Effects of Usual Source of Care by Patients with Diabetes on Use of Medical Service and Medical Expenses

So Dam Lee*†, Euichul Shin**†, Jae-Young Lim***, Sang Gyu Lee****,*****, Ji Man Kim****‡

*Health Insurance Review and Assessment Service, Wonju, Korea, **Department of Preventive Medicine, Catholic University College of Medicine, Seoul, Korea, ***Department of Food and Resource Economics, Korea University, Seoul, Korea, ****Graduate School of Public Health, Yonsei University, Seoul, Korea, *****Institute of Health Services Research, Yonsei University, Seoul, Korea, †So Dam Lee and Euichul Shin contributed equally to this work.

〈Abstract〉

당뇨병 환자의 상용치료원 보유가 의료이용 및 의료비에 미치는 영향

이소담*†, 신의철**†, 임재영***, 이상규****, *****, 김지만****‡

*건강보험심사평가원, **가톨릭대학교 의과대학 예방의학교실, ***고려대학교 식품자원경제학과,
****연세대학교 보건대학원, *****연세대학교 보건정책및관리연구소

목적: 상용치료원(usual source of care)은 아프거나 건강문제에 대한 조언이 필요할 때 주로 방문하는 특정 개인의원, 보건소, 혹은 기타 장소로, 상용치료원 보유는 예방서비스를 제공을 더 받게 되며, 보건의료에 대한 전반적인 만족도가 높고, 입원율을 감소시키며 의료급여자의 의료비를 감소시킬 수 있다. 이 연구에서는 당뇨병을 보유하고 있는 20세 이상을 대상으로 상용치료원 보유 여부에 따른 대상자의 현황을 파악하고, 의료이용 횟수 및 의료비의 차이와 이에 영향을 미치는 특성을 분석하였다.

방법: 이 연구는 제7차 한국의료패널 자료를 이용하였다. 상용치료원 보유여부에 따른 의료이용 횟수와 의료비를 비교하기 위해 분산분석을 실시하였으며, 상용치료원 유형에 따른 의료이용 횟수와 의료비용에 영향을 미치는 요인을 파악하기 위해 Tobit 분석을 수행하였다.

결과: Tobit 분석결과, 상용치료원을 보유한 경우 보유하지 않은 경우보다 외래의료비는 증가했으나 입원의료비는 감소하였다. 상용치료원을 보유한 경우 보유하지 않은 경우보다 외래이용횟수와 입원횟수가 증가했으나 통계적으로 유의하지 않았다.

함의: 지속적이고 포괄적인 의료서비스가 제공되는 상용치료원을 당뇨병 환자들이 보유하게 되면, 외래 예방서비스의 이용을 통해 장기적으로 입원의료비의 감소를 기대할 수 있을 것이다.

중심 단어: 상용치료원, 당뇨병, 의료이용

Ⅰ. Introduction

The improvements in medical technology, expansion of medical assurance, and development of transportation offering increased accessibility to medical care have improved both the life expectancy and quality of life of patients[1]; however, the aging population and changes in life habits have also contributed to a

continuous increase in chronic diseases[2]. The International Diabetes Federation(IDF) reported that 3 patients were newly diagnosed with diabetes every 10 seconds worldwide, and it predicted that 1 out of 10 people would have diabetes by 2030[3].

Among chronic diseases, diabetes is a major risk factor of cardiovascular and cerebrovascular diseases. While it was estimated to be less than 1% in 1970, this increased dramatically to 12.8% for men and 9.1% for women in 2013[4]. Considering that the prevalence rate of impaired fasting glucose - a pre-diabetic stage - is 25.0%, this means that 4 out of 10 Korean adults were diabetic or pre- diabetic patients in 2013[4]. Diabetes is a metabolic disorder that causes secondary complications such as terminal renal failure, non-traumatic lower extremity amputation, and blindness, imposing a critical burden on families and society. Precedent studies[5,6] have shown that these complications could be prevented or delayed by controlling the blood glucose, and diabetes is a disease that requires continual care to prevent complications.

The medical costs of diabetes have been continually increasing along with the increase in diabetic cases. According to the 2005 Diabetes Basic Statistics Report of the Korean Diabetes Association and Health Insurance Review and Assessment Service, in 2003, the medical consultation fees paid by the National Health Insurance of diabetic patients aged 20~79 was 3.1853 trillion KRW, which represented an 8-fold increase. It encompassed about 1/5th (19.2%) of the total medical consultation fees paid by health insurance[7]. Moreover, the average number of outpatient visits of diabetic patients was 17.64, while that of non-diabetic patients was 5.24. The average outpatient costs of diabetic patients amounted to 397,983 KRW, while those of non-diabetic patients came to 131,023 KRW[8].

According to the Bridges to Excellence research, diabetic patients can save about $421~$1,059 in medical costs if the disease is well-maintained/controlled[9]. As medical costs are increasing due to diabetes, having a usual source of care(USC) appears to be an important factor in reducing diabetic patients' medical costs through blood glucose control.

The USC are "specified private clinics, public health centers, or other facilities to visit when ill or when health-related advice is needed"[10], where patients can receive high-quality medical services in a comfortable and friendly environment. People with a USC tend to receive more preventative services than those without USC[11] and to have a higher overall rate of satisfaction with public health care. Moreover, people with a USC reduce the costs and inpatient rates of medical aid recipients[12]. Diabetic patients with a USC can receive a greater preventative service, which helps to prevent complications and to ensure a high quality of life.

In the United States, several studies have examined the effects of having a USC. The results have shown that preventative services are enhanced by the possession of a USC, as it leads to increased outpatient visits but decreased inpatient or emergency room visits[12-16]. There have been few studies on the effects of having a USC in Korea[17,18]. However, the continuity of medical service usage, which is a similar concept to the USC, has been studied. The results have shown that a higher continuity of outpatient usage led to decreased inpatient rates and medical costs. However, contradicting studies[19,20] about medical visits and the medical cost expenditure of chronic disease patients with a USC showed that having a USC increased outpatient visits and medical costs.

Therefore, this study evaluated the major factors affecting the outpatient visits, inpatient, and medical costs of diabetic patients with a USC based on a Korea Health Panel dataset representative of the Korean population.

Ⅱ. Materials and Methods

1. Data source and study subjects

This study used data from the 7th Korea Health Panel. The Korea Health Panel is a survey conducted by the Korea Institute for Health and Social Affairs and the National Health Insurance Service. It includes detailed information about the individual, the socioeconomic characteristics of the household, and the medical visits and costs of around 8,000 households and household members from 350 nation-wide enumeration districts extracted as a representative sample of the population using a 2-level proportionate probability stratified sampling and cluster sampling method. The Korea Health Panel has been conducted annually since 2008. It contains comprehensive information about medical visit types and costs and the factors affecting them. Therefore, it served as an in-depth data source for this study. In particular, the 7th Korea Health Panel (2012) survey differed from previous ones (1st~6th) as it included additional information about mainly-visiting medical institutions, mainly- visiting doctors, the mainly-visiting medical institution types, the satisfaction rates, and the reasons for not having a USC, making it possible to overview the medical service usage and health-related awareness and attitude of chronic disease patients.

The 2012 Korea Health Panel collected data from 15,872 people. This study selected 599 adults over 20 years of age with diabetes (ICD-10 E10~E14) as its subjects. After excluding those who had responded "not applicable to USC" in the USC survey, 555 final subjects were chosen.

2. Variables

In this study, the variables related to diabetes and the USC were selected based on previous studies about the effects of having a USC on medical visits and their costs[19] and the factors of diabetes prevalence[21,22]. In order to evaluate the medical service usage and its cost depending on the possession of a USC, the medical service usage, frequency of medical service usage, and costs were selected as dependent variables. Sociodemo-graphic characteristics including the gender, age, marital status, medical security, private insurance, and health behavior, and the medical institution types (the USC type) were selected as independent variables. The measurements and operational definition of each variable were as follows.

1) Dependent variables

For diabetic patients, the medical service usage (yes or no), frequency of medical service usage, and medical costs were selected. For inpatient, "currently in hospital" was classified as a form of inpatient usage. For the medical service usage, the frequency of medical service usage was counted by the number of inpatient, emergency room, and outpatient visits. For the medical costs, the sum of out-of-pocket costs, including the costs paid to the hospital and prescription medication costs, was used. These categories were further divided into emergency room cases, inpatient cases, and outpatient cases.

2) Independent variables

In the 2012 Korea Health Panel survey, 2 questions were asked: 1) "Do you have a medical center that you regularly visit for medical examinations or treatment consultations?" to check if the subject had a mainly-visiting medical institution, and 2) "Do you have a doctor that you regularly visit for medical examinations or treatment consultations?" to check if the subject had a mainly-visiting doctor.

The possession of a USC variable was reclassified into 3 categories using these two questions to subdivide the continuity of the USC. Having a mainly-visiting doctor (includes having a mainly-visiting medical institution), having a mainly-visiting medical institution only, having neither a mainly-visiting medical institution nor a mainly-visiting doctor.

The sociodemographic variables included the gender, age, education level, marital status, disability status, and household income quintile. The age was divided into 20-34, 35-49, 50-64, and above 65. The education level was classified into below elementary school(including preschool and uneducated), middle school, high school, and college/university. The marital status classified both married and separated patients into the "having a spouse" category, while others were classified as not having a spouse. The disability status classified those with a disability into having a disability, while others were classified as not having a disability.

The total household income quintile was used to define the household income. The annual household income as adjusted according to the number of household members was divided into 5 levels, with the 1st quintile representing the lowest income and the 5th the highest. The medical security was classified into national health insurance and medical aid. Private insurance was included in the insurance possession question; if the answer was yes, the subject was classified as having private insurance, while others were classified as not having a private insurance.

Smoking, drinking, and the self-reported health status were included as dependent variables to see how they affected the health behavior. The smoking variable was divided into non-smoker, current smoker, and former smoker. The drinking was divided into no drinking, less than once a month, less than once a week, and about more than two times a week. The self-reported health status was classified into very good, good, fair, bad, very bad, and not applicable.

Due to information asymmetry, the use of medical services is more frequently decided by the medical service provider than the patient[23], and it is hard to consider it without classifying the medical service center. Therefore, for patients with a USC, the variables were selected to reflect the form of USC and the type of medical service center. As there is a high correlation between the possession of a USC and the type of medical service center, these 2 characteristics were used to divide the medical service center characteristic variables into 6 groups: has no USC/only mainly-visiting doctor without mainly-visiting medical institution, has mainly-visiting doctor and visits public health center, clinic, or oriental medicine clinic, has mainly-visiting doctor and visits hospital, or only has mainly-visiting medical institution and visits clinic, public health center, oriental medicine clinic, has mainly-visiting doctor and visits general hospital or university hospital, only has mainly-visiting medical institution and visits hospital, only has mainly-visiting medical institution and visits general hospital or university hospital.

3. Statistical analysis

The study subjects were classified into three groups: has a mainly-visiting doctor, has a mainly-visiting medical institution only, has neither a mainly-visiting medical institution nor a mainly-visiting doctor. A simple statistical analysis including a frequency analysis and percentage was then conducted to evaluate the distribution of the study subjects based on the sociodemographic characteristics, self-reported health status, medical security, and private insurance of each group. An analysis of variance was conducted to compare the differences

in the average frequency of medical service usage and average medical costs based on whether the subjects had a USC or not. Frequency analysis was performed for USC possession status of patients with diabetes and in order to simply analyze difference by each feature for medical service using frequency and medical expenses based on USC possession status of patients with diabetes, Kruskal–Wallis was performed. In order to analyze an effect of USC possession status of patients with diabetes on medical service using frequency and medical expenses after considering an effect of other features, Tobit analysis was performed. The tobit analysis is designed to estimate linear relationships between variables when there is censored in the dependent variable. In healthcare utilization studies, the dependent variable response is not observed for some participants. The tobit analysis is better suited to analyze data with censoring. SAS (version 9.3) was used for the data analysis.

Ⅲ. Results

1. General characteristics of study subjects

There were more female subjects (55.0%) than male subjects (45.0%). The age group with the greatest number of subjects was the 35–49 age bracket (33.3%), followed by the above 65 (26.3%), the 50–64 (25.2%), and the 20–34 (15.1%). With regard to the marital status, 71.2% of the subjects had a spouse, while 28.8% did not. In terms of education level, 20.9% had a level below primary school, 12.8% were lower secondary school graduates, 31.4% were upper secondary school graduates, and 35.0% were post–secondary school graduates. The total household income was distributed as follows: 1st quintile (24.1%), 4th quintile (22.7%), 3rd quintile (18.7%), 5th quintile (18.6%), and 2nd quintile (15.9%).

In terms of medical institution status, the highest proportion of subjects did not have a USC and only mainly–visiting doctor without mainly–visiting medical institution (73.3%). 12.3% had a mainly– visiting doctor and visited a public health center, clinic, or oriental medicine clinic, 8.3% had a mainly–visiting doctor and visited a hospital or had a mainly–visiting medical institution and visited a clinic, public health center, and oriental medicine clinic, 2.3% had a mainly–visiting doctor and visited a general hospital or university hospital, 2.2% only had a mainly–visiting medical institution and visited a hospital, and 1.6% only had a mainly–visiting medical institution and visited a general hospital or university hospital [Table 1].

2. Difference in medical service utilization

Table 2 shows the results of the distribution of the medical service costs and frequency between those with and without a USC. The group with a mainly–visiting doctor as their USC showed the greatest frequency of outpatient visits (99.0%), while the group with a mainly–visiting medical institution only showed the greatest frequency of inpatient and of emergency room usage (inpatient 25.0%, outpatient visits 10.4%).

The group with the mainly–visiting doctor had an average of 34.1 visits, the group with the mainly–visiting medical institution only had 26.1 visits, and the group with neither the institution nor the doctor had 13.3 visits. On the other hand, there were more inpatient cases in the group with the mainly–visiting medical institution only (0.4 visits), followed by the group with the mainly– visiting doctor (0.3 visits) and the group with neither the institution nor the doctor (0.1 visits). The difference was statistically significant (p<0.01). The group with the mainly–visiting medical institution had an average of 0.1 visits to the

emergency room, while the group with the mainly-visiting doctor had 0.1 visits, and the group with neither the institution nor the doctor had 0.1 visits. This showed a similar tendency to that of the inpatient cases, although there was no statistical significance.

<Table 1> General Characteristics of study subjects

Category		Possession of mainly-visiting doctor or medical institution						Total		x^2 or F
		Doctor		Medical institution only		Neither				
		N	%	N	%	N	%	N	%	
		103	18.6	48	8.6	404	72.8	555	100.0	
Sex	Male	38	36.9	18	37.5	194	48.0	250	45.0	5.31
	Female	65	63.1	30	62.5	210	52.0	305	55.0	
Age	20–34	2	1.9	4	8.3	78	19.3	84	15.1	70.42***
	35–49	21	20.4	18	37.5	146	36.1	185	33.3	
	50–64	24	23.3	8	16.7	108	26.7	140	25.2	
	Over 65	56	54.4	18	37.5	72	17.8	146	26.3	
Spouse	Yes	75	72.8	35	72.9	285	70.5	395	71.2	0.28
	No	28	27.2	13	27.2	119	29.5	160	28.8	
Education Level	≤Elementary school	43	41.8	12	25.0	61	15.1	116	20.9	47.54***
	Middle school	17	16.5	3	6.3	51	12.6	71	12.8	
	High school	28	27.2	17	35.4	129	31.9	174	31.4	
	≥College/university	15	14.6	16	33.3	163	40.4	194	35.0	
Disability	Yes	18	17.5	6	12.5	17	4.2	41	7.4	23.12***
	No	85	82.5	42	87.5	387	95.8	514	92.6	
Household income	1st quintile	42	40.8	14	29.2	78	19.3	134	24.1	25.17**
	2nd quintile	11	10.7	6	12.5	71	17.6	88	15.9	
	3rd quintile	16	15.5	7	14.6	81	20.1	104	18.7	
	4th quintile	18	17.4	15	31.3	93	23.0	126	22.7	
	5th quintile	16	15.5	6	12.5	81	20.1	103	18.6	
Health insurance	Medical aid	11	10.7	5	10.4	16	4.0	32	5.8	8.91*
	NHI	92	89.3	43	89.6	388	96.0	523	94.2	
Private insurance	Yes	61	59.2	32	66.7	295	73.0	388	69.9	7.68*
	No	42	40.8	16	33.3	109	27.0	167	30.1	

* p <0.05, ** p <0.01, *** p <0.001
NHI: National Health Insurance

<Table 1> (Continued) General Characteristics of study subjects

Category		Possession of mainly-visiting doctor or medical institution						Total		x^2 or F
		Doctor		Medical institution only		Neither				
		N	%	N	%	N	%	N	%	
Smoking	Non-smoker	67	65.1	33	68.8	245	60.6	345	62.2	13.93**
	Current smoker	13	12.6	8	16.7	108	26.7	129	23.2	
	Past smoker	23	22.3	7	14.6	51	12.6	81	14.6	
Drinking	No drinking	43	41.8	23	47.9	113	28.0	179	32.3	15.44*
	≤ 1 time/month	24	23.3	11	22.9	104	25.7	139	25.2	
	≤ 1 time/week	15	14.6	9	18.8	94	23.3	118	21.3	
	≥ 2 times/week	21	20.4	5	10.4	93	23.0	119	21.4	
Self-reported health status	Very good	7	6.8	1	2.1	40	9.9	48	8.7	31.63**
	Good	24	23.3	13	27.1	134	33.2	171	30.8	
	Fair	41	39.8	22	45.8	151	37.4	214	38.6	
	Bad	21	20.4	6	12.5	42	10.4	69	12.4	
	Very bad	8	7.8	2	4.2	5	1.2	15	2.7	
	N/A	2	1.9	4	8.3	32	7.9	38	6.9	
USC type	Have not usual source of care/only mainly-visiting doctor without mainly-visiting medical institution	3	2.9	0	0.0	404	100.0	407	73.3	900.82***
	Have mainly-visiting doctor and visits public health center, clinic, or oriental medicine clinic	68	66.0	0	0.0	0	0.0	68	12.3	
	Have mainly-visiting doctor and visits hospital, or only has mainly-visiting medical institution and visits clinic, public health center, oriental medicine clinic	19	18.5	27	56.3	0	0.0	46	8.3	
	Have mainly-visiting doctor and visits general hospital or university hospital	13	12.6	0	0.0	0	0.0	13	2.3	
	Only have mainly-visiting medical institution and visits hospital	0	0.0	12	25.0	0	0.0	12	2.2	
	Only have mainly-visiting medical institution and visits general hospital or university hospital	0	0.0	9	18.8	0	0.0	9	1.6	

* p <0.05, **p <0.01, ***p <0.001
USC: Usual Source of Care

<Table 2> Study subjects' medical utilization status

Category		Possession of mainly-visiting doctor or medical institution						Total		F
		Doctor		Medical institution only		Neither				
		N	(%)	N	(%)	N	(%)	N	(%)	
		103	(100.0)	48	(100.0)	404	(100.0)	555	(100.0)	
Use of outpatient service	Yes	102	(99.0)	47	(97.9)	318	(78.7)	467	(84.1)	32.86***
	No	1	(1.0)	1	(2.1)	86	(21.3)	88	(15.9)	
Use of inpatient service	Yes	16	(15.5)	12	(25.0)	41	(10.2)	69	(12.4)	10.76**
	No	87	(84.5)	36	(75.0)	363	(89.9)	486	(87.6)	
Use of emergency department	Yes	10	(9.7)	5	(10.4)	35	(8.7)	50	(9.0)	0.23
	No	93	(90.3)	43	(89.6)	369	(91.3)	505	(91.0)	
Frequency of outpatient care		34.1 times (SD=34.5)		26.1 times (SD=29.6)		13.3 times (SD=22.2)		18.3 times (SD=26.8)		100.71***
Frequency of inpatient care		0.3 times (SD=0.7)		0.4 times (SD=0.8)		0.1 times (SD=0.4)		0.2 times (SD=0.6)		11.42**
Frequency of emergency department visits		0.1 times (SD=0.5)		0.1 times (SD=0.5)		0.1 times (SD=0.4)		0.1 times (SD=0.4)		0.26
Average outpatient medical expenses		413,387 KRW (SD=608,048)		494,423 KRW (SD=813,660)		276,458 KRW (SD=761,724)		320,721 KRW (SD=742,935)		48.63***
Average admission medical expenses		208,567 KRW (SD=694,915)		232,077 KRW (SD=610,710)		86,471 KRW (SD=385,156)		121,723 KRW (SD=481,484)		10.00**
Average emergency department expenses		4,904 KRW (SD=21,466)		8,046 KRW (SD=30,962)		6,604 KRW (SD=44,540)		6,413 KRW (SD=40,124)		0.76

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
KRW: Korean Won, SD: Standard Deviation

The average outpatient medical costs were the highest in the group with a mainly-visiting medical institution (494,423 KRW), followed by those with a mainly-visiting doctor (413, 387 KRW), and those with neither an institution nor a doctor (276,458 KRW). The group with a mainly-visiting medical institution had statistically higher medical costs (p <0.001). In terms of inpatient costs, the group with the mainly-visiting medical institution had the highest expenditure (232,077 KRW), followed by the group with the mainly-visiting doctor (208,567 KRW), and the group with neither the institution nor the doctor (86,471 KRW).

3. Analysis of variables affecting frequency of medical service usage

Table 3 shows the results of the analysis of the way the possession of a USC affects the frequency of medical service usage. Regarding the gender variable, the frequency of outpatient service use was statistically higher in male subjects than in female subjects, while the frequency of inpatient service use was significantly lower in male subjects than in female subjects (p<0.05). In terms of age, the frequency of outpatient service use was statistically reduced in all age groups except in that

above 65 age group (p<0.05). In terms of marital status, only the outpatient medical service use was statistically higher for those with a present spouse (p<0.05). Furthermore, sociodemographic variables such as the education level and disability status did not show a statistical significance.

<Table 3> Results of Tobit regression analysis for average annual frequency of outpatient and inpatient care

Category		Frequency of outpatient care		Frequency of inpatient care	
		b	SE	b	SE
	Constant	16.926	19.576	−0.175	2.379
USC possession	Doctor	19.008	14.321	2.534	1.684
	Medical institution only	20.137	16.094	2.952	1.988
	Neither	(REF.)		(REF.)	
Sex	Male	8.361*	3.631	−1.234*	0.539
	Female	(REF.)		(REF.)	
Age	20–34	−23.106***	4.909	−0.682	0.729
	35–49	−21.209***	3.815	−1.206*	0.588
	50–64	−12.234**	3.397	−0.236	0.479
	Over 65	(REF.)		(REF.)	
Spouse	Yes	5.793*	2.933	0.124	0.443
	No	(REF.)		(REF.)	
Education level	≤ Elementary school	3.320	4.330	0.130	0.659
	Middle school	−1.871	4.041	0.239	0.617
	High school	−0.675	2.822	0.234	0.465
	≥ College/university	(REF.)		(REF.)	
Disability	Yes	0.005	4.337	0.149	0.590
	No	(REF.)		(REF.)	
Household income	1st quintile	−6.104	3.837	−0.008	0.604
	2nd quintile	2.718	3.784	0.677	0.580
	3rd quintile	−1.385	3.598	0.600	0.553
	4th quintile	0.493	3.407	0.282	0.554
	5th quintile	(REF.)		(REF.)	
Health insurance	Medical aid	8.896	4.928	0.211	0.706
	NHI	(REF.)		(REF.)	
Private insurance	Yes	−3.393	2.759	−0.213	0.411
	No	(REF.)		(REF.)	

*p <0.05, **p <0.01, ***p <0.001
USC: Usual Source of Care, NHI: National Health Insurance

<Table 3> (Continued) Results of Tobit regression analysis for average annual frequency of outpatient and inpatient care

Category		Frequency of outpatient care		Frequency of inpatient care	
		b	SE	b	SE
Smoking	Non-smoker	−6.946	4.358	0.326	0.619
	Current smoker	−7.928*	3.658	−0.272	0.535
	Past smoker	(REF.)		(REF.)	
Drinking	No drinking	1.791	3.750	0.593	0.584
	≤ 1 time/month	2.979	3.612	1.161*	0.571
	≤ 1 time/week	2.283	3.485	0.464	0.562
	≥ 2 times/week	(REF.)		(REF.)	
Self – reported health status	Very good	−11.901	8.196	−1.621	0.941
	Good	−14.332	7.982	−3.251**	1.055
	Fair	−13.903	7.153	−3.112**	0.853
	Bad	− 3.742	6.961	−2.703**	0.790
	Very bad	10.793	7.214	−2.099**	0.820
	N/A	(REF.)		(REF.)	
USC type	Have not usual source of care/only mainly-visiting doctor without mainly-visiting medical institution	5.231	18.315	1.184	2.222
	Have mainly-visiting doctor and visits public health center, clinic, or oriental medicine clinic	0.243	11.942	−1.426	1.554
	Have mainly-visiting doctor and visits hospital, or only has mainly-visiting medical institution and visits clinic, public health center, oriental medicine clinic	− 3.285	9.786	−0.954	1.168
	Have mainly-visiting doctor and visits general hospital or university hospital	−16.469	13.251	−0.879	1.659
	Only have mainly-visiting medical institution and visits hospital	−13.797	11.317	−0.348	1.411
	Only have mainly-visiting medical institution and visits general hospital or university hospital	(REF.)		(REF.)	
		Log Likelihood = −2,206		Log Likelihood = −268	

*p <0.05, **p <0.01, ***p <0.001
USC: Usual Source of Care

4. Analysis of variables affecting medical costs

Table 4 shows the effects of the possession of a USC on the medical costs. The results show that the outpatient costs were higher in the group with a USC than in the group without it, but that their inpatient costs were reduced with statistical significance (outpatient $p<0.01$, inpatient $p<0.01$). Moreover, the outpatient and inpatient medical costs were lower in the group with a mainly-visiting doctor as their USC than in that with a mainly-visiting medical institution only.

In terms of sociodemographic factors, the outpatient costs of male subjects were statistically higher.

Regarding the age, the outpatient medical costs were statistically lower for the middle-aged groups (ages 20-34, 35-49) than for the oldest group (above 65), and the inpatient costs were only statistically lower for the 35-49 age group ($p<0.05$). Looking at the health insurance types, medical aid recipients spent statistically less than National Health Insurance(NHI) recipients, although this may have resulted from lower out-of-pocket costs for medical aid recipients than NHI recipients reported in the Korea Health Panel survey.

The other sociodemographic factors, such as having a spouse, the education level, and the disability status, were not statistically significant.

<Table 4> Results of Tobit regression analysis for average annual costs of outpatient and inpatient care

Category		Cost of outpatient care		Cost of inpatient care	
		b	SE	B	SE
	Constant	−922,690	635,967	6,857,683***	457,532
USC possession	Doctor	1,509,134**	464,631	−4,983,125***	292,877
	Medical institution only	1,703,858**	522,407	−4,774,708***	335,919
	Neither	(REF.)		(REF.)	
Sex	Male	288,677*	118,168	−809,419	460,047
	Female	(REF.)		(REF.)	
Age	20–34	−347,609*	160,454	−513,330	611,038
	35–49	−306,158*	124,238	−1,104,703*	501,890
	50–64	−59,456	110,561	−306,629	410,000
	Over 65	(REF.)		(REF.)	
Spouse	Yes	134,559	95,591	319,849	372,606
	No	(REF.)		(REF.)	
Education level	≤Elementary school	−33,352	140,942	238,891	558,563
	Middle school	−69,700	131,458	166,522	521,807
	High school	−18,187	92,054	267,503	395,346
	≥College/university	(REF.)		(REF.)	
Disability	Yes	−35,132	142,221	−178,249	520,742
	No	(REF.)		(REF.)	
Household income	1st quintile	−228,642	124,910	24,614	497,827
	2nd quintile	− 90,955	123,260	214,482	496,627
	3rd quintile	−182,536	117,183	244,432	462,437
	4th quintile	−136,235	111,342	267,316	456,741
	5th quintile	(REF.)		(REF.)	
Health insurance	Medical aid	−337,288*	162,819	−372,173	601,938
	NHI	(REF.)		(REF.)	
Private insurance	Yes	43,532	89,919	−46,144	348,527
	No	(REF.)		(REF.)	

*p <0.05, **p <0.01, ***p <0.001
USC: Usual Source of Care, NHI: National Health Insurance

<Table 4> (Continued) Results of Tobit regression analysis for average annual costs of outpatient and inpatient care

Category		Cost of outpatient care		Cost of inpatient care	
		b	SE	b	SE
Smoking	Non–smoker	−221,912	142,280	276,799	531,022
	Current smoker	−233,502	119,398	−342,161	462,497
	Past smoker	(REF.)		(REF.)	
Drinking	No drinking	73,199	122,133	262,854	498,802
	≤ 1 time/month	667,757	118,185	792,036	490,790
	≤ 1 time/week	148,839	113,723	461,641	480,408
	≥ 2 times/week	(REF.)		(REF.)	
Self – reported health status	Very good	−384,548	267,651	−968,758*	458,858
	Good	−455,589	259,015	−2,404,009***	519,403
	Fair	−314,099	232,230	−2,363,266***	351,974
	Bad	−180,760	225,974	−1,886,159***	320,241
	Very bad	256,424	234,143	−1,487,656**	427,878
	N/A	(REF.)		(REF.)	
USC type	Have not usual source of care/only mainly–visiting doctor without mainly–visiting medical institution	1,170,561*	594,537	−6,689,731***	292,932
	Have mainly–visiting doctor and visits public health center, clinic, or oriental medicine clinic	−311,710	388,043	−1,547,023***	395,990
	Have mainly–visiting doctor and visits hospital, or only has mainly–visiting medical institution and visits clinic, public health center, oriental medicine clinic	−232,430	318,140	−1,330,843**	475,967
	Have mainly–visiting doctor and visits general hospital or university hospital	−97,055	429,905	−1,134,548*	508,352
	Only have mainly–visiting medical institution and visits hospital	−509,774	367,422	−1,231,524**	342,871
	Only have mainly–visiting medical institution and visits general hospital or university hospital	(REF.)		(REF.)	
		Log Likelihood = −3,734		Log Likelihood = −710	

*p <0.05, **p <0.01, ***p <0.001
USC: Usual Source of Care

Ⅳ. Discussion

Based on the 2012 Korea Health Panel survey data, this study set out to examine the medical service usage and medical costs of diabetic adults over 20 years of age according to their possession of a USC. The subject characteristics were then compared, and the difference in the distribution of medical service usage and medical costs was analyzed. Furthermore, the different factors that could affect the medical service usage and medical costs according to the possession of a USC were

analyzed.

For the distribution of the frequency of medical service usage based on the possession of a USC, the group with a mainly-visiting doctor as its USC showed the highest frequency of outpatient visits, followed by the group with a mainly-visiting medical center only, and that with neither an institution nor a doctor. On the other hand, the frequency of inpatient and emergency room visits was the highest in the group with a mainly-visiting medical center only, followed by the group with a mainly-visiting doctor and that with neither an institution nor a doctor. The frequency of medical service usage showed a similar tendency to the frequency of outpatient visits. Regarding the outpatient medical service, the group with a mainly-visiting doctor showed the highest rate, which may have been due to the increased frequency of visits for preventative measurements. These results echoed those of published studies[13,14] that suggested that the possession of a USC increased the usage of preventative services more than threefold. Also, these results were similar to previous studies that patients without a USC are less likely to make healthcare visits[13,15]. On the other hand, the inpatient and emergency room usage was higher in the group with a mainly-visiting medical center only. This is thought to be due to the fact the group with a mainly-visiting medical center only had a lesser consistency of treatment than those with a mainly-visiting doctor, leading to a worsening of the disease.

From our analysis of the effect of the possession of a USC on the frequency of medical service usage, we found that the frequency was higher for those with a USC, although this was not statistically significant. These results were similar to those of precedent studies[16,20,25] that showed that the possession of a USC increased the frequency of outpatient visits.

The control factors for the frequency of medical service usage showed that in terms of sociodemographic variables, male subjects had a higher frequency of usage of all types of medical services but a lower inpatient rate than female subjects. Age-wise, the frequency of medical service usage was significantly lower in the younger age groups (p<0.05). Smoking-wise, current smokers had a lower frequency of medical service usage than former smokers, and a better self-reported health status decreased the frequency of medical service usage (p<0.05).

The distribution of medical costs according to the possession of a USC was the highest in terms of frequency, outpatient visits, inpatient, and emergency cases in the group that possessed a mainly-visiting medical institution, followed by the group with a mainly-visiting doctor and that without a mainly-visiting institution or doctor. Regarding outpatient visits, the frequency of usage was lower in the group with a mainly-visiting medical institution only than in the one with a mainly-visiting doctor, while the medical costs showed opposite results. This indicated that the medical costs per visit were relatively higher for those with a mainly-visiting medical institution as their USC.

Moreover, the analysis of the effects of the possession of a USC on the medical costs showed that the latter were higher in the group with a USC in terms of outpatient visits, while the inpatient costs were significantly lower in the group with a USC. In terms of outpatient visits, the group with a USC visited more frequently for preventative measurements, which may have contributed to the increased medical costs. In terms of inpatient, those with a USC received good management of the disease, which reduced the frequency of inpatient and led to reduced medical costs. These results echoed those of another

study[12] that found that having a consistent relationship with a USC reduced the inpatient rates and medical costs of medical aid recipients.

In terms of control factors affecting the medical costs, the sociodemographic variable of the gender showed a significantly higher medical cost in male subjects than in female subjects (p<0.05). Age-wise, younger subjects had lower medical costs. In terms of medical security, the outpatient medical costs were greatly reduced for medical aid recipients, with statistical significance. Regarding the self-reported health status, a better health status showed a greater reduction in all medical costs (p<0.05).

Precedent studies were limited in not being able to clearly distinguish whether the concept of a USC referred to a specific doctor or a specific medical institution. This study supplemented these limitations by including a mainly-visiting doctor and a mainly-visiting medical institution in order to subdivide the concept of the USC. As a result, the subjects with mainly-visiting doctors as their USC had less medical expenditure than those with mainly-visiting medical institutions only. This shows that in comparison with having a mainly-visiting doctor, having a mainly-visiting medical institution only reduces the consistency of treatment. This is because if the mainly-visiting medical institution has more than 2 doctors or several departments, the main visiting doctor may be changed even if the subject visits the same main visiting medical institution. Furthermore, analyses from precedent studies about the USC were restricted to the medical service usage and medical costs of outpatient visits. However, the results of this study showed that the possession of a USC could reduce the inpatient usage and medical costs over the long run.

Aging proceeds, the medical cost due to chronic diseases is constantly increasing. In order to reduce the disease burden of chronic diseases, preventive care is important. Thus, the health care organizations to provide chronic disease- management services should be made of the activation. Health problems are usually well-managed when you get the treatment from a reliable doctor. If you have the trusted relationship and rapport with your doctor, then you will get the interpersonal continuity. And your health care providers will get the directionality to be healthy and accountability. In order to get the improved health outcomes, policy support is needed to guarantee health care continuity and appropriate service quality of USC. At the same time, FFS(fee-for-service) that is likely to focus on treatment-oriented services rather than health promotion and prevention services must be improved.

In Korea, the prevalence of diabetes has been consistently increasing due to changes in the westernized diet and the mode of life and the medical costs of diabetes represent up to 1/5th of the health insurance budget, which makes it a great medical cost burden[7]. This increase in diabetes-related medical costs deepens the burdens of health insurance, medical aid funds, and personal budget. Therefore, the study showed that if the possession of a USC were promoted to provide consistent and comprehensive care in order to control diabetes, the medical costs of inpatient could be reduced by offering outpatient preventative services.

This study encompassed different variables that affect the medical service usage and medical expenditure of diabetes patients, using Korea Health Panel data representative of the nationwide population to analyze subdivided groups of USC users, including those with a mainly-visiting doctor and a mainly-visiting medical institution. Nonetheless, the study presented certain restrictions. First, the responses were dependent on the

participants' answers about their USC, and they may have had different perspectives on the concept of a USC. According to the survey results from the 2012 Korea Health Panel, 261 participants responded that they did not have a USC as they did not get sick often, which meant that they only considered the USC as a place to go when they were sick, and not for preventative measurements. This seems to have sprung from the lack of information at the time of the survey, and the operational definition of the USC needs to be accurately explained to the participants. Second, reporting biases may have appeared for the dependent variables, as the frequency of medical service usage and the out-of-pocket expenditure were reported from memory. Third, the severity of the diabetic patients' condition was not taken into account. The quality of life of diabetic patients may be different according to the severity of the disease, and the medical service usage and medical costs may differ greatly as well. The severity of the study subjects' condition was not included in the 1st-year data of the Korea Health Panel, which leads to limitations in the interpretation of the research results. Therefore, in future studies, clinical study results or comorbidities need to be included in the analysis, or 2~3 years of Korea Health Panel data should be used to minimize the effects of the disease severity on the analysis.

This study is considered beneficial in that it used systematically-collected data representative of the nationwide population from the Korea Health Panel to allow for proper generalization of the research results. Moreover, due to certain restrictions, there has been scarce research on the different factors that can affect the medical service usage and medical costs of diabetic patients according to the possession of a USC. Consequently, further studies should consider other variables not included in this study.

<References>

1. Kim JG. The impact of family type on health behavior of elderly people. J Welf Aged 2011;51:35-55.
2. WHO. Noncommunicable diseases country profiles 2011. Geneva, Switzerland: World Health Organization; 2011.
3. International Diabetes Federation (IDF). IDF Diabetes, 5th edition. Brussels, Belgium: International Diabetes Federation; 2011.
4. Korean Diabetes Association. Korean diabetes fact sheet 2015. Seoul, Korea: Korean Diabetes Association, 2015.
5. UK prospective diabetes study group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. BMJ 1998;317(7160):703-713.
6. The diabetes control complications trial research group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med 1993;329(14):977-986.
7. Park IB, Baik SH. Epidemiologic characteristics of diabetes mellitus in korea: current status of diabetic patients using Korean Health Insurance Database. Korean Diabetes J 2009;33(5):357-362.
8. Lim JH, Oh CS. Medical care utilization status and quality of life in diabetes mellitus patients. J Digit Policy Manag 2013;11(10):609-618.
9. Diabetes care analysis-savings estimate [Internet]. 2005 [cited 2 october 2015]. Available from: http://www.hci3.org/sites/default/files/files/files/Guide_BTE-Diabetes.pdf.
10. Kim MY, Kim JH, Choi I-K, Hwang IH, Kim SY. Effects of having usual source of care on preventive services and chronic disease control: a systematic review. Korean J Fam Med 2012;33(6):336-345.
11. Xu KT. Usual source of care in preventive service use: a regular doctor versus a regular site. Health Serv Res 2002;37(6):1509-1529.

12. Weiss LJ, Blustein J. Faithful patients: the effect of long-term physician-patient relationships on the costs and use of health care by older Americans. Am J Public Health 1996;86(12): 1742-1747.

13. Ettner SL. The timing of preventive services for women and children: the effect of having a usual source of care. Am J Public Health 1996;86(12): 1748-1754.

14. Ettner SL. The Relationship between continuity of care and the health behaviors of patients: does having a usual physician make a difference? Med Care 1999;37(6):547-555.

15. Liaw W, Petterson S, Rabin DL, Bazemore A. The impact of insurance and a usual source of care on emergency department use in the United States. Int J Family Med. 2014;2014:842847.

16. Donahue K, Fryer GE, Phillips R, Green L. The importance of usual source of care for patients with cardiovascular-related conditions. Academy for Health Services Research Annual Meeting; June 10-12, 2001; Atlanta, Ga 2001.

17. DeVoe JE, Fryer GE, Phillips R, Green L. Receipt of preventive care among adults: insurance status and usual source of care. Am J Public Health 2003;93(5):786-791.

18. Korean Institute for Health and Social Affairs, National Health Insurance Service. In-depth analysis of medical utilization on Korea using Korean Health Panel Survey, 2012.

19. Kim KM, Jeon HS, Lee JH. Having a physician rather than a place as a usual source of care would be better - from 2012 Korea Health Panel Data. J Korean Med Sci 2017;32(1):4-12.

20. Ko SJ. In-depth analysis of medical utilization in Korea using Korean Health Panel Survey(KHPS). Seoul, Korea: Korea Institute for Health and Social Affairs, 2012.

21. Kim JY, Kim HY, Kim HY, Min KW, Park SW, Park IB, et al. Current status of the continuity of ambulatory diabetes care and its impact on health outcomes and medical cost in Korea using National Health Insurance database. Diabetes Metab J 2006;30(5):377-387.

22. Kim Jh, Chu SK, Moon JR, Song MS, Kim SE. Health behaviors of diabetic and non-diabetic subjects across age groups. Korean J Health Educ Promot 2010;27(3):13-22.

23. Nam SM, Yu HY, Lee MY, Koh JH, Shin JY, Shin YG, et al. Alcohol consumption, liver enzymes, and prevalence of metabolic syndrome in korean adult men. Diabetes Metab J 2007;31(3): 253-260.

24. Bloom G, Standing H, Lloyd R. Markets, information asymmetry and health care: Towards new social contracts. Soc Sci Med 2008;66(10): 2076-2087.

25. KIM ES. Medical care utilization and its determinants of industrial workers with diabetes mellitus detected through periodic health examination program. Daegu, Korea: Graduate School of Public Health, Kyungpook National University; 2007.

〈Abstract〉

Effects of usual source of care by patients with diabetes on use of medical service and medical expenses

So Dam Lee*[†], Euichul Shin**[†], Jae-Young Lim***, Sang Gyu Lee****, *****,

Ji Man Kim****[†]

*Health Insurance Review and Assessment Service, Wonju, Korea, **Department of Preventive Medicine, Catholic University College of Medicine, Seoul, Korea, ***Department of Food and Resource Economics, Korea University, Seoul, Korea, ****Graduate School of Public Health, Yonsei University, Seoul, Korea, *****Institute of Health Services Research, Yonsei University, Seoul, Korea, [†]So Dam Lee and Euichul Shin contributed equally to this work.

Purposes： Diabetes is a metabolic disorder that requires continuous care in order to prevent complications, as it can impose a critical burden on families and society due to various complications, including terminal renal failure, non-traumatic lower extremity amputation, and adult blindness. The usual sources of care are "specified private clinics, public health centers, or other facilities to visit when ill or when health-related advice is needed". These usual sources of care offer preventative services, have a high overall satisfaction rate in terms of public health care, and decrease the inpatient rates and medical costs of medical aid recipients. This study analyzed the current status of diabetic patients over 20 years of age based on their possession of a usual source of care, and the effects of this possession on the frequency of their medical service usage and its costs.

Methodology： Based on data from the 7th Korea Health Panel, a Tobit analysis was used to analyze the different factors that can affect the frequency of medical service usage and its costs for diabetic patients with and without a usual source of care.

Findings： The medical costs of diabetic patients with a usual source of care decreased in terms of inpatient, and the outpatient visits and inpatient costs of the group with a usual source of care in the form of a mainly-visiting doctor decreased more than those of the group with a mainly-visiting medical institution only.

Practical Implications： Having a usual source of care can increase the treatment continuity, leading to reduced inpatient, and having a mainly-visiting doctor as the usual source of care further increases the treatment continuity. Based on these results, a new policy is needed to increase and strengthen diabetic patients' possession of a usual source of care.

Key words： diabetes; usual source of care; medical utilization