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Basic Study on Elderly Tele-nursing Model for Emote Nursing by Smart Device

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Abstract: This study was carried out to examine the development of an "elderly tele-nursing model" for care provided in-home by family members and through remote nursing systems in a super-aging society. This model studied the travel time, cost, and means of transportation of care providers. The pre-survey results regarding elderly tele-nursing show that a son/daughter can visit a parent more than once a week. In the results, the time required for elderly tele-nursing was influenced by whether or not the visitor uses the shinkansen (bullet train of Japan). In the main survey, based on 40 questionnaires, clear differences were observed according to whether visits were "every two weeks" or "once per month". Furthermore, this result was also indicated by *t*-tests.

Key words: Senior citizen, information systems, smart device, time distance, elderly tele-nursing model.

1. Introduction

1.1 Context of Study

In 2025, there will be 36.57 million senior citizens (over 65 years old) in Japan. This accounts for 30.3% of the Japanese population. In such a rapidly aging society, we cannot care for people only in nursing homes, and expect that in-home care will increase. Therefore, the need for elderly care by family members is emphasized. This type of care is generally difficult because the population of elderly living alone increases concurrently with declining birth rates and the growth of the nuclear family, resulting in a heavy burden for families (Table 1). On the other hand, substantial in-home care is gradually being enabled by the progress of remote nursing systems (Table 2).

Based on this trend, we believe that one method of future elderly care is in-home care by family members or through remote nursing systems. Before realizing these goals, we need to grasp the need for elder care and the effect of remote nursing systems on relieving the burden on the family.

1.2 Goal and Implications of the Study

The goal of this study is to show the benefit of an "elderly tele-nursing model" based on the degree of elderly care required so that the family is less burdened. The degree of care required was indicated in terms of travel time, cost, and means of transportation. Before discussing these factors, the survey method and model are outlined.

This model only considers care for a parent by a son/daughter. Based on this model, we could conduct a survey about remote nursing systems and demonstrate their effects.

1.3 Definition of Terms

In this study, the degree of elderly care that is required so the family is not burdened is defined as how often a child can visit a parent in a location far from where he or she lives without being burdened by

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Table 1 Problems of elderly care by son/daughter if they live in remote location.

Category	the Problem
caring in son/daughter's house	Pychosis uneasy of parent who misfit new environment.
	Increasing a burden of son/daughter because it's difficult to have nursing-care servise
caring in remote location	Dispite of using "Care Giver's Saver Fare",son/daughter is burdened with travel time and cost.
in-home care	People who is in the prime of life decline in urban because retired employee for caring his/her parent is about 100,000 per year

Table 2 Abstract of Remote Nursing Systems.

Category	Tele-medicine (used by between health care providers)
	Tele-medicine (used by between health care providers and apatient)
	Tele-care (care etc.)
Object	Grasping existence, Confirming health condition, Communication
Method	Sensor, Sueveillance camera, Smart phone, Tablet, Phone, TV phone, Game, etc.

the parent. “Tele-nursing” is defined as care for a parent provided by a son/daughter who lives far away, using remote nursing systems.

2. Pre-survey

2.1 Pre-survey Plan

We conducted a pre-survey prior to the main survey (Figs. 1, 2 and Table 3). The goal of the pre-survey was to develop predictions for the results and identify problems with the survey method. Furthermore, the pre-survey assumed that elderly tele-nursing exists when the son/daughter visits a parent more than once a week. Four categories of people were surveyed, i.e., under 40 years old, 40-49 years old, 50-59 years old, and over 59 years old.

One pre-survey question asked how many times the panelist (child) visits his/her parent who lives alone. The panelist was asked about the travel time and cost to each location (Fig. 2), and their responses indicated the time required and means of transportation.

2.2 Results of Pre-survey

Regarding each location in Fig. 3, travel time and cost level are such that D > C > B > A > E > F > G > H (H being the highest).

According to the responses, between locations E and F, visit times decline sharply and the number of shinkansen users increases significantly (Fig. 3). Based on these results, it is difficult to establish elderly tele-nursing when a child visits a parent by shinkansen. Answers regarding locations A, B, C, and D require additional analysis.

2.3 Analysis of the Pre-survey

First, based on travel time and cost, we drew regression lines for each transportation method (i.e., local line, public way, and highway). Second, the answers

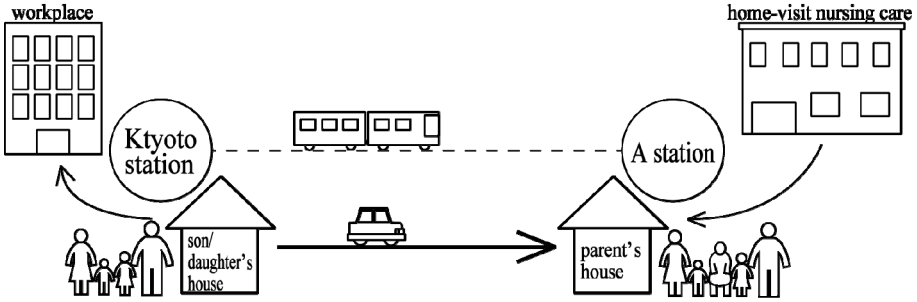


Fig. 1 Concept model in pre-survey.

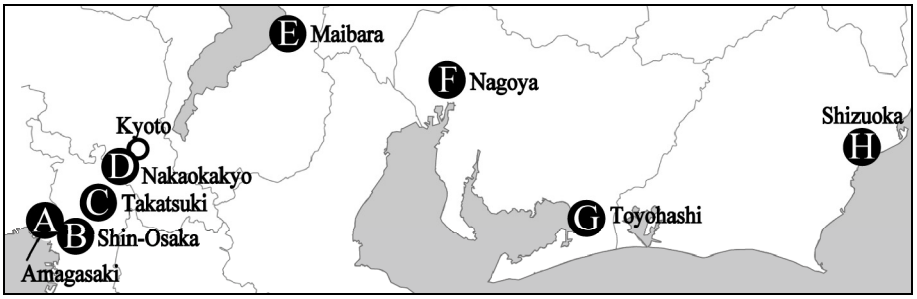


Fig. 2 A-H positions in pre-survey.

were drawn on the graph. This graph showed that the "number of local line and highway users: number of public way users was about 2:1" (Fig. 4). Regression equations for the answers (Eq. (1) for local line and highway users and Eq. (2) for public way users) are shown below. The equations include the "elderly tele-nursing model", as shown by the pre-survey (Fig. 5).

[Regression equations]

Local line and highway users:

$$y = 31.5x - 823.4 \quad (1)$$

Public way users:

$$y = 5.2x - 52.2 \quad (2)$$

(rounded to one decimal place).

According to the regression equations, local line and highway users incur higher travel costs than time costs. On the other hand, public way users require more time than money. Moreover, the distribution of answers was concentrated at $x < 200$ and $y < 4{,}000$. In summary, these models probably involve a broad range of factors. This analysis excludes outliers to maintain the reliability of the study results.

2.4 Problems with the Pre-survey

The pre-survey was difficult to complete because panelists were given a great deal of information, which was intentional. Furthermore, because the pre-survey assumes that elderly tele-nursing consists of more than one visit per week, the survey could not incorporate cases when a panelist wants to visit biweekly. Therefore, the main survey had more precise questions for the panelists.

3. Main Survey

3.1 Main Survey Plan

The main survey comprised four items (i.e., items P, Q, R, and S). Items P and S were common questions, whereas items Q and R were choice questions, depending on answers to item P (refer to Fig. 6). Item P assessed the panelist's attributes (e.g., gender, age, and occupation) in addition to the items shown in Fig. 6. Item Q asked the panelist, "In the future, how do you estimate the travel time and cost per single journey when you periodically visit your parent who

Table 3 Abstract of pre-survey.

survey title	attitude survey about travel for elderly care
survey days	April 29, May 9-June 1 , 2014
target	25-75 years old
mcthod	send to suevey seet and collect it by direct or collect box

contsnts

〈common〉 contents of quiestion

Please image invironment①-⑥.
Which transportation (shinkansen/local line/public way/highway) do you want to use if you visit to your mother for care? And, how many times do you want to visit in week?
Plcasc consider cach casc(mothcr livc in A or B or C...) based onyour timc and moncy sensc.
※Glaphs of "(by transportations) travel time and cost from Kyoto station" are showed in survey sheet.

① You live in near Kyoto station with your spose, a daughter and a son.
② Your mother live alone in near A or B or C...or H station (Fig.1).
③ Your mother use home-visit nursing care, but need not to care all the time. (she needs mimamori all the time.)
④ Your mother can use home-visit nursing survise freely.
⑤ Working time (work place is in near Kyoto station) is 9:00-18:00 on weekday.
⑥ Mother' s carc carry out by only family and thc survisc.

〈by age-group〉 invironment to make panelist image

under 40 years old (mother;65)	panelist	spouse	daughter	son
age	35	35	5	3
work(yes/no)	yes	yes	no	no
driving(can/can't)	can	can	can't	can't
mother's carc(can/can't)	can	can	can't	can't

40-49 years old (mother;75)	panelist	spousc	daughtcr	son
age	45	45	15	13
work(yes/no)	ycs	ycs	no	no
driving(can/can't)	can	can	can't	can't
mother's care(can/can't)	can	can	can't	can't

50-59 ycars old (mothcr;85)	panelist	spouse	daughter	son
age	55	55	25	23
work(ycs/no)	yes	yes	yes	yes
driving(can/can't)	can	can	can	can
mother's care(can/can't)	can	can	can	can

over 59 years old (mother;95)	panclist	spousc	daughtcr	son
age	65	65	35	33
work(yes/no)	no	no	ycs	ycs
driving(can/can't)	can	can	can	can
mothcr's carc(can/can't)	can	can	can	can

※Panclist and spousc arc rctirement agc and hcalty.

result of survey	distrbution number; 92 / collect number; 71 / rate of collect; 77%
panelist's attribute	under 40 ycars old; 19 / 40-49 ycars old; 19 / 50-59 ycars old; 17 / ovcr 59 ycars old; 9

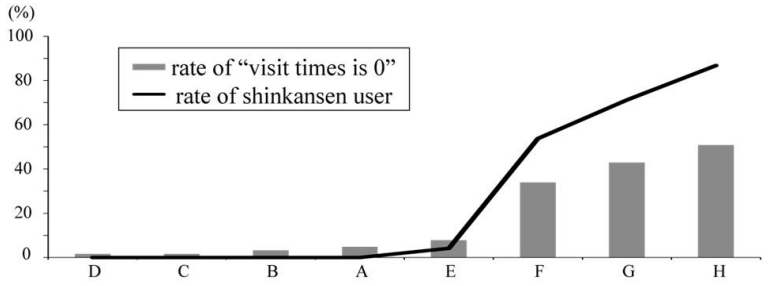


Fig. 3 Rate of "visit times is 0" and shinkansen users.

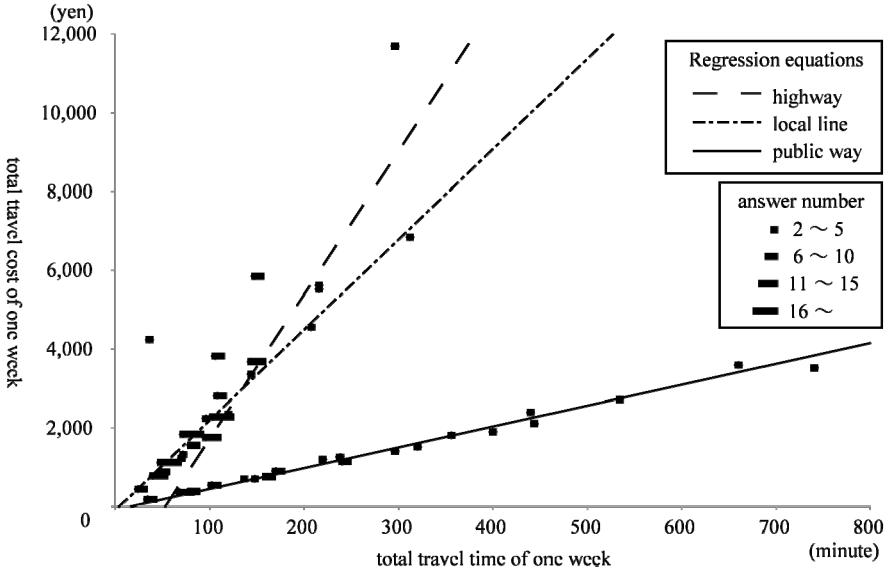


Fig. 4 Regression lines by transportations and distribution of answers.

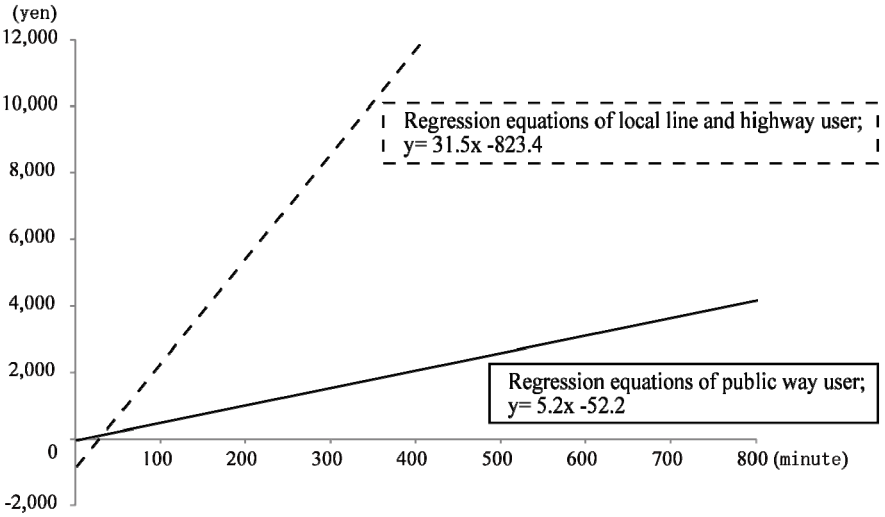
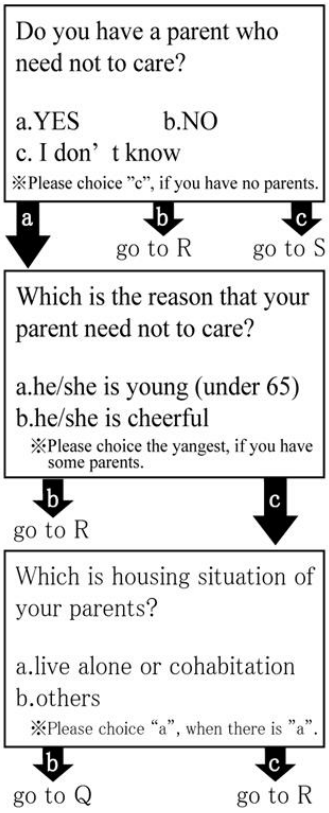


Fig. 5 "Elderly tele-nursing model" by pre-survey.



Approximate single travel time to intend to consume (unit; minute)

frequency of visits	~10	~30	~45	~60	~90	~120	~180	over 180
once per week	✓							
every two weeks		✓						
once per month				✓				
every two months					✓			
every four months						✓		
every half year							✓	
once per year							✓	

Approximate single travel cost to intend to consume (unit; yen)

frequency of visits	~500	~1,000	~3,000	~5,000	~10,000	~15,000	~20,000	over 20,000
once per week	✓							
every two weeks	✓							
once per month		✓						
every two months			✓					
every four months				✓				
every half year						✓		
once per year						✓		

Q2. Please answer each means of transportation and ideal visit's frequency.

frequency of visits	means of transportation(one choice)	ideal frequency of visits
once per week	✓walking □bicycle □car □public transportation	
every two weeks	□walking ✓bicycle □car □public transportation	
once per month	□walking □bicycle ✓car □public transportation	✓
every two months	□walking □bicycle ✓car □public transportation	
every four months	□walking □bicycle □car ✓public transportation	
every half year	□walking □bicycle □car ✓public transportation	
once per year	□walking □bicycle □car ✓public transportation	

Fig. 6 Portion of the main survey.

lives alone?" based on the visit frequency set by us. Item Q also probed the means of transportation and ideal frequency of visits (Fig. 6). Item R requested the panelist to write freely about the parent's life. Item S asked about an ideal life when the panelist is elderly (over 65 years old and after retirement). This study analyzed 40 questionnaires that were collected before August 2014.

3.2 Results and Features of Item Question Q

Results for of item question Q are illustrated in Figs. 7 to 10. In Fig. 7, ranges under 30 min and over 120 min show clear changes. First, in the range for of under 30 min, "ideal frequency of visits is once per week" accounts for approximately about 60% of answers and "every two weeks" accounts for approximately about 40%. On the other hand, "once per month" declines to about 5%. To summarize, there is a great difference in time costs according to visit frequencies of between "every two weeks" and "once per month". In the range of under 10 min range, "once per week" accounts for about 30% of answers, whereas "every two weeks" declines to about 5%. Second, the percentage of responses over 120 min increases clearly in the lower range of a frequency than "ideal frequency of visits is every two months". This result is probably related to the frequency of ideal visits.

In Fig. 8, a cost level of approximately around 5,000 yen shows a clear change in visit frequency. In the range under 5,000 yen, "every four months" accounts for approximately about 70% of responses, but "every half year" declines to about 20%. Furthermore, in the range under 1,000 yen, "every two weeks" accounts for over 80% of answers, but "once per month" declines to 50%. In summary, there is also a significant difference in cost according to visit frequency between responses of "every two weeks" and "once per month".

Regarding the "means of preferred transportation", Fig. 9 shows two types of responses, i.e., "once per week and every two weeks" and "lower frequency

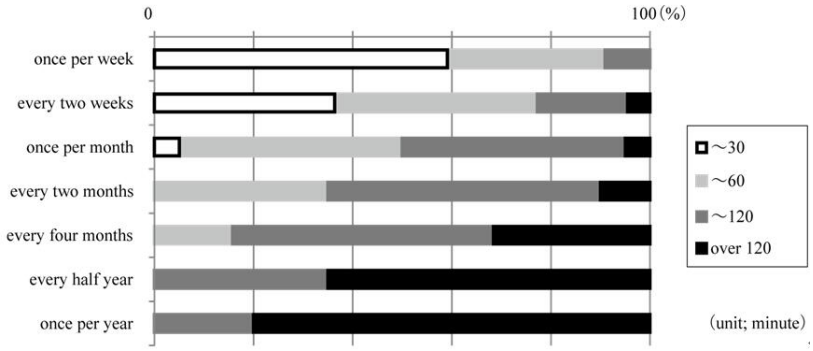


Fig. 7 Approximate travel time required for single journey (by frequency of visits).

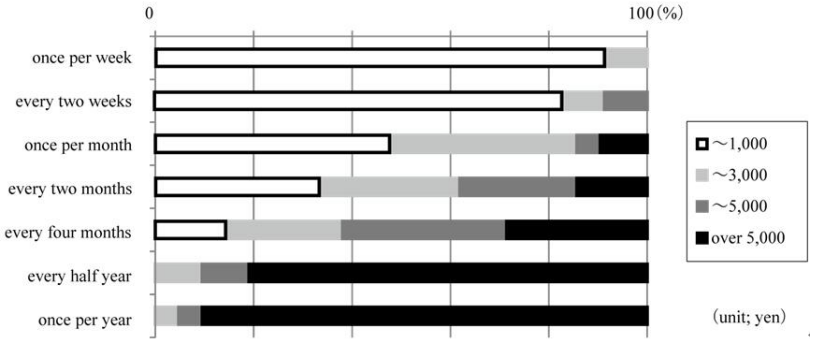


Fig. 8 Approximate travel cost required for single journey (by frequency of visits).

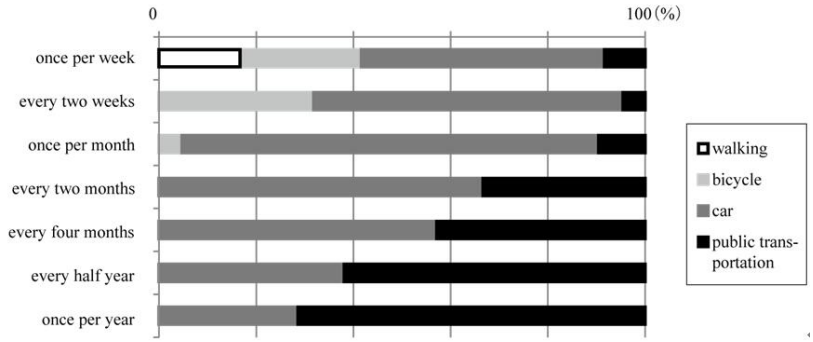


Fig. 9 Means of preferred transportation.

than once per month". Thus, a great difference is also seen in transportation means according to frequency responses of between "every two weeks" and "once per month". For responses of "once per week and every two weeks", walking and bicycling accounted for 30%-40%. However, for responses of "once per month", these transportation methods declined to under 5% and car accounted for 85%. For "lower frequency than once per month", the amount of public transportation increased steadily. Regarding the panelists' attributes in the "once per week" category, only women answered "walking". For frequencies of "once per week and every two weeks", only men used public transportation. These results are the focus of the following study. Finally, for in "ideal frequency of visits" (Fig. 10), "once per week" accounted for about 25%, "every two weeks" accounted for about 30%, "once per month" accounted for about 35%, and

"every two months" accounted for about 10%. Finally, "lower frequency than every two months" accounted for 0%.

Next, the distribution maps of "approximate travel time required for a single journey" and "required cost" are shown in Fig. 11. This graph shows single travel time (min) on the *x*-axis and cost (yen) on the *y*-axis. The distribution of this graph involves two factors, i.e., "once per week and every two weeks" and "once per month and every two months". We expected this result. For "once per week and every two weeks", time cost was steadily in the range of $x < 60$ min. However, in the range $x > 60$ min, there were two grouping types, i.e., cost increases and time were steady, or both cost and time increased. On the other hand, for the factor in "once per month and every two months", there was no clear trend.

Based on these results, the elderly tele-nursing model should be evaluated using two frequency of visit factors, i.e., "once per week and every two weeks" and "once per month and every two months". Thus, the distribution map shown in Fig. 12 is based on answers that the ideal frequency of visits is once per week or every two weeks, or once per month

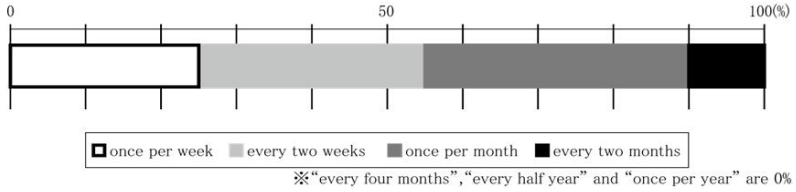


Fig. 10 Ideal frequency of visits.

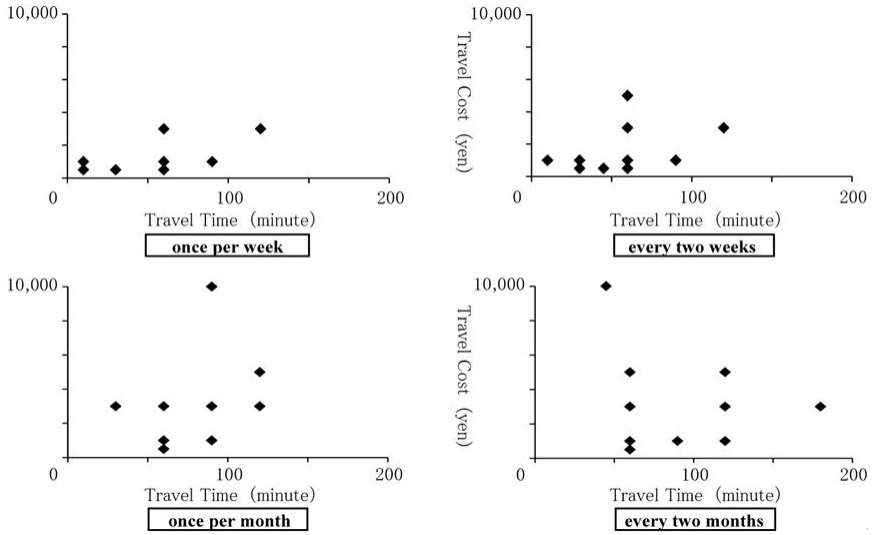


Fig. 11 Distribution maps of "approximate travel time required for single journey" and "required cost" (by frequency of visits).

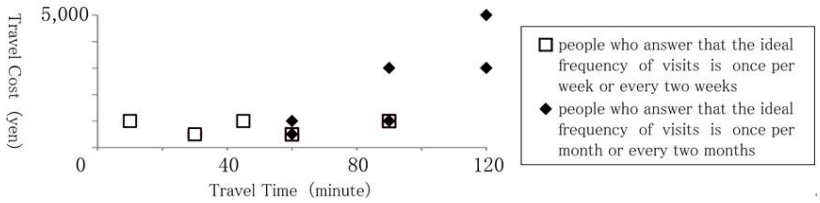


Fig. 12 Distribution maps of "approximate travel time required for single journey" and "required cost" on ideal frequency of visits.

Table 4 Result of *t*-test.

Category	Apporoximate travel time required for single journey (unit;		Apporoximate travel cost required for single journey (unit;	
	□	◆	□	◆
Average	51.9	90.0	750.0	2222.2
Variance	828.1	675.0	71428.6	2381944.4
t	-2.853		-2.815	
P(T<=t) one side	0.006		0.010	
t-limit value one sides	1.761		1.833	
P(T<=t) both side	0.013		0.020	
t-limit value both sides	2.145		2.262	

□People who answer that the ideal frequency of visits is once per week or every two weeks
◆People who answer that the ideal frequency of visits is once per month or every two weeks

or every two months. Fig. 12 shows "approximate travel time required for an ideal frequency of visits" and "required cost for an ideal frequency of visits". Figs. 11 and 12 exclude outliers to maintain the reliability of the study results.

3.3 Analysis of Distribution Maps (T-Tests)

Distribution maps based on Fig. 12 show the analytical methods. To test whether the previously noted two factors (i.e., answers that the ideal frequency of visits is once per week or every two weeks and once per month or every two months) differ, *t*-tests were conducted (Table 4). The significance level of the test was 5%. Focusing on the *t*-limit value (both sides) and magnitude correlation of the *t*-value's absolute value, the results were $2.145 < |-2.853|$ and $2.262 < |-2.815|$. Therefore, regarding travel time and cost, the population's average values for these types were significantly different. In other words, this result is probably not accidental.

Furthermore, regression analysis of each type was conducted based on data shown in Fig. 12. Consequently, the regression line for "answers that the ideal frequency of visits is once per week or every two weeks" was y = 500-1,000 and $0 < x < 100$. The regression line for "once per month or every two months" was about $y = 40x$-2,000 ($50 < x < 120$).

4. Conclusion

4.1 Summary

The pre-survey results regarding elderly tele-nursing show that a son/daughter can visit a parent more than once a week. In the results, the time required for elderly tele-nursing is influenced by whether or not the visitor uses the shinkansen. However, tendencies and regression equations were identified, and problems were found.

In the main survey based on 40 questionnaires, clear differences between responses according to ideal visit frequencies of "every two weeks" and "once per month" were observed. Furthermore, this result was also shown by *t*-tests. Therefore, this study indicates important tendencies and points to consider in future surveys.

4.2 Future Considerations

Future surveys should expand on the limited parameters of this study. Following this survey, we need to conduct comparative analysis, adding the panelists' attributes, and clarify the conclusions of this

study.

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