

Dialysis Patients' Utilization of Health Care Services Covered by Long-Term Care Insurance in Japan

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Hemodialysis patients in Japan are aging and thus more patients need support for attending hemodialysis facilities. This study aimed to clarify how dialysis patients utilize the services covered by Japan's public long-term care insurance (LTCI) system. This cross-sectional study was based on LTCI data of March 31, 2009, the latest available data provided by Niigata City, located on the northwest coast of Honshu. Among 30,349 LTCI users in Niigata City, there were 234 dialysis patients. To clarify the characteristics of the dialysis patients, we compared the utilization of LTCI services between the dialysis patients (234 users) and randomly selected 765 non-dialysis users. We also calculated the annual transportation service costs per patient for dialysis patients who continued home care (home care group) and those who switched to long-term hospital care at LTCI care levels 4 and 5 (hospital admission group). These care levels indicate difficulty in walking or maintaining a sitting posture without assistance. The dialysis group more frequently utilized home care and equipment services, such as renting or purchasing care-support products and support for home equipment repair, and utilized facility services and short-stay services (respite care) less frequently (both $p < 0.001$). Cost per patient was higher in the home care group than in the hospital admission group, because the transportation services for dialysis patients at care levels 4 and 5 involve higher costs. These findings indicate that LTCI services usable for dialysis patients were limited. Therefore, instead of merely subsidizing transportation expenses, transportation services must be improved.

Keywords: care needs; dialysis facilities; dialysis patients; long-term care insurance; transportation service costs
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Introduction

The mean age of dialysis patients in Japan increased from 62.2 years in 2002 to 66.9 years in 2012 (Nakai et al. 2014). The mean age of dialysis patients in the United States and the United Kingdom is 62.1 years (United States Renal Data System 2014) and 66.4 years in 2012 (Shaw et al. 2013), respectively. The percentage of dialysis patients in Japan who need assistance to walk is 10.7% for individuals aged 45-74 years and 32.0% for those aged over 75 years (Canaud et al. 2011), and the percentage increases with age. Hospitalized dialysis patients accounted for only 10% (The Japanese Society for Dialysis Therapy 2014); over 90% of dialysis patients requiring long-term care live in their own home or in a care facility. In addition, hemodialysis patients needing to attend a dialysis facility three times a week accounted for 96.8% of chronic dialysis patients in Japan in 2012 (Nakai et al. 2014). These figures indicate the importance of having suitable transportation

services between patients' homes or care facilities and dialysis facilities.

An elder-care taxi service, which is covered by the long-term care insurance (LTCI) system in Japan, provides assistance with getting in and out of welfare vehicles and for going out, and the service may be used for attending dialysis facilities. In addition, some dialysis facilities provide patient transportation services at their expense. However, the literature on health care utilization by dialysis patients in Japan is scant. Therefore, the scale of transportation services required for patients to attend dialysis facilities has not been clarified. Furthermore, it is necessary to consider the provision of transportation services based on implementation costs and the LTCI services for dialysis patients.

The purpose of this study was to clarify how dialysis patients utilize the services covered by the LTCI system and to estimate the costs necessary for attending dialysis facilities.

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Methods

This cross-sectional study was based on LTCI data of March 31, 2009 that are the latest data provided by Niigata City, located on the northwest coast of Honshu. The use of LTCI services was compared between patients receiving dialysis and those not receiving dialysis. Then, the costs of transportation were calculated for the home care group and hospital admission group. The home care group was defined to comprise all dialysis patients who continued to live in their home as of March 31, 2009, based on LTCI data in Niigata City. Patients at care levels 4 and 5 have difficulty in walking and maintaining a sitting posture without assistance, and need a large amount of care. The hospital admission group was defined to comprise those dialysis patients living at home at care levels 4 and 5 who then switched to a long-term hospital.

The LTCI system in Japan

LTCI data, collected by adjusted survey items, have provided a standard means of evaluation. LTCI data should be dependable and useful for clarifying how dialysis patients utilize services.

To help properly manage the very rapidly aging population and care for the frail, the Government of Japan implemented the LTCI system in April 2000. This system provides long-term care services, including home-based services, to support the growing number of community-dwelling elderly persons and their families. Its goal is socialization of care, meaning that the Government provides care as an entitlement to all, irrespective of their income level or the availability of informal care (Tamiya et al. 2011). The LTCI system operates as a social insurance system, although half of its funding is financed by matching funds from taxes. Everyone aged 40 years or older pays premiums, and everyone aged 65 years or older is eligible for formal caregiving services.

In 2006, the LTCI system was revised and new preventive benefits were introduced. The aim of the revision was to allocate the limited resources to impaired elderly individuals by providing services intended to improve physical strength, nutritional status, oral function, and mental health (Tsutsui and Muramatsu 2007). The LTCI system is managed by municipal governments. When a person applies for benefits, an investigator who is responsible for the certification of long-term care visits his or her home to assess the degree of functional disability by using a questionnaire developed by the Ministry of Health, Labour and Welfare (Tsutsui and Muramatsu 2005). Certifying eligibility and determining the level of benefits are based on a nationally standardized assessment process. Since the 2006 revision, seven eligibility levels have been established: “support levels 1 and 2” in which assistance is needed, and “care levels 1-5” in which care is needed, with care level 1 requiring the lowest amount of care and 5 requiring the greatest (Tsutsui and Muramatsu 2007). These levels are primarily determined by a computerized algorithm based on responses to questionnaire items on current physical and mental status. This algorithm was derived from a statistical analysis of care time and subjects’ clinical characteristics (Tsutsui and Muramatsu 2005). The final decision of levels is made by a local committee of specialists such as physicians and social workers (Tsutsui and Muramatsu 2005; Ikegami 2007), and needs are reassessed every 2 years (or 6 months for those requiring less care), or as requested in the event of any decline in health (Tamiya et al. 2011). After the care plan is drawn up, based on the needs and preferences of each client, provider agencies are contracted and the appropriate ser-

vices are delivered (Ikegami 2007). The benefits are not provided as cash but in the form of home- and community-based or facility services, with recipients paying 10% of the service cost (Campbell and Ikegami 2003; Ikegami 2004).

The eldercare taxi service is available for traveling to and from dialysis facilities and employs vehicles that are easy for patients to enter and exit. This service is covered by the LTCI system in Japan and is classified as home-visit services. Payment for using the service is calculated as the taxi fare in full plus a helper charge of 10%. Taxis for users of care levels 1 to 5 are available, but those for support levels 1 and 2 are not covered by LTCI.

Study population

There were 30,349 LTCI users in Niigata City as of March 31, 2009 (Ministry of Health, Labour and Welfare, Japan 2009a). Of these users, all dialysis patients (234 users) and 765 randomly selected non-dialysis users were enrolled in the present study; namely, a total study population was 999 LTCI users. The population of Niigata City as of March 31, 2009 was 801,998 (Niigata City 2012), and the percentage aged 65 years or older was 22.9%, which was similar to the value in the rest of Japan (22.7%) (Statistics and Information Department, Minister’s Secretariat, Ministry of Health, Labour and Welfare, Japan 2010).

Data collection

Utilization status of long-term care services: This study was based on the following data obtained from a survey of the LTCI system: age, sex, physical condition score, mental condition score, use of long-term care services, medical treatment received in the past 14 days, and care level. The most recent data were used from the survey of the LTCI system.

Costs for transportation service for attending dialysis facilities: The sources of cost data were the Retail Price Survey 2010 (Ministry of Internal Affairs and Communications 2011) and the Basic Survey on Wage Structure 2010 (Ministry of Health, Labour and Welfare, Japan 2011). It was assumed that special-purpose vehicles (HiAce, Toyota, Aichi, Japan) with a license plate starting with the number “8” were introduced for use as welfare vehicles. The care setting and care levels associated with costs are shown in Table 1.

Statistical analysis

Comparison of long-term care services between the dialysis and non-dialysis groups: The use of long-term care services was compared between the dialysis and non-dialysis groups using Fisher’s exact test. Twenty long-term care services were classified into the following 7 categories (Table 2): facility services, home-visit services, commuting services, short-stay services, residential care facility for the elderly requiring care, equipment services, and community-based services. Factors associated with utilization of long-term care services were explored using logistic regression analysis in each service. The results are presented as odds ratios with 95% confidence intervals. The significance level was set at < 0.05 and all analysis was performed in the software package PASW Statistics 18.0.0 (SPSS Inc., Chicago, IL).

Calculation of transportation services costs: The dialysis patients who required long-term care were divided into two groups: those continuing home care (home care group) and those switching to

Table 1. Care settings and support provided.

Care setting for attending dialysis facilities				
Home care group				
Elder-care taxi service is used to travel between patients' homes and dialysis facilities				
<ul style="list-style-type: none"> Facility vehicles are used to travel between care facilities and dialysis facilities Number of new purchases of welfare vehicles for the elder-care taxi service: <ul style="list-style-type: none"> Care levels 1-3: 1 welfare vehicle for every 6 patients Care levels 4, 5: 1 welfare vehicle for every 2 patients Home helper level 2 assists with moving patients 				
Hospital admission group				
<ul style="list-style-type: none"> Dialysis patients in care levels 4 and 5 admitted to hospitals with dialysis equipment Two certified care workers assist the patients with moving, and the time for preparation and moving a patient is set to 20 min one way 				
Patient support				
Care level	Moving assistance	Number of caregivers	Travel time	Traveling and preparing for dialysis (hospital admission)
Support level 1	No	0		
Support level 2	No	0		
Care level 1	Need help with walking	1	15 min one way	
Care level 2	Need help with walking	1	15 min one way	
Care level 3	Need help with wheelchair	1	15 min one way	
Care level 4	Need help with wheel stretcher	2	30 min one way	20 min one way
Care level 5	Need help with wheel stretcher	2	30 min one way	20 min one way
Range of costs				
Equipment				
<ul style="list-style-type: none"> Welfare vehicles, car-stretcher 				
Tax and insurance				
<ul style="list-style-type: none"> Toyota HiAce (wheelchair specification car type D) Special purpose vehicles (for private use) 				
Maintenance				
<ul style="list-style-type: none"> Maintenance and operation of welfare vehicles 23 min one way (15 km at 40 km/h) 				
Labor				
<ul style="list-style-type: none"> Home helper level 2: in case of elder-care taxi service Certified care workers: in case of admission 				
In case of facility services				
<ul style="list-style-type: none"> Transportation of dialysis patients by facility vehicles Staff wages and fuel costs were budgeted for patient transportation 				

Needing support means needing assistance in everyday life, but not long-term care.

Care level 1: Needs some long-term care.

Care level 2: Needs a small amount of long-term care.

Care level 3: Needs a moderate amount of long-term care.

Care level 4: Needs a large amount of long-term care.

Care level 5: Needs the highest amount of long-term care.

Means of attending dialysis facilities and support for patients were set according to care level.

Range of costs was set according to equipment, tax, insurance, maintenance, labor, and facility services.

Table 2. Division of 20 long-term care services into 7 categories.

Category / Long-term care service
Facility services*
· Facility services
Home-visit services
· Home-help service
· Home-visit bathing service
· Home-visit nursing
· Home-visit rehabilitation
· Management and guidance for in-home care [†]
Commuting services
· Day care service
· Day rehabilitation service
Short-stay services [‡]
· Short-stay for the elderly requiring care
· Short-stay for the elderly requiring medical care
Residential care facility [§] for the elderly requiring care
· Residential care facility for the elderly requiring care [¶]
Equipment services
· House reform
· Rental service for welfare equipment
· Sales of designated welfare equipment
Community-based services**
· Community-based one-stop home care service for small group of users ^{††}
· Night care service ^{††}
· Day care service for the elderly with dementia
· Group home for the elderly with dementia
· Community-based residential care facility for the elderly requiring care [¶]
· Community-based welfare facility for the elderly requiring care [¶]

Long term care services in Japan were classified 7 categories.

*Admitted to facilities covered by long-term care insurance (LTCI).

[†]Management and instructions for medical care provided by a physician, dentist, pharmacist or other personnel as determined by an Ordinance of the Ministry of Health, Labour and Welfare.

[‡]Continuous use of respite services up to 30 days.

[§]Housing for the elderly not covered by LTCI.

[¶]Provision of basic care such as bathing, waste elimination, and meals and care in other daily activities based on a service plan at each facility provided by the facility directly or by an outsourcing service.

**Services received in the local community based on the functional status of LTCI users.

^{††}Service for “aging in place” through local commuting to a care center and provision of a combination service of “home-visit” and “short-stay” at any time.

^{‡‡}Services to respond on demand through regular patrols and telephone calls.

long-term hospital care for care levels 4 and 5 (hospital admission group). The distribution of patients in the home care group was based on the LTCI data on care levels in Niigata in 2009. In the hospital admission group, it was assumed that all dialysis patients of care levels 4 and 5 were switched to hospital care by their medical insurance provider and received dialysis treatment in the hospital. Because the service life of welfare vehicles is 5 years, we next calculated the annual and 5-year transportation service costs per patient for both groups. Although it would be appropriate to calculate the total health-care costs associated with dialysis in the home care group and hospi-

tal admission group, the costs of dialysis and admission to a facility or hospital can be estimated from medical treatment or nursing care fees. However, transportation service costs are generally difficult to estimate from these sources. Therefore, these difficult-to-estimate costs were calculated in the present study. The costs of transportation services for dialysis patients were calculated based on costs for attending the dialysis facility, costs for patient support, and range of cost (Table 1).

1. The costs for attending the dialysis facility included transportation and the number of caregivers necessary for physical assis-

tance.

2. The costs for patient support included the time needed for physical assistance and transportation according to care level.

3. For the range of costs, the time needed to travel to the dialysis facility was set to 23 min one-way (median range, 15-30 min) (Japan Association of Kidney Disease Patients 2012), which was calculated based on averaging the answers of the 2006 survey of the hemodialysis patients.

The annual cost per dialysis patient was explored by sensitivity analysis. Equipment, tax, insurance, maintenance, and labor costs changed from -25% to +25%.

Ethics

The Niigata City Municipal Information Office approved the use of anonymized personal data. The Elderly Care Division of the Niigata City Health and Welfare Department anonymized and labeled the data with consecutive numbers before providing them to us. This study was approved by the Ethics Committee of Niigata University School of Medicine.

Results

Subject characteristics

The data of 999 approved users of long-term care as of March 31, 2009 were obtained. Subjects with incomplete data were excluded from the study. Table 3 shows the basic characteristics of the subjects. The dialysis group comprised 234 users (113 men, 121 women; mean age, 77.9

years) and the non-dialysis group comprised 765 users (356 men, 409 women; mean age, 84.4 years). The largest care levels were level 2 (27.4%) in the dialysis group and level 3 (21.2%) in the non-dialysis group. In total, 83.8% of the non-dialysis group had received one or more of the following medical treatments within 2 weeks: infusion management, intravenous hyperalimentation, dialysis, stoma procedure, oxygen therapy, respiratory management, tracheostomy management, pain control, tube feeding, monitoring by patient monitor, bedsores treatment, and catheter management. In the dialysis group, 76.5% of the patients were living at home, 6.4% were at a long-term care facility for LTCI, and 17.1% were at a care facility for reasons other than LTCI. In the non-dialysis group, 64.3% of the patients were living at home, 27.8% were in a long-term care facility for LTCI, and 7.8% were in a care facility for reasons other than LTCI. Type of residence by care level is shown in Table 4.

Utilization of long-term care services

In the dialysis group, the rate of home-visit services and equipment services was significantly higher, and the rate of facility and short-stay services was significantly lower (both $p < 0.001$, Table 5). Logistic regression analysis is shown in Table 6. An omnibus test was performed, excluding residential care facilities for the elderly requiring

Table 3. Basic subject characteristics.

	Age	Investigation object	
		Dialysis group (%) <i>n</i> = 234	Non-dialysis group (%) <i>n</i> = 765
Men	≤ 69 years	26 (11.1)	11 (1.4)
	70-79 years	48 (20.5)	106 (13.9)
	80-89 years	34 (14.5)	161 (21.0)
	≥ 90 years	5 (2.1)	78 (10.2)
Women	≤ 69 years	18 (7.7)	12 (1.6)
	70-79 years	43 (18.4)	109 (14.2)
	80-89 years	48 (20.5)	149 (19.5)
	≥ 90 years	12 (5.1)	139 (18.2)
Care level	Need support 1	2 (0.9)	43 (5.6)
	Need support 2	32 (13.7)	64 (8.4)
	Care level 1	23 (9.8)	98 (12.8)
	Care level 2	64 (27.4)	151 (19.7)
	Care level 3	55 (23.5)	162 (21.2)
	Care level 4	40 (17.1)	138 (18.0)
Receiving medical treatment during the past 14 days	Yes		124 (16.2)
	No		641 (83.8)
Types of residences by care levels	At home	179 (76.5)	492 (64.3)
	Facility covered by long-term care insurance	15 (6.4)	213 (27.8)
	Other facility	40 (17.1)	60 (7.8)

Table 4. Types of residences by care level.

	Care level	Home	(%)	Facility				Total
				Facilities covered by long-term care insurance	Other facility	Facility care total	(%)	
Dialysis group	Need support 1	2	(1.1)	0	0	0	(0.0)	2
	Need support 2	30	(16.8)	0	2	2	(3.6)	32
	Care level 1	16	(8.9)	4	3	7	(12.7)	23
	Care level 2	50	(27.9)	2	12	14	(25.5)	64
	Care level 3	46	(25.7)	2	7	9	(16.4)	55
	Care level 4	26	(14.5)	6	8	14	(25.5)	40
	Care level 5	9	(5.0)	1	8	9	(16.4)	18
Total		179				55		234
Non-dialysis group	Need support 1	41	(8.3)	1	1	2	(0.7)	43
	Need support 2	59	(12.0)	1	4	5	(1.8)	64
	Care level 1	84	(17.1)	8	6	14	(5.1)	98
	Care level 2	121	(24.6)	27	3	30	(11.0)	151
	Care level 3	98	(19.9)	46	18	64	(23.4)	162
	Care level 4	69	(14.0)	56	13	69	(25.3)	138
	Care level 5	20	(4.1)	74	15	89	(32.6)	109
Total		492				273		765

Facilities covered by long-term care insurance (LTCI) comprise special nursing home, health care facilities for the elderly, and medical long-term care sanatoriums.

Other facilities are not covered by LTCI.

Table 5. Use of long-term care services.

Service		Dialysis group (%)	Non-dialysis group (%)	<i>p</i> value*
Facility services	Yes	55 (23.5)	273 (35.7)	< 0.001
	No	179 (76.5)	492 (64.3)	
Home-visit services	Yes	90 (38.5)	139 (18.2)	< 0.001
	No	144 (61.5)	626 (81.8)	
Commuting services	Yes	81 (34.6)	311 (40.7)	n.s.
	No	153 (65.4)	454 (59.3)	
Short-stay services	Yes	13 (5.6)	116 (15.2)	< 0.001
	No	221 (94.4)	649 (84.8)	
Residential care facility for the elderly requiring care	Yes	2 (0.9)	6 (0.8)	n.s.
	No	232 (99.1)	759 (99.2)	
Equipment services	Yes	121 (51.7)	281 (36.7)	< 0.001
	No	113 (48.3)	484 (63.3)	
Community-based services	Yes	2 (0.9)	15 (2.0)	n.s.
	No	232 (99.1)	750 (98.0)	
Total		234	765	

Utilization of long-term care insurance services was compared between the dialysis and non-dialysis group.

n.s., not significant.

*dialysis vs. non-dialysis groups.

Table 6. Odds ratios (OR) and 95% confidence interval (CI) for utilization of long term care services.

Variable	Comparison	OR	95% CI	P
Facility services				
Sex	Male vs. Female	1.6	1.2-2.1	< 0.01
Age	≤ 69 years			
	70-79 years	1.2	1.0-1.4	n.s.
	80-89 years			
	≥ 90 years			
Dialysis	Y vs. N	0.6	0.4-0.9	< 0.05
Care level	Need support 1			
	Need support 2			
	Care level 1			
	Care level 2	1.5	1.3-1.6	< 0.001
	Care level 3			
	Care level 4			
Home-visit services				
Sex	Male vs. Female	1.2	0.9-1.6	n.s.
Age	≤ 69 years			
	70-79 years	1.0	0.8-1.2	n.s.
	80-89 years			
	≥ 90 years			
Dialysis	Y vs. N	2.8	2.0-3.9	< 0.001
Care level	Need support 1			
	Need support 2			
	Care level 1			
	Care level 2	0.9	0.9-1.0	< 0.01
	Care level 3			
	Care level 4			
Commuting services				
Sex	Male vs. Female	0.8	0.6-1.0	n.s.
Age	≤ 69 years			
	70-79 years	0.8	0.7-0.9	< 0.01
	80-89 years			
	≥ 90 years			
Dialysis	Y vs. N	0.7	0.5-0.9	n.s.
Care level	Need support 1			
	Need support 2			
	Care level 1			
	Care level 2	1.0	0.9-1.0	n.s.
	Care level 3			
	Care level 4			
Short-stay services				
Sex	Male vs. Female	0.8	0.5-1.1	n.s.
Age	≤ 69 years			
	70-79 years	1.0	0.8-1.3	n.s.
	80-89 years			
	≥ 90 years			
Dialysis	Y vs. N	0.3	0.2-0.6	0.001
Care level	Need support 1			
	Need support 2			
	Care level 1			
	Care level 2	1.2	1.1-1.3	< 0.001
	Care level 3			
	Care level 4			
Equipment services				
Sex	Male vs. Female	0.7	0.6-0.9	< 0.05
Age	≤ 69 years			
	70-79 years	0.9	0.7-1.0	n.s.
	80-89 years			
	≥ 90 years			
Dialysis	Y vs. N	1.7	1.2-2.3	0.001
Care level	Need support 1			
	Need support 2			
	Care level 1			
	Care level 2	1.0	0.95-1.0	n.s.
	Care level 3			
	Care level 4			
Equipment services				
Sex	Male vs. Female	0.7	0.6-0.9	< 0.05
Age	≤ 69 years			
	70-79 years	0.9	0.7-1.0	n.s.
	80-89 years			
	≥ 90 years			
Dialysis	Y vs. N	1.7	1.2-2.3	0.001
Care level	Need support 1			
	Need support 2			
	Care level 1			
	Care level 2	1.0	0.95-1.0	n.s.
	Care level 3			
	Care level 4			
Equipment services				
Sex	Male vs. Female	0.7	0.6-0.9	< 0.05
Age	≤ 69 years			
	70-79 years	0.9	0.7-1.0	n.s.
	80-89 years			
	≥ 90 years			
Dialysis	Y vs. N	1.7	1.2-2.3	0.001
Care level	Need support 1			
	Need support 2			
	Care level 1			
	Care level 2	1.0	0.95-1.0	n.s.
	Care level 3			
	Care level 4			

Logistic regression was used to examine the influence of sex, age, dialysis, and care level.

care ($p = 0.78$) and community-based services ($p = 0.72$). Male sex ($p < 0.01$), non-dialysis ($p < 0.05$), and low care level ($p < 0.001$) were significantly higher in facility services. Dialysis ($p < 0.001$) and high care level ($p < 0.01$) were significantly higher in home-visit services. High age ($p < 0.01$) was significantly higher in commuting services. Non-dialysis ($p = 0.001$) and low care level ($p < 0.001$) were significantly higher in short-stay services. Lastly, female sex ($p < 0.05$) and dialysis ($p = 0.001$) were significantly higher in equipment services.

Costs for transportation service for attending dialysis facilities

The breakdown of costs for transportation to and from dialysis facilities is shown in Table 7. The service cost was

calculated according to the number of dialysis patients who required long-term care according to care level in Niigata in 2009. In the home care group, the total cost for the transportation service was 256,038,299 yen in the first year and 661,933,904 yen for five years. The annual cost for such services per dialysis patient needing long-term care was 565,755 yen. In the hospital admission group, the total cost for transportation services was 169,070,449 yen in the first year and 540,766,748 yen for five years. The annual cost of such services per dialysis patient needing nursing care was 462,194 yen (Table 8). One-way sensitivity analysis revealed that the annual cost per dialysis patient exceeded that of the home care group in +25% of the hospital admission group (Table 9).

Table 7. Breakdown of costs.

Category	Item	Cost (yen)	Source	Remark
Equipment	Welfare vehicles	4,052,000	*	Toyota HiAce (Wheelchair specification car type D)
	Installation of car-stretcher fixing device	44,000		
	Car-stretcher	357,450		Average price of 10 vehicles from 5 companies
Tax and insurance	Registration license tax	30,000		General Passenger Vehicle Transportation
	Automobile acquisition tax	0	†	Total exemption (Tokyo)
	Automobile tax	0	†	Total exemption (Tokyo)
	Automobile weight tax	24,600	‡	As of December 2013, for 2 years
	Inspection and registration fee (New) (at time of automobile inspection)	2,100	§	Newly purchased cars
	Compulsory automobile liability insurance	1,800	§	Second and fourth year
	Voluntary insurance for automobile	27,840	¶	Rate of insurance premiums (Revised April 1, 2013): Private vehicles, for 2 years
Maintenance	Maintenance cost of automobiles	83,323		Special purpose vehicles (private use), average insurance premiums of 3 major Japanese insurance companies
	Fuel cost	9,563	**	Legally prescribed periodic inspection (6 months)
	Monthly parking fee	147	**	Annual average retail price of regular gasoline for 2012, gas mileage 8.6 km/L
Labor	Wage for home helper level 2 (hourly)	10,604	**	Annual average for 2012
	Wage for certified care worker (hourly)	1,351	††	Wage rates for home helper (Office with 10-99 employees)
		1,494	††	Wage rates for care worker at welfare facility (Office with 10-99 employees)

*Toyota website: Price list for HiAce. http://toyota.jp/welcab/hiace/w_chair/

†Bureau of Taxation, Tokyo Metropolitan Government: Rate of automobile and automobile acquisition tax.

http://www.tax.metro.tokyo.jp/shitsumon/tozei/index_j.htm#j0

‡Ministry of Land, Infrastructure, Transport and Tourism: Motor vehicle tonnage tax.

http://www.mlit.go.jp/jidosha/jidosha_fr1_000029.html

§Ministry of Land, Infrastructure, Transport and Tourism: Cost of examination registration.

<http://www.mlit.go.jp/jidosha/kensatoroku/sikumi/skm04.htm>

¶Ministry of Land, Infrastructure, Transport and Tourism: Premium rate of the automobile third party liability insurance.

<http://www.mlit.go.jp/jidosha/anzen/04relief/jibai/policyholder.html#2>

**Ministry of Public Management, Home Affairs, Posts and Telecommunications: Retail Price Survey 2012.

<http://www.stat.go.jp/data/kouri/doukou/2012np.htm>

††Ministry of Health, Labour and Welfare: Basic Survey on Wage Structure 2012.

<http://www.e-stat.go.jp/SG1/estat/NewList.do?tid=000001011429>

Table 8. Cost of providing transportation service.

Period	Total cost (yen)	
	Home care group	Hospital admission group
First year	256,038,299	169,070,449
Second to fifth year	405,895,605	371,696,299
Total	661,933,904	540,766,748
Annual cost per dialysis patient	565,755	462,194

Annual cost per dialysis patient was calculated for the Home care and Hospital admission groups independently.

Table 9. One-way sensitivity analysis.

Home care group				
Cost items section	5-year cost (yen)	Annual cost per dialysis patient (yen)		
		± 0%	-25%	+25%
Equipment	153,572,708	131,259	98,444	164,073
Tax and insurance	20,963,466	17,917	13,438	22,397
Maintenance	68,600,182	58,633	43,974	73,291
Labor	418,797,548	357,947	268,460	447,433
Total	661,933,904	565,756	424,316	707,194
Hospital admission group				
Cost items section	5-year cost (yen)	Annual cost per dialysis patient (yen)		
		± 0%	-25%	+25%
Equipment	75,637,333	64,647	48,485	80,809
Tax and insurance	10,831,053	9,257	6,943	11,572
Maintenance	21,707,033	18,553	13,915	23,191
Labor	432,591,328	369,736	277,302	462,170
Total	540,766,747	462,193	346,645	577,742

Annual cost per dialysis patient calculated when equipment, tax, insurance, maintenance, and labor costs were changed from -25% to +25%.

Discussion

According to the Dialysis Outcomes and Practice Patterns Study, among dialysis patients aged ≥ 75 years, 35% (Europe), 39.9% (Australia and New Zealand), and 47.1% (North America) need help with walking (Canaud et al. 2011). Dialysis patients of care levels 1-5 who have difficulty in walking unassisted need transportation to and from dialysis facilities, but little was known prior to this study about how they traveled to and from the dialysis facilities and the costs associated with such travel. Below we discuss the support needed by dialysis patients to attend dialysis facilities based on the results of this study.

The utilization of long-term care services was compared between the dialysis and non-dialysis groups. The rate of home-visit services and equipment services was significantly higher, and that of the facility and short-stay ser-

vices was significantly lower in the dialysis group. In logistic regression analysis, dialysis was the limiting factor for using facility and short-stay services (OR 0.6 and 0.3, respectively). It is conceivable that dialysis patients needing long-term care lean toward using home-visit services and equipment services because facility and short-stay services compatible with dialysis patients are limited. Additionally, dialysis patients must adjust to continued dialysis, so home-visit services and equipment services are useful.

Internationally, dialysis requires high medical costs, and efforts are made to ensure that care is provided equitably (Just et al. 2008). It has been found that reducing travel times lowers travel costs for attending dialysis facilities while maintaining health-related quality of life (Diamant et al. 2010). In the present study, the annual transportation cost per dialysis patient in the home care group (565,755

yen) was about 1.2-fold higher than that in the hospital admission group (462,194 yen). It became clear that the promotion of home care for dialysis patients needing long-term care requires substantial investment in planning and equipment for attending dialysis facilities. The cost of funding the LTCI system increased from 6,737.5 billion yen in 2008 to 8,895.8 billion yen in 2013 (Ministry of Health, Labour and Welfare, Japan 2009b, 2014). Reducing the costs associated with the LTCI is a major issue in Japan.

In Japan, even though dialysis costs were \$2,833 per month (about 340,000 yen per month; \$1 = 120 yen) (Fukui et al. 2004), the upper limit on dialysis expenditures is 20,000 yen per month. Japanese patients have been concerned about rising out-of-pocket expenses for medical care and decreasing life security. The subsidies for transportation expenses from the main public programs in Japan are unable to sufficiently cover the cost of attending dialysis facilities for patients needing long-term care. It is therefore necessary to improve transportation services systematically according to the number of patients at each care level, in preference to providing the subsidy for transportation expenses. The transportation services provided by each dialysis facility are effective because they can be adapted to patient status and dialysis time. According to a survey by the Japan Association of Kidney Disease Patients in 2011, 11.1% of dialysis patients attend dialysis treatment by means of the facility's vehicle (Japan Association of Kidney Disease Patients 2012), and the dialysis facilities absorb the costs of these transportation services. A subsidy program for transportation services by each dialysis facility might lead to the development of a new and more efficient transportation service.

The costs of labor, equipment, and administration in the hospital admission group were excluded from the calculation. In future, to promote admission to hospitals, it will be necessary to consider the increased medical costs for dialysis patients needing long-term care.

In conclusion, in the dialysis group, the rate of home-visit services and equipment services was significantly higher, and the rate of the facility and short-stay services was significantly lower. Calculating the transportation service costs revealed that promoting home care for dialysis patients needing long-term care requires substantial investment and equipment for attending dialysis facilities. Taken together, it is necessary to improve transportation services systematically according to the number of patients in each care level and type of residence.

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Conflict of Interest

The authors declare no conflict of interest.

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