

Accessibility of Health Care: The Utilization of Cross-regional Health Care by Patients with Osteoarthritis

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Abstract: Although Taiwan implemented the National Health Insurance (NHI) program, which was a considerable achievement that has enabled all citizens' access to medical care services since 1995, substantial discrepancies in the distance to hospitals that affects a patient's hospital-seeking behavior exist between different districts and communities (Chang, et al., 2009). In this study, the National Health Insurance Research Database (NHIRD) was used to select patients diagnosed with osteoarthritis for analyses. The purpose of this study was to observe how factors, such as the severity of osteoarthritis in patients, the amount of medical resources available in residencies, the amount of copayment, and the difficulties of receiving medical services because of individual factors, affect the use of cross-regional health care by residents.

Keywords: Accessibility of Health Care; Utilization of Cross-Regional Health Care; National Health Insurance

JEL Classification Number: I10; I18; I19

1. Introduction

The implementation of the National Health Insurance (NHI) program in 1995 was a crucial step in advancing social welfare and policy development in Taiwan. Since then, the number of people included in the NHI program has increased, fiscal burden encountered by insured families have been reduced, and ensuring that all citizens are entitled to equal opportunity and access to medical care in the past eighteen years (Chang, 2005; Lai, 2005; Cheng and Chu, 2008). Although the access to medical care has become substantially more widespread after the NHI program was implemented, substantial discrepancies in the distance to hospitals that affects a patient's hospital-seeking behavior exist between different districts and communities (Chang, et al., 2009).

The barriers to accessing medical care are divided into three types: structural barriers, which are caused by the number, density, and type of medical care providers located in the area (Williams, 1987; Tanser, et al., 2006; Dunne, et al., 1994; Cunningham, et al., 1995); financial barriers, which can reduce the willingness of people to visit hospitals or prevent them from receiving medical care when the financial burden is heavy (Alberts, et al., 1997); and personal barriers. Personal barriers are the difficulties of receiving medical services because of individual factors that influence the accessibility of medical care

(Andersen and Aday, 1995). These factors include sex, age, marital status, education level, and perceived health status.

In this study, the accessibility of medical care was evaluated by considering the level of cross-regional health care received by people in Taiwan because medical care access is an abstract concept (Chang, et al., 2009). To differentiate the obstacles to accessing cross-regional medical care, we adopted the following research method: First, we referred to the classified method established by the Bureau of National Health Insurance (BNHI), and subsequently excluded remote communities and mountain and islet districts according to the number of doctors and the urbanization levels of the township in which the patients lived. We categorized the remaining regions into three groups: regions with abundant, moderate, and scarce medical resources. After the groups were established, we observed whether differences in the use of cross-regional health care existed among these three groups. Second, in 2005, the BNHI substantially raised the amount of copayment required to receive medical care, except for clinics, which maintained a NT\$50 copayment. Thus, the copayment required in district hospitals, regional hospitals, and medical centers was respectively increased from NT\$50, \$140, and \$210 to NT\$80, \$240, and \$360 for people without a referral, and this adjustment caused the cost of receiving medical treatment to substantially increase. Therefore, we surveyed whether the use of cross-regional medical care was affected by these policy changes. Finally, by adopting a fixed-effect logit model, we investigated whether structural barriers, financial barriers, and personal barriers affected the utilization of cross-regional medical care after controlling for unobserved heterogeneity.

We obtained the characteristics of the study patients and those of the hospitals that they visited to analyze the ability of patients to access medical care by using the NHI Research Database (NHIRD), which was maintained by the National Health Research Institute (NHRI). Because NHI covers almost the entire population, Due to the rapid growth of Taiwan's aging population places an increasingly heavy burden on the finances of the BNHI, and osteoarthritis is a common chronic disease among people over 65 years olds, to determine whether the access to medical care by the elderly population is constrained by structural, financial, and personal factors, we selected patients diagnosed with osteoarthritis for analysis. The results of this study can be used as a reference for policy investigation.

2. Materials and Methods

2.1. Data

To analyze the accessibility of medical care for osteoarthritis patients, we obtained the characteristics of the patients and the hospitals that they visited. The NHIRD was

maintained by the NHRI. Data are longitudinal medical claims (inpatient and outpatient) of NHI enrollee. These claims record diagnose of diseases, admission dates, and copayment. Most importantly, each claim record consists of three scrambled but unique IDs: patient ID, doctor ID, and provider ID; these unique IDs enable us to link information about patients and providers (Lien et al., 2010).

Based on ambulatory care expenditures by visits (CD), we selected patients which the ICD9 value corresponded with 715.16, 715.26, 715.36, or 715.96. Those patients ID enable us to link all the inpatient and outpatient claim data of patients diagnosed with osteoarthritis from 2004 to 2008. In addition, we excluded patients from remote communities and mountain and islet districts (Jinmen, Matsu and Penghu).

The NHIRD includes the eligibility file of all NHI enrollees. The eligibility file reports an enrollee's ID, basic demographics (sex and age), group of enrollment, and enrollment location(Lien et al., 2010). We divided the samples into four groups based the group of enrollment as follows: farmers, unemployed, retired soldiers and their families, and the others. The enrollment location means insurance regions or workplace but not the records for residential regions; therefore, we selected 65–85-year-old osteoarthritis patients who were insured oneself or insured through their spouse. The reason why we selected these samples is that patients who rely on their children to insure them are likely to live in a residence that is not located where they were registered for insurance. Furthermore, we considered insurance townships as the townships in which people are registered or live. Because most people retire when they are over 65 year olds, people who are insured or rely on their spouse for insurance represent over 70% of the insurance categories including farmers or the unemployed (Lien, 2010). These patients must be insured based on the districts in which they have household registration, and they can avoid differences in between residential areas and the workplace. In addition, to focus on the accessibility of medical care for the aging population without family support, we excluded people who relied on their children for insurance. This excluded approximately 1/3 of the samples.

Regarding the severity of osteoarthritis in patients, we divided the samples into three groups based the number of osteoarthritis visits as follows: patients who visited less than 6 times (hereafter called Sample I), over 6 times but less than 10 times (Sample II), and over 10 times (Sample III). We also observe whether the behavior of the patients when choosing which district to visit was influenced by severity of disease by comparing results. After obtaining the samples, we transformed the osteoarthritis claim data into the data based on the unit of person/year. Owing to the large amount of osteoarthritis patients, the quantity of data would be too large to measure if we conducted assessments using the distance between the patient's residence to that of any hospital. Consequently, we evaluated the accessibility of medical care for patients within the residential regions and

the counties in which the percentage of their visits occurred over 50%, and measured the distance between the centers of residential regions (the countries in which they were insured or registered) and the visited counties (all counties in which the percentage of their visits was over 50%). We defined the distance between the residential region and the county with the most visits as the standard of distinction. The 75th percentile was approximately 10 km; the 90th percentile was approximately 25 km. In this study, if the distance between the two locations was greater than 10 or 25 km, the medical care received was considered cross-regional health care. In other words, Cross-regional health care was used if the distance between the residential region and the county that received the most visits was over 10 (or 25) kilometers; based on this definition, we observed the use of cross-regional health care by patients and performed analysis. In addition, the health state of patients can be measured using the following two variables: the number of visits and whether they have had internal derangement of the knee joint (IDK), or knee replacement.

2.2. Model

The estimative model adopted in this study is defined as:

$$y_{it} = \beta_0 + \beta X_{it} + \varepsilon_{it} \tag{1}$$

where y_{it} is whether the patient i received medical care by visiting a different area in the period t ; y_{it} is 1, the patient received cross-regional medical care. X_{it} includes the factors of visit cost, the characteristics of the patients (age group, insurance status, and health state), and the years. Finally, ε_i is an error term that comprises other factors, which cannot be observed.

Although Equation (1) covers numerous variables that can be observed, several elements still cannot be surveyed in empirical studies. For example, patient visiting habits affect which site is chosen by the patient. To control the effects that influence the decision of the patients and those that cannot be observed, we performed empirical analyses using the fixed-effect logit model, and excluded these variables. We conducted analyses using *Stata 12.0* software, and performed estimations using the *xlogit* command because we considered the variable items as binary variables.

2.3. Samples

We divided the samples into three groups based the number of osteoarthritis visits as follows: patients who visited less than 6 times (hereafter called Sample I), over 6 times but less than 10 times (Sample II), and over 10 times (Sample III). According to Table 1, regarding the osteoarthritis patients of Sample I, male patients comprised 44% of the

group. This result indicates that the rate that females are diagnosed with osteoarthritis is higher than that of males. We selected samples aged from 65 to 85 years old; the average age was 74 years old and the percentage of those aged 70–75 years was the highest among the age groups. According to the insured status of the patients, farmers represent the majority of the samples because the 65–85-year-old patients almost retired. Moreover, patients who had internal derangement of the knee joint (IDK) or received a knee replacement comprised only 1% of the samples; approximately 65% of the samples made less than 40 outpatient visits in a year. On average, the number of outpatient visits was 37 times. By comparing Samples I, II, and III, we determined that the number of visits was affected by osteoarthritis and a high average age, a high number of patients who had received a previous operation, and a high average number of visits.

Table 1: Descriptive Statistics of Variables (All figures except averages are in percentages)

	All			Districts with Abundant Medical Resources			Districts with Moderate Medical Resources			Districts with Scarce Medical Resources		
	Sample I	Sample II	Sample III	Sample I	Sample II	Sample III	Sample I	Sample II	Sample III	Sample I	Sample II	Sample III
Male age (Years)	43.8	42.3	44.5	47.7	45.2	48.3	40.2	37.8	40.5	44.1	43.5	44.2
Average age	74.0	74.2	75.0	74.4	74.5	75.2	73.9	74.0	74.8	74.0	74.3	75.0
65-70	31.1	28.7	24.0	30.4	27.6	22.8	31.4	29.6	24.6	31.5	28.9	24.5
70-75	29.3	30.0	28.5	28.0	28.3	27.4	30.9	32.0	30.5	28.8	29.8	28.1
75-80	25.8	27.4	30.6	27.2	29.3	32.4	25.0	26.1	29.1	25.5	27.0	30.2
80-85	13.8	13.9	16.9	14.4	14.9	17.5	12.7	12.3	15.9	14.2	14.4	17.2
Group of enrollment												
Farmers	46.4	38.9	33.0	33.1	29.5	25.4	73.7	70.8	64.8	30.8	22.2	17.8
Unemployed	22.9	26.1	27.7	26.7	27.8	28.8	9.9	10.9	13.1	32.3	36.1	36.4
Retired soldiers and their families	14.4	18.3	22.4	20.9	24.4	28.1	7.5	9.5	12.2	15.7	20.4	24.7
The others	16.4	16.7	17.0	19.3	18.3	17.7	9.0	8.9	10.0	21.2	21.3	21.1
Health status	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operations	1.2	5.6	5.7	1.1	5.1	5.6	1.4	7.9	7.4	1.1	4.3	4.7
The number of visits												
<40	64.3	45.8	22.9	63.0	43.9	20.9	66.4	49.4	27.0	63.2	44.6	21.8
40-75	30.6	44.5	53.0	31.3	45.4	52.1	29.1	42.2	52.3	31.4	45.6	54.1
>75	5.2	9.7	24.1	5.7	10.7	27.0	4.5	8.4	20.7	5.4	9.8	24.2
Average	37.4	48.8	66.4	38.2	50.2	69.1	36.0	46.6	62.7	37.4	49.3	66.8

Note: Patients had internal derangement of the knee joint (IDK) or received a knee replacement.

By further dividing them into districts with abundant, moderate, and scarce medical resources, we discovered that among all of these districts, females had a higher probability of developing osteoarthritis than males did. Although the average age of these three groups was similar, the age distribution in each group was different: the age of the patients ranged from 80 to 85 in the district with moderate medical resources, which was lower than that

of the patients in the other groups, but the percentage of peasants in this group was much higher than that of the other groups. In addition, the percentage of patients who had received an operation in this group was the highest among the groups, and this group had the highest percentage of patients who did not frequently receive medical care. Moreover, the average number of visits was the lowest in this group compared with that of the other groups.

3. Results

According to Table 2, we determined that regardless of whether 10 or 25 km was used as the dividing point to define cross-regional medical care, the increase in copayment in 2005 increased the use of cross-regional health care. This result contradicts our expectations; therefore, we will discuss the reasons for these results further in the follow-up content. As the age of patients increases, the use of cross-regional medical care decreases, but this trend reverses when patients reach 80 years. The use of cross-regional medical care was differentiated because of the difference in insurance status, and the retired soldiers and their families tended to have a greater possibility of using cross-regional medical care. If the patients had received a knee replacement or other operations, we observed that the out-of-area health care utilization increase. Furthermore, the number of outpatient visits affected the possibility: the higher the number of outpatient visits, the lower the possibility.

By further dividing the samples based on the amount of medical resources available in the districts in which the patients lived, we discovered that the district with scarce medical resources exhibited a greater increase after the copayment raise in 2005. Regardless of whether the regions contained abundant or scarce medical resources, age and insurance status barely affected the use of cross-regional medical care. Patients who lived in the districts with moderate or scarce resources after receiving IDK or a knee replacement exhibited a higher possibility of using cross-regional health care. In addition, people with a high number of visits exhibited a decrease of using cross-regional medical care.

Table 2: Analyses of using Cross-Regional Medical Care by Patients with Osteoarthritis: Fixed-Effect Logit Model (Sample I)

The standard of using cross-regional medical care	All		Districts with Abundant Medical Resources		Districts with Moderate Medical Resource		Districts with Scarce Medical Resources	
	10 km	25 km	10 km	25 km	10 km	25 km	10 km	25 km
The increase in copayment	0.1182**	0.1139**	0.0806**	0.1507**	0.1023**	0.0991**	0.2033**	0.1491**
Age								
70-75	-0.0733**	-0.1470**	-0.0983*	-0.2045**	-0.1021**	-0.1411**	-0.0442	-0.1129*
75-80	-0.0209	-0.0744	-0.0422	-0.1235	-0.0625	-0.0463	-0.0273	-0.1335
80-85	0.1252**	0.1525*	0.0505	0.0409	0.1025	0.1699	0.1331	0.1343
Group of enrollment								
Unemployed	-0.0402	-0.1529*	0.018	0.0063	0.1998*	0.2570*	-0.128	-0.1263
Retired soldiers and their families	-0.1011	-0.3484**	-0.0177	-0.1258	0.1983	0.2408	-0.1156	-0.2767
The others	0.2507**	0.1528*	0.0886	0.1047	0.2035**	0.2301*	0.0712	0.005
Operations	0.3840**	0.3271**	0.3258**	0.3414**	0.4340**	0.3892**	0.3867**	0.2765**
The number of visits								
40-75	-0.2944**	-0.2921**	-0.3523**	-0.3447**	-0.3293**	-0.3190**	-0.2155**	-0.2197**
>75	-0.6667**	-0.5703**	-0.7825**	-0.5507**	-0.7132**	-0.7891**	-0.5269**	-0.4099**
Observations	266,133	118,103	68,493	29,048	105,296	47,382	82,471	35,967

Note: All regressions include years. * and ** indicate significance at 5% and 1% levels respectively.

Table 3 shows the patients who made over 6 but less than 10 visits because of osteoarthritis (Sample II). These samples comprised patients who had severe osteoarthritis, and the increase in copayment increased the use of cross-regional medical care over a distance of 10 km. The inconvenience of moving oppositely possibly increased the probability of using cross-regional health care because the increase in copayment deterred healthier patients from visiting hospitals. Additionally, if we consider 25 km as the dividing line, the use of cross-regional medical care by these patients did not increase, which indicates that they could not travel to overly remote districts to visit hospitals, even if they wanted to use cross-regional health; this is because they may be required to visit the remote district continually. Furthermore, as previously discussed, people who had a high number of visits had a low probability of using cross-regional medical care. Age, insured categories, and whether they have received operations do not seem to be factors that affect the use of cross-regional health care, regarding patients who visited other regions over 6 but less than 10 times one year.

Table 3: Analyses of using Cross-Regional Medical Care by Patients with Osteoarthritis: Fixed-Effect Logit Model (Sample II)

The standard of using cross-regional medical care	All		Districts with Abundant Medical Resources		Districts with Moderate Medical Resource		Districts with Scarce Medical Resources	
	10 km	25 km	10 km	25 km	10 km	25 km	10 km	25 km
The increase in copayment	0.2759*	0.1171	0.3981	0.359	-0.0058	-0.2625	0.4029*	0.3291
Age								
70-75	-0.2616	-0.0797	-1.2133*	-0.4004	-0.0874	0.2226	0.0475	-0.0438
75-80	-0.4822	-0.1171	-1.1089	0.1295	-0.1731	-0.1072	-0.5489	0.0843
80-85	-0.2029	0.4139	-1.5556	0.76	0.1116	0.5231	0.2323	0.7759
Group of enrollment								
Unemployed	-0.0155	0.3763	0.2787	-16.4027	-1.23	0.3142	0.7725	13.6292
Retired soldiers and their families	0.0363	0.2196	0.1326	-16.9233	-0.8411	0.4113	0.9889	13.4251
The others	0.5468	1.0104	0.8946	-15.0378	-0.7486	0.3108	0.716	12.8037
Operations	0.1099	0.0789	-0.2809	-0.6525	0.3126	0.1457	-0.1339	0.6166
The number of visits								
40-75	-0.3067**	-0.4443*	-0.7181*	-0.9790*	-0.1981	-0.0741	-0.1981	-0.5901
>75	-0.6719**	-0.6538	-1.5605**	-2.6590**	-0.453	0.7105	-0.3383	-1.0407
Observations	2,894	1,174	632	247	1,006	429	1,100	376

Note: All regressions include years. * and ** imply significance at 5% and 1% levels respectively.

By comparing the differences in medical resources for the districts included in Sample II, we determined that the patients in Sample II, who lived in a district with abundant resources, had a low probability of using cross-regional medical care if they had a high number of outpatient visits. However, no differences existed between the number of outpatient visits and the probability of using cross-regional medical care, if the patients in Sample II belonged to districts with moderate or scarce medical resources. Because these patients live in regions with ample medical resources, they typically do not choose to use cross-regional health care; the reason for this is the high cost of time and transportation required to make frequent outpatient visits number of outpatient.

The patients who made over 10 visits (Sample III) belonged had severe osteoarthritis. In contrast with Samples II and III, the movement of the Sample III patients may have been

confined because of their health condition. Therefore, according to Table 4, we determined that the influence of copayment adjustment, age, insurance status, and whether they have received operations on the use of cross-regional health care is not substantial. However, people with the same conditions who had a high number of outpatient visits exhibited a decrease of using cross-regional medical care. The use of cross-regional health care by these patients was consequently not affected, regardless of whether the patients lived in districts with abundant medical resources.

Table 4: Analyses of using Cross-Regional Medical Care by Patients with Osteoarthritis: Fixed-Effect Logit Model (Sample III)

The standard of using cross-regional medical care	All		Districts with Abundant Medical Resources		Districts with Moderate Medical Resource		Districts with Scarce Medical Resources	
	10 km	25 km	10 km	25 km	10 km	25 km	10 km	25 km
The increase in copayment	0.1912*	0.174	0.0747	0.0739	0.2827	0.1477	0.2509	0.235
Age								
70-75	-0.0798	-0.1286	-0.2336	-0.4925	0.1966	-0.0751	-0.2233	0.0088
75-80	-0.0352	-0.0613	-0.2088	-0.6531	0.1767	0.4527	-0.0403	-0.0493
80-85	-0.0589	-0.0861	-0.8459	-1.8903	0.0738	0.8736	0.6132	0.4079
Group of Enrollment								
Unemployed	-0.175	0.3302	0.0385	0.5519	1.1795	14.0907	-0.1943	0.88
Retired soldiers and their families	-0.157	-0.0658	0.1728	0.2551	1.5064	14.6857	-0.1987	0.338
The others	0.0799	0.1802	-0.0471	0.1112	0.2444	13.22	-0.0765	-0.6602
Operations	0.135	0.0102	0.1332	-0.2947	0.4562*	0.2988	-0.1285	-0.003
Number of visits								
40-75	-0.587**	-0.567**	-0.908**	-0.747*	-0.587**	-0.683*	-0.487**	-0.457
>75	-0.893**	-1.055**	-1.108**	-1.044**	-0.761**	-1.217**	-0.938**	-0.945**
Observations	5559	2171	1526	619	1638	644	2030	699

Note: All regressions include years. * and ** indicate significance at the 5% and 1% levels respectively.

4. Discussion and Conclusion

We divided osteoarthritis patients into three groups based on the number of hospital visits

made, and if they lived in townships with ample, moderate, or scarce medical resources. We subsequently observed whether their access to medical care was affected by structural, financial, or personal barriers. The results indicate that those who had severe osteoarthritis were not affected by the difference in the amount of medical resources available regarding the use of cross-regional health care. Moreover, only the patients with a moderate osteoarthritis who lived in regions with abundant medical resources typically did not receive cross-regional medical care as their number of outpatient visits increased.

By investigating the effect of financial barriers on medical care access, we discovered that cross-regional medical care use was not evidently affected after the increase in copayment in 2005, and the patients who did not have severe osteoarthritis were more likely to use cross-regional health care. By comparing the differences in medical resources among the residential areas, we discovered that the districts with scarce medical resources had greater possibility of using cross-regional medical care after the increase in copayment in 2005. One explanation might be that there is a capacity constraint that limits outpatient services offered by hospitals. While individuals residing in districts with abundant medical resources reduced their hospital visits due to the price hike, those residing in the districts with moderate or scarce medical resources increased their hospital visits. (Sheu et al., 2010). In other words, because people who lived in districts with abundant medical resources decreased hospital visits after increasing copayment of hospital visit, people who live in regions with moderate or scarce medical resources increased cross-regional health care for hospital visits.

Regarding personal factors, we determined that age, insurance status, and whether the patients have received operations all areas affect the use of cross-regional health care when they do not have severe osteoarthritis. However, as the illness becomes more severe, the differences in personal factors typically disappear. In addition, we observed that the higher the number of visits, the lower the possibility of using cross-regional medical care, regardless of whether patients have been diagnosed with osteoarthritis.

This study has several limitations. First, we used the NHIRD, which lacks information on marital status, education level, family structure, and other socioeconomic variables, such as income; the influence of these variables on medical care access cannot be ignored. In addition, we used partial samples, which exhibited differences between the townships in which the patients are insured and the regions in which they have household registration; thus, this may have caused biased estimate.

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