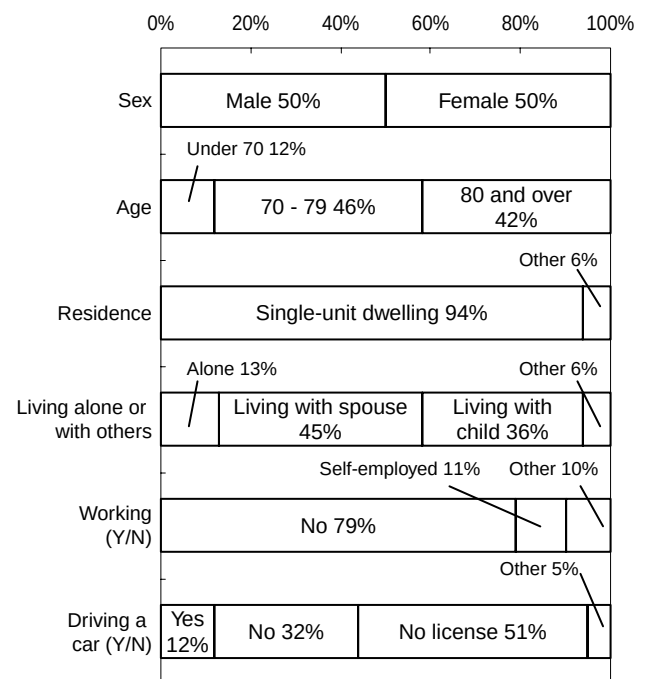


Fig. 1 Subject attributes

increasing their mobility, with 271 respondents (59%) answering “It had become difficult to walk outside,” 122 (27%) answering “It had become difficult to use a car or motorcycle to get around,” 98 (21%) answering “I wanted to go out independently, rather than being helped by others,” and 96 (21%) answering “It had become difficult to use a bicycle to get around.” Other respondents indicated that they had been encouraged to purchase an electric scooter, for example by family or friends (111 people; 24%) or retail store staff (56 people; 12%). Other responses included “A person I know started using one, and seemed to enjoy it” (46 people; 10%), “I saw one in a magazine or newspaper, and it looked appealing” (31 people; 7%), and “I saw one at an exhibition or test ride meeting, and it seemed appealing” (25 people; 5%).

With regard to the actual purchase, 204 respondents (38%) indicated that they decided to purchase a scooter by themselves, 176 (45%) indicated that they decided on purchasing a scooter in consultation with their family, and 50 (11%) indicated that the scooter was a gift from their family. When asked whether they had compared the Monpal to competitors’ models, 89 respondents (19%) answered that they had, and 296 respondents (65%) answered that they had not. This suggests that the majority of users did not gather information about the scooters from the Internet, pamphlets, and the like, but were introduced to the vehicle by more personal sources of information (staff members of stores with which they had dealt previously, personal acquaintances, and the like) prior to their purchase.

3.3.1. Mode of use of the vehicle

The literature suggests that an elderly individual’s desire to leave the house, and the necessity for that individual to leave the house, is affected by whether or not they live with another person or persons⁽⁵⁾. It can therefore be reasonably assumed that the type of use to

which an elderly individual will put an electric scooter in order to leave the house will also be affected by the same factor. Specifically, an elderly person who lives alone will have to run all their errands – shopping, going to the post office, visiting the hospital – by themselves, and the necessity for them to leave the house will be greater than that of a person who does not live alone. With regard to the status of respondents’ outdoor activities and changes in that status, in addition to reviewing overall results, the researchers divided the results into three groups, “Living alone” (60 people), “Living with spouse” (204 people), and “Living with children” (163 people), and applied an χ^2 test to determine whether responses differed between the three groups.

When asked their reason for using the electric scooter, the majority of respondents answered “Going shopping” (273 of 458 people, or 59% of the total), followed by “Going to the bank/post office” (188 people; 41%), “Visiting the hospital” (165 people; 36%), and “Visiting a friend’s home” (159 people; 35%) (Fig. 2). The application of an χ^2 test to determine a difference between respondents living alone and respondents living with others showed no significant difference. This demonstrates that it is not merely elderly people living alone who have to purchase food and daily necessities by themselves, but also elderly people living with their families whose main purpose in using the electric scooter is to go shopping. Sixty-three percent (63%) of respondents who live alone indicated that they use their electric scooter for shopping.

With regard to the frequency with which they use their scooter, 31% of all respondents (143 of 458 people) answered “Every day,” 13% (61 people) answered “Once every two days,” 27% (123 people) answered “Two or three times a week,” and 15% (69 people) answered “Once a week.” No difference was observed between respondents who live alone and respondents who live with others, with 10 respondents in the former group (17% of

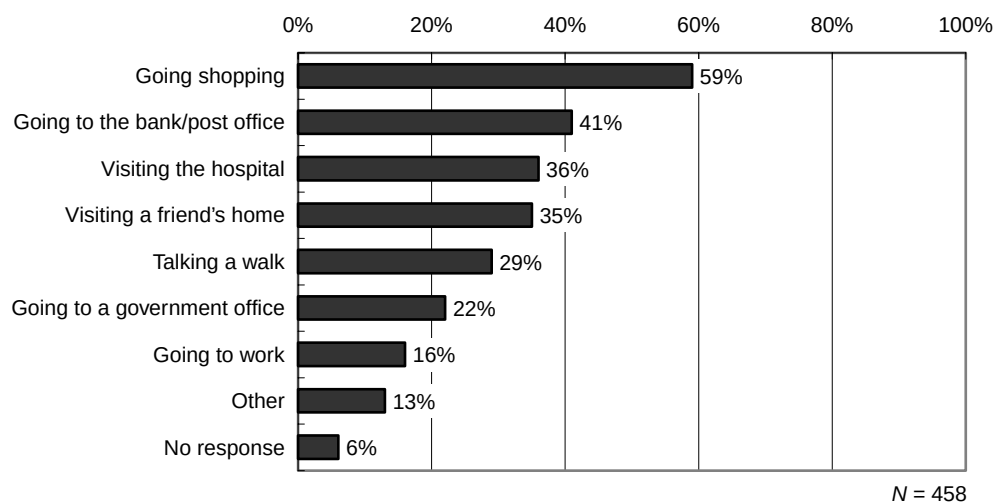


Fig. 2 Reason for using the electric scooter

Table 2 Time spent using the electric scooter on each trip outside the house

	Overall N = 458	Living alone n = 60	Living with spouse n = 204	Living with a child n = 163	χ^2 value
For less than 30 min	31% (142)	22% (13)	33% (67)	31% (51)	2.77
For 30 min to 1 h	37% (167)	23% (14)	40% (82)	38% (62)	5.78 [†]
For 1 to 2 h	20% (93)	35% (21)	17% (35)	19% (31)	9.40**
For 2 h or longer	4% (20)	7% (4)	4% (8)	3% (5)	1.49
No response	8% (36)	13% (8)	6% (12)	9% (14)	–

** : $p < 0.01$, [†] : $p < 0.1$

Table 3 Changes in status of trips outside the house

	Overall N = 458	Living alone n = 60	Living with spouse n = 204	Living with a child n = 163	χ^2 value
I no longer become very tired when leave the house	45% (208)	45% (27)	45% (92)	45% (74)	0.00
I am now able to go places that I had been visiting less frequently	39% (183)	37% (22)	38% (77)	41% (67)	0.57
I leave the house more often	37% (174)	33% (20)	38% (77)	38% (62)	0.46
I take more walks and strolls	21% (97)	8% (5)	22% (45)	25% (40)	7.15*
I can go to places that I've never been to before	16% (77)	10% (6)	18% (37)	17% (28)	2.27
Other	9% (43)	8% (5)	11% (22)	9% (15)	–
No noticeable change	14% (66)	20% (12)	16% (33)	13% (21)	1.85
No response	4% (20)	11% (7)	29% (7)	7% (12)	–

* : $p < 0.05$

60 people) answering that they only used their electric scooters once a week.

When asked the average length of time for which they used their electric scooter each time, the largest number of respondents answered “30 minutes to one hour” (37% of the total), followed by “Less than 30 minutes” (31%), and “One to two hours” (20%) (Table 2). Approximately 70% of respondents indicated that each trip would take them no longer than one hour, allowing for the conjecture that the majority were using their scooters to shuttle between their houses and nearby shops, post offices, banks, hospitals, and friends’ houses. Checking for differences between respondents living alone and respondent living with others showed a significant trend for the response “30 minutes to one hour” ($\chi^2(2) = 5.78$, $p < 0.1$) and a significant difference for the response “One to two hours” ($\chi^2(2) = 9.40$, $p < 0.01$) (Table 2). This demonstrates that the periods spent using their electric scooters tend to be longer among respondents who live alone. Elderly people living with their families are able to request their family members to run errands for them outside the house, or can be driven around outside the house in the family car. By contrast, elderly people living alone must perform all their necessary daily activities – getting cash from the bank, making payments, buying food – by themselves, and many have no means of getting around other than their electric scooter. This means that on each trip that they take, they will tend to visit multiple destinations, for example banks, post offices, shops, and

hospitals. It can therefore be considered only natural that the periods that they spend using their scooters will be longer.

3.3.2. Changes in status of outdoor activities and feelings regarding outdoor activities with use of electric scooter

Respondents were asked how the status of their outdoor activities had changed since they began using an electric scooter (Table 3). “I no longer become very tired when I leave the house” was the most popular response (45% of the total), followed by “I am now able to go places that I had been visiting less frequently” (39%), “I leave the house more often” (37%), “I take more walks and strolls” (21%), and “I can go to places that I’ve never been to before” (16%). Muronaga and Morozumi (2004) indicate that the desire of elderly individuals to leave the house is affected by changes in their physical capacity and state of health⁽⁵⁾. The fact that a scooter can help prevent the elderly from becoming fatigued can therefore be pointed to as an important element in encouraging them to leave the house. In considering why the use of an electric scooter reduces fatigue, it can be assumed that it is related not merely to the fact that the vehicle makes the user mobile without having to walk, but also that when using one, they do not have to walk with heavy parcels.

Testing for differences between respondents living alone and respondents living with others in terms of changes in the status of outdoor activities following the

Table 4 Changes in feeling towards trips outside the house

	Overall N = 458	Living alone n = 60	Living with spouse n = 204	Living with a child n = 163	χ^2 value
I am more confident when leaving the house, even if I go alone	44% (206)	42% (25)	47% (95)	42% (69)	0.85
I no longer feel that leaving the house is a hassle	43% (201)	42% (25)	42% (86)	47% (77)	1.11
I am now able to enjoy a variety of sights and scenery	34% (157)	32% (19)	35% (71)	33% (54)	0.25
I enjoy meeting people	25% (116)	23% (14)	23% (47)	26% (42)	0.39
I am more comfortable since I have to ask for help less and don't need someone to go with me	19% (90)	8% (5)	20% (41)	24% (39)	6.70*
Other	5% (24)	8% (5)	6% (12)	4% (7)	—
No noticeable change	14% (65)	12% (7)	15% (30)	15% (25)	0.49
No response	5% (23)	6% (4)	4% (9)	2% (4)	—

*: $p < 0.05$

purchase of an electric scooter showed a significant difference ($\chi^2(2) = 7.15$, $p < 0.05$) for the response “I take more walks and strolls” (Table 3). This indicates that the number of users who go for more walks and strolls following their scooter purchases tends to be higher among individuals who live with others. One reason that might be considered for this is that elderly individuals who live with others have more free time. Given that they must perform all their necessary activities for themselves, leaving the house will require time and energy for elderly people who live alone, and many will not have more opportunity to walk or stroll. Elderly individuals living with others, by contrast, will often have household errands performed by family members, and will thus have free time available for walking or strolling. In addition, many elderly people who are being looked after try to be considerate of the family members they live with, and find it difficult to be with them constantly. It may be considered that some individuals go for walks or strolls to escape these types of psychological pressures.

The survey questioned respondents on changes in the way they feel about leaving the house since beginning to use an electric scooter (Table 4). “I am more confident when leaving the house, even if I go alone” (44% of the total) and “I no longer feel that leaving the house is a hassle” (43%) were the top responses, followed by “I am now able to enjoy a variety of sights and scenery” (34%), and “I enjoy meeting people” (25%). Testing for differences between respondents living alone and respondents living with their spouses or children showed a significant difference for the response “I am more comfortable since I have to ask for help less and don't need someone to go with me” ($\chi^2(2) = 6.70$, $p < 0.05$). This indicates that this feeling is most common among respondents living with others, but this result can be considered natural because respondents living alone have no one around them who they can turn to for assistance or go somewhere with.

Helping the elderly to maintain feelings of self-efficacy (the feeling that one can successfully do things for

oneself) and self-esteem (a feeling of positive self-acceptance) is important in helping to prevent them from becoming housebound or bedridden. A decline in self-efficacy and self-esteem can lead to a vicious circle in which the individual tends to stay indoors, leading to a decline in physical ability, which in turn leads to a loss of self-confidence and further declines in self-efficacy and self-esteem. The majority of users of electric scooters who were surveyed can be characterized as having felt anxious about walking and having lost a previous mode of mobility before they began using the vehicle, resulting in a situation in which their self-efficacy and self-esteem could decline or had already declined. Almost half of respondents indicated that the use of the electric scooter had made them “...more confident when leaving the house, even if I go alone,” and almost 20% answered that it had made them “...more comfortable since I have to ask for help less and don't need someone to go with me” (Table 4). These results justify the conjecture that there are cases in which the use of an electric scooter can assist an elderly person in maintaining or recovering their sense of self-efficacy and self-esteem.

4. Interview Survey

4.1. Purpose of Interview Survey

To attempt to determine the degree to which using an electric scooter has increased the user's level of satisfaction with their outdoor activities.

4.2. Method

Nine subjects were selected from respondents to the questionnaire survey who indicated that they would be able to participate in interviews, and these interviews were conducted either at the subject's house or at the store from which they purchased their electric scooter. Table 5 shows the attributes of the subjects (ability to walk, and the like). Three male and six female subjects were interviewed. One subject was in her 60s, three were in their 70s, and five were in their 80s. All subjects resided

Table 5 Subject attributes

Subject	Sex	Age	Living alone or with others	Residence	Ability to walk
A	F	80 - 89	Living with son	Single-unit dwelling	Difficulty walking (use of cane required)
B	M	80 - 89	Living with spouse (C)	Single-unit dwelling	Ambulatory but only for short distances
C	F	70 - 79	Living with spouse (B)	Single-unit dwelling	Ambulatory
D	M	80 - 89	Living with spouse	Single-unit dwelling	Difficulty walking
E	F	70 - 79	Living with child	Single-unit dwelling	Ambulatory but only for short distances
F	F	60 - 69	Living with spouse and son	Single-unit dwelling	Ambulatory
G	F	70 - 79	Living with spouse	Single-unit dwelling	Ambulatory but only for short distances
H	F	80 - 89	Living with spouse	Single-unit dwelling	Ambulatory
I	M	80 - 89	Living alone	Single-unit dwelling	Ambulatory but only for short distances

1) Sex: F = Female, M = Male

in single-unit dwellings.

Eight of the interview subjects lived with others; only one subject lived alone. Interviews were conducted with three subjects (A, B, and C) on July 12, 2007, with one subject (D) on July 13, 2007, with three subjects (E, F, and G) on August 6, 2007, and with two subjects (H and I) on October 17, 2007.

4.3. Results and Considerations

Everyday visits outside the house were divided into eight categories according to purpose: 1) Enjoying a hobby; 2) Going shopping; 3) Running household errands such as sending mail; 4) Interacting with friends; 5) Visiting the hospital; 6) Traveling between home and fields; 7) Participating in neighborhood associations; and 8) Taking a walk. Interview subjects were asked to compare their feelings of satisfaction in performing these activities before and after they commenced using their electric scooter, and to rank their degree of satisfaction on a scale from 1 to 5, with 1 representing "Not satisfied at all," and 5 representing "Extremely satisfied." In

addition to determining average figures for each category, the research team conducted *t*-tests in order to determine whether there were any statistically significant differences before and after the subjects commenced using their scooters (Fig. 3). Significant differences were determined for the categories "Going shopping" ($t(8)= 2.12, p<0.05$), "Running household errands" ($t(8)= 2.87, p<0.05$), "Interacting with friends" ($t(8)= 2.24, p=0.05$), and "Traveling between home and fields" ($t(8)= 1.90, p<0.05$).

Significant increases in the subjects' level of satisfaction in leaving the house for shopping, running errands, and traveling between the house and fields were observed after they commenced using their electric scooters, indicating that they had experienced considerable loss of mobility prior to using the vehicles. Five of the nine subjects (A, B, D, E, and G) had in fact found walking difficult due to pain in their legs and other factors. Subject A, for example, had not been able to walk without a cane, and had to be driven in a car by her husband, but lost this means of mobility following her husband's death. Subject D's legs gave him trouble, and

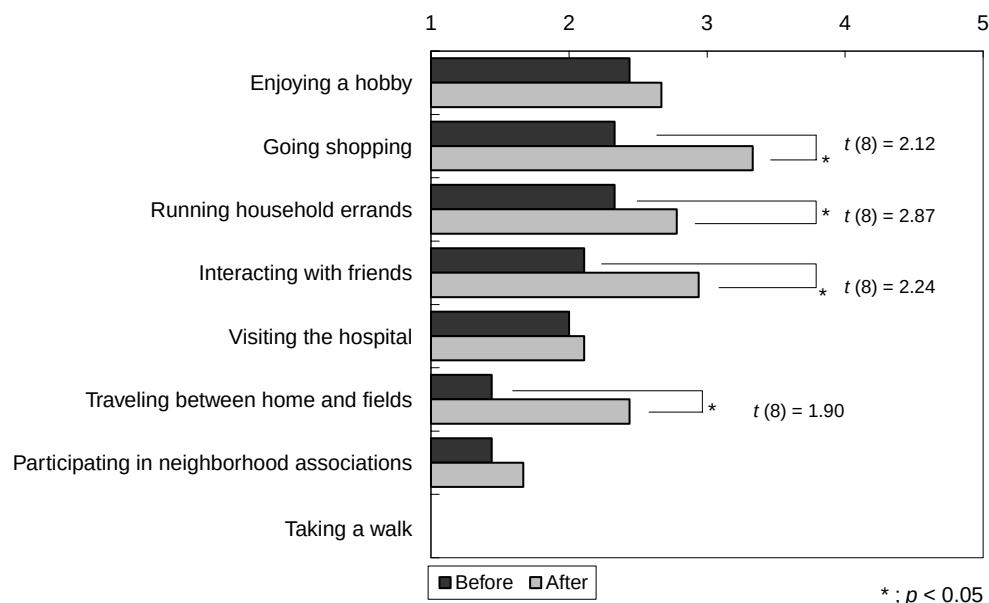


Fig. 3 Comparison of level of satisfaction when leaving the house before and after beginning to use an electric scooter

he could not ride a bicycle, as a result of which he tended to be confined to his house. In addition, three of the nine subjects (F, H, and I) had given up driving or riding motorcycles due to their advanced age. The majority of subjects were obliged to rely on the assistance of family members to perform their daily errands. They would, for example, request family members to do their shopping for them, or ask to be driven to their fields. It is presumably because of this that the majority of subjects experienced a strong feeling of satisfaction when they became able to perform their household errands and daily business by themselves. At present, subject A uses her electric scooter to pay her respects at her husband's grave in addition to going shopping and visiting the hospital (Fig. 4). Subject D indicated that the electric scooter had enabled him to meet his wife on her way home when she goes out to do the shopping, and to carry her purchases home for her. Subjects E and F are able to make the trip between their fields and their homes when they feel like it without bothering members of their family. Subject B has found pleasure in being able to go shopping at the local mall with his wife, subject C.

The results of the interviews also suggested that the use of electric scooters had expanded and enhanced contacts with friends. It may be conjectured that this is due to the fact that the vehicle enables its user to comfortably visit their friends' homes by themselves, that being able to progress at a walking pace in the vehicle enables the user to easily converse with acquaintances that they meet, and that they are also able to stop the vehicle and remain seated, enjoying a conversation without becoming fatigued. Subject F pointed out that "When I'm out on my Monpal and I meet a friend, I can stay seated while we stop and talk. When I want to rest, the Monpal is my very own seat." Having a place to sit and rest when they go out of the house is important for the elderly; it has been reported that elderly people will limit the amount

of times that they leave the house if they cannot be sure that they will find a place to rest⁽⁵⁾. Elderly people can feel relaxed when going out using an electric scooter, because it functions as a seat when they need to rest – when the vehicle is stopped, the user does not have to support the vehicle in an upright position. With regard to the ability to interact with friends when they went out, subjects indicated that "I am now able to visit friends who live a long way away," and "Before, I had to have my family drive me to the field, but now I can go there and come back on the sidewalk, and that gives me a lot more opportunities to chat with friends and acquaintances." Subject G said that her scooter had enabled her once again to visit a friend who lives 6 km away.

The use of an electric scooter also reduced the burden of carrying parcels when shopping. Subject B pointed out that "With my scooter, I can go out and buy a case of beer. I can buy rice!" As this indicates, in addition to offering increased mobility, the electric scooter is a vehicle that provides its users with various other functions, including the ability to carry parcels, and functioning as a place to rest.

5. Conclusion

Reasons for the elderly becoming housebound include a lack of inclination on the part of the individual to go out, a lack of desire on the part of family members to let the individual go out, an inability to go out due to social barriers, and a lack of places to go⁽⁶⁾. The latter stage elderly in particular are obliged, unwillingly, to rely on their families and others for even their minimum requirements for leaving the house, such as running necessary errands or receiving medical care. This can be considered to result in some level of decline in their QOL. The survey discussed here has indicated that an electric scooter can offer assistance to elderly people who find it difficult to walk but cannot use other means of mobility, and can help people who tend not to leave the house because of a lack of confidence. The results have shown that, by means of changing elderly peoples' experience of leaving the house and their feelings about leaving the house, the use of an electric scooter can enable an elderly person to continue to perform their basic daily requirements independently, can increase their freedom and their enjoyment of life, and can enable them to recover their sense of self-efficacy and self-esteem. It can therefore be concluded that electric scooters are able to contribute to the maintenance or enhancement of the QOL of the elderly. The survey produced the following results leading to this conclusion:

- 59% of respondents had found it troublesome to walk outside the house before beginning to use an electric scooter.
- Almost half of respondents (45%) indicated that the use of an electric scooter enabled them to leave the house without feeling tired.



Fig. 4 Subject A using an electric scooter to pay respects at a gravesite

- A high percentage of respondents answered that with the use of an electric scooter “I am more confident when leaving the house, even if I go alone” (44%) and “I no longer feel that leaving the house is a hassle” (43%).
- In addition to reducing the troublesomeness of leaving the house, 34% of respondents indicated that their electric scooter had enabled them to enjoy sights and scenery at a variety of different destinations, and 25% indicated that it had enabled them to enjoy spending time with other people.
- The level of satisfaction of the user increased with the use of the electric scooter for the responses “Going shopping” ($t(8)=2.12$, $p<0.05$), “Running household errands” ($t(8)=2.87$, $p<0.05$), “Interacting with friends” ($t(8)=2.24$, $p<0.05$), and “Traveling between house and fields” ($t(8)=1.90$, $p<0.05$).

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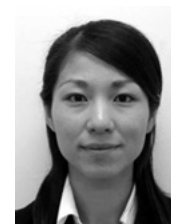
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