

# Investigating the Level of Competition between Public Health Centers and Private Clinics in Korea

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## 〈Abstract〉

### Investigating the Level of Competition between Public Health Centers and Private Clinics in Korea

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The purpose of this study is to investigate the level of competition between Public Health Centers (PHCs) and private clinics (PCs) by examining the number of patients that used PHCs vs. PCs, estimating the total amount of revenue generated from outpatient services at both PHCs and PCs, thereby analyzing the financial impacts on PCs derived from the PHCs. We utilized 2011 National Inpatient Sample data (NIS). Using the 20 table containing general information on each individual claims, we integrate it with the 40 table which contains all the diagnostic codes for each claim. Then, we disaggregate the bundled claims into the original individual claims. Overall, 3.1% of outpatient visits are made at PHCs while the rest was made at the PCs (96.9%). Among the total claim costs of 6.34 billion USD (as of 2011), PHCs occupy 2.0% (124 million USD), and 98.0% are contributed to PCs (6.21 billion USD). The estimated economic losses of PCs due to PHCs are summarized as follow; the maximum potential loss is estimated at 198 million USD in total and 7,099 USD per clinic when we include all patient types; the minimum loss is estimated at 71 million USD in total and 2,540 USD per clinic where Medical Aid recipients and the elderly (aged 65 and over) are excluded. Our results confirm the potential economic effect on PCs due to PHCs providing outpatient services. PCs and PHCs are the most important players providing primary care in Korea. Unnecessary competition between PCs and PHCs is not desirable. Health authorities should carefully examine the healthcare services currently provided by PHCs and their impacts on PCs.

**Keywords:** Community (Public) health center, Outpatient clinics, Economic competition, Primary care

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## I . Introduction

Many researchers have indicated that the healthcare delivery system in Korea has been distorted and intertwined[1–5]. The level of competition among healthcare organizations has continued to deteriorate. Moreover, this kind of competition has been taking place not only among hospitals but also among clinics [1,3,4]. Private clinics (PCs) and Public Health Centers (PHCs) have played an important role in providing primary care in Korea. However, their relationship, unfortunately, has been viewed to be competitive rather than collaborative[1,2]. Many doctors working at local clinics consider PHCs as a threat because they provide medical services free of charge or at a reduced rate of ordinary medical fee[6–9]. According to a recent research, general internists believe the services provided by PHCs should be limited, and 66.1% of respondents disagreed that it is necessary for PCs to maintain the collaboration with PHCs in treating patients with chronic diseases[10]. Why do private practitioners distrust PHCs? Is it true that PHCs have been taking away patients from private clinics? If we assume it is true, how much financial losses could arise to PCs from PHCs? Also, how do we evaluate the issue that the activities of PHCs may interrupt fair competitions in providing primary care? However, we could not find solid answers to these questions from the relevant literature. Therefore, we decided to investigate the level of competition between private clinics and PHCs. The purpose of this study was to examine how many patients utilized PHCs vs. PCs, to calculate how much money was generated from outpatient services, and finally estimate the financial impacts on PCs due to PHCs.

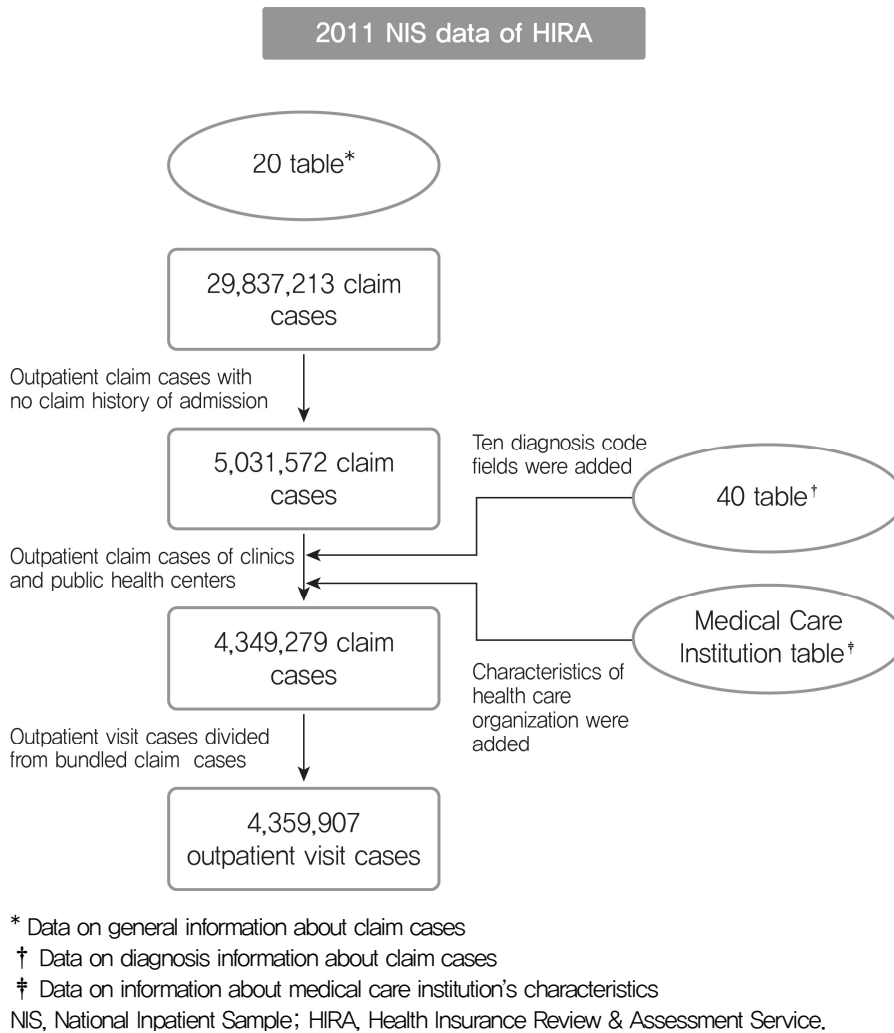
## II . Materials and Methods

### 1. Data source

The National Inpatient Sample (NIS) database of 2011 was used to analyze the level of competition between local PCs and PHCs. NIS is a database containing Korean representative sample of the Health Insurance Review and Assessment Service (HIRA) claims data, which is composed of 13% of the annual inpatient claims (about 700 thousands inpatients) and 1% of annual outpatient claims (about 400 thousands outpatients). The 2011 NIS contains a total sample of 29,837,213 claims from outpatient services where each claim in the database is designed to represent 100 claims [11,12].

### 2. Patient Selection Process

Using the 2011 NIS 20 table containing general information on each individual claims, 5,031,572 outpatient services claims were extracted on those without any history of hospital admissions in 2011. Secondly, the selected NIS 20 table was merged with the NIS 40 table consisting of all the diagnostic codes for each claim. Thirdly, from the total of 5,031,572 outpatient services claims, we extracted 4,349,279 claims from PCs and PHCs. Finally, bundled claims (a healthcare institution can submit a single file of merged claims, called “bundled claims”) were divided into the original individual claims. There were 4,359,907 cases of single claims, which were the subjects of this study(Figure 1). Each individual claim was designed to represent 100 claims in the 2011 NIS database. This sampling weight was applied to all statistical analysis in this study.



<Fig. 1> The data management process using HIRA-NIS database

### 3. Data analysis

Total number of visits and total claim costs were presented according to socio-demographic factors such as gender (male, female), age group (0–19, 20–39, 40–64 years old, and aged 65 and over) and type of health insurance (National Health Insurance, Medical Aid). We also described total number of visits and total claim costs in two ways — by provinces (16) and by metropolitan and non-metropolitan areas. Metropolitan regions refer 7 regions including Seoul, Busan, Incheon, Daegu, Gwangju, Daejeon, Ulsan, and Gyeonggi. 9 provinces including Gangwon, Chungbuk, Chungnam, Jeonbuk,

Jeonnam, Gyeongbuk, Gyeongnam and Jeju were categorized as non-metropolitan regions. Healthcare costs (or expenditure) presented as total claim cost are the sum of costs reimbursed from the National Health Insurance Service in Korea (NHIS cost) and out-of-pocket money paid by beneficiaries (OOP cost). All costs are presented in United States dollars (USD), with an exchange rate of 1 USD equal to 1,151.8 Korean won (the annual average rate in 2011). In order to identify the difference in outpatient utilization between PCs and PHCs,  $\chi^2$  tests were performed. t test was conducted to prove the difference in annual average healthcare costs between PCs and PHCs. ANOVA and Tukey's

B (ad hoc test) test were implemented to identify the difference in healthcare costs by variables including more than two categories: age group and province where medical institution was located.

Lastly, we estimated how much impact PHCs had on PCs. We assumed that if the visits to PHCs had been switched to PCs, each clinic would have more annual patient visits and subsequently would result in additional annual revenues. We operationally defined these two —additional visits and increased revenue as economic impact caused on PCs by PHCs. In order to ensure more accurate evaluation, we decided to take into account the social and healthcare coverage status that exist within Korean society (i.e., all Korean people vs. Koreans except for Medical Aid recipients and patients aged 65 and over). In case of the vulnerable, such as Medical Aid recipients and the elderly (aged 65 and over), treatment of these patient groups is considered to be the one of the primary roles of PHCs. Therefore, we calculated the number of

additional visits and increased revenue per clinic under 2 scenarios; one is with all Korean people; the other is with Korean people excluding the vulnerable people. To calculate the annual number of additional visits and the increased revenue, we used the total number of PCs and PHCs from the Korean Statistical Information Service (KOSIS) data[13]. As of December, 2011, there were 27,837 PCs and 3,468 PHCs (240 Public Health Centers, 17 Hospitalized Public Health Centers, 1,294 Public Health Sub-centers, and 1,917 Public Health Posts) in Korea (Table 1)(KOSIS)[13].

All analyses were completed using SAS, version 9.2 (SAS Institute, Inc., Cary, NC, USA) and SPSS 20 (IBM Corporation, Armonk, NY, USA). All statistical tests were two-sided and a P-value <0.05 was considered statistically significant.

Ethics statement

This study was approved by the Institutional Review Board of Chungnam National University School of Medicine (IRB No. 14-05).

<Table 1> The distribution of private clinics and PHCs by 16 provinces

	Total(%)	Private clinic (%)	PHCs Subtotal (%)	Public Health Center* (%)	Public Health Sub-center (%)	Public Health Post (%)
Total	31,305(100)	27,837(88.9)	3,468(11.1)	257(0.8)	1,294(4.1)	1,917(6.1)
Seoul	7,415(23.9)	7,388(99.6)	27(0.4)	25(0.3)	2(0.0)	0(0.0)
Busan	2,123(6.8)	2,091(98.5)	32(1.5)	16(0.8)	11(0.5)	5(0.2)
Incheon	1,412(4.5)	1,354(95.9)	58(4.1)	10(0.7)	24(1.7)	24(1.7)
Daegu	1,557(5.0)	1,531(98.3)	26(1.7)	8(0.5)	9(0.6)	9(0.6)
Gwangju	853(2.7)	837(98.1)	16(1.9)	5(0.6)	1(0.1)	10(1.2)
Daejeon	986(3.1)	965(97.9)	21(2.1)	5(0.5)	8(0.8)	8(0.8)
Ulsan	561(1.8)	537(95.7)	24(4.3)	5(0.9)	8(1.4)	11(2.0)
Gyeonggi	6,037(19.3)	5,704(94.5)	333(5.5)	46(0.8)	123(2.0)	164(2.7)
Gangwon	924(3.0)	679(73.5)	245(26.5)	20(2.2)	96(10.4)	129(14.0)
Chungbuk	1,056(3.4)	788(74.6)	268(25.4)	13(1.2)	94(8.9)	161(15.2)
Chungnam	1,447(4.6)	1,032(71.3)	415(28.7)	16(1.1)	158(10.9)	241(16.7)
Jeonbuk	1,481(4.7)	1,074(72.5)	407(27.5)	14(0.9)	148(10.0)	245(16.5)
Jeonnam	1,463(4.7)	896(61.2)	567(38.8)	22(1.5)	212(14.5)	333(22.8)
Gyeongbuk	1,737(5.5)	1,180(67.9)	557(32.1)	25(1.4)	219(12.6)	313(18.0)
Gyeongnam	1,882(6.0)	1,472(78.2)	410(21.8)	21(1.1)	171(9.1)	218(11.6)
Jeju	371(1.2)	309(83.3)	62(16.7)	6(1.6)	10(2.7)	46(12.4)

\*Number of Public Health Center includes 17 hospitalized public health centers

### III. Results

There were a total of 436 million visits to the outpatient services at PCs and PHCs with the total claim costs at 6.34 billion USD in 2011. Overall, 3.1% of outpatient visits were made at PHCs and the rest (96.9%) took place at PCs. Among total claim costs of 6.34 billion USD (as of 2011), PHCs occupied 2.0% (124 million USD) and 98.0% were taken to PCs (6.21 billion USD) (Table 2).

Table 2 shows the composition of patient visits and revenues between PCs and PHCs according to socio-demographic factors. Female patients were more likely to utilize primary care institutions such as clinics and PHCs than male patients. Overall, female patients accounted for approximately 60% of total outpatient visits and 60% of revenues. These patterns were similar across PCs and PHCs. The composition of total visits and revenues according to age groups were significantly different between PCs and PHCs. The distribution by age groups in PHCs were significantly skewed to age group 65 and over than that of PCs ( $P < 0.001$ ). In case of PHCs, 60% of patient visits and 70% of revenues resulted from aged 65 and over whereas the group roughly occupied only 20% of visits and revenues in PCs ( $P < 0.001$ ). The beneficiaries of Medical Aid made up about 5–6% of visits (5.0% of PCs and 6.2% of PHCs) and about 6% of revenues (5.9% of PCs and 5.8% of PHCs). Even though the number of visits between clinics and PHCs was statistically significant, the difference was just 1.2%. Regardless of socio-demographic factors, the average claim costs per visit at PHCs was less than that of PCs ( $P < 0.001$ ).

We broke down the number of visits and total claim costs between PCs and PHCs by region and province. PHCs located in non-metropolitan areas (rural areas) had higher proportions in visits (6.3%) and revenues (5.0%) than PHCs in

metropolitan areas (urban areas) (1.6% in visits, 0.7% in revenues, respectively). The province with the highest proportions of visits to PHCs was Jeonnam (7.8% of total visits) and claim costs was Chungnam (8.1% of total claim costs) while Daegu was the province with not only the lowest proportion of total visits (1.1%) but also the least proportion of total claim costs (0.3%) (Table 3).

Lastly, we estimated the economic impacts imposed on PCs by PHCs. If all visits made to PHCs were to be switched over to PCs, each clinic would have additional 483 visits and earn additional 7,099 USD, annually. If the vulnerable group were to be excluded, each clinic would have additional 172 patient visits and 2,540 USD revenue increase. Depending on the province, the number of patient visits ranged between 51 to 622 visits and increased revenue ranged between 1,152 to 8,994 USD. Also, the lowest estimated impacts on PCs were 38 additional visits and 575 USD revenue gain in Gyeonggi while the highest impact was 5,744 additional visits and 84,544 USD revenue gain in Jeju among 16 provinces (Table 4).

### IV. Discussion

Korean Medical Association (KMA) and its supporters insist that PCs are now competing with not only hospitals but also PHCs. In particular, they believe PHCs are also taking away patients from PCs as a result of unfair competition (e.g., almost free of charge or reduced rate for medical fees at PHCs). PHCs are owned and operated by the Korean government. Thus, PCs feel the Korean government should prevent PHCs from providing outpatient services [6–9, 14]. However, there is no empirical evidence that shows how many patients and how much money PHC are taking away from PCs.

<Table 2> The composition of visits and revenues between private clinics and PHCs by socio-demographic factors

		Total	Private clinic	PHC	P-value
Total	No. of visits(%)*	435,993,996 (100)	422,557,308 (96.9)	13,436,687 (3.1)	
	Revenues* ‡	6,338,996,657 (14.5±41.7) (100)	6,214,737,032 (14.7±42.3) (98.0)	124,259,625 (9.3±12.4) (2.0)	<0.001
Gender§	No. of visits (%) †	180,518,252 (41.4)	174,988,221 (41.4)	5,530,031 (41.2)	
	Male	2,699,786,538 (15.0±61.7) (42.6)	2,651,124,975 (15.2±62.7) (42.7)	48,661,563 (8.8±11.9) (39.2)	<0.001   ¶
	No. of visits (%) †	255,475,744 (58.6)	247,569,087 (58.6)	7,906,657 (58.8)	
	Female	3,639,210,118 (14.2±16.5) (57.4)	3,563,612,057 (14.4±16.6) (57.3)	75,598,062 (9.6±12.6) (60.8)	<0.001   ¶
Age group (years)§	No. of visits (%) †	98,427,058 (22.6)	98,114,551 (23.2)	312,506 (2.3)	
	0-19	1,204,463,398 (12.2±30.1) (19.0)	1,202,471,229 (12.3±30.2) (19.3)	1,992,169 (6.4±8.1) (1.6)	<0.001   ¶
	No. of visits (%) †	74,351,559 (17.1)	73,930,561 (17.5)	420,998 (3.1)	
	20-39	1,178,175,324 (15.8±86.7) (18.6)	1,175,483,421 (15.9±87.0) (18.9)	2,691,903 (6.4±8.0) (2.2)	<0.001   ¶
	No. of visits (%) †	162,325,949 (37.2)	157,983,301 (37.4)	4,342,648 (32.3)	
	40-64	2,516,884,614 (15.5±21.2) (39.7)	2,484,684,532 (15.7±21.3) (40.0)	32,200,082 (7.4±9.9) (25.9)	<0.001   ¶
	No. of visits (%) †	100,889,430 (23.1)	92,528,895 (21.9)	8,360,535 (62.2)	
	≥65	1,439,473,320 (14.3±18.9) (22.7)	1,352,097,849 (14.6±19.2) (21.8)	87,375,471 (10.5±13.9) (70.3)	<0.001   ¶
Type of Health Insurance§	No. of visits (%) †	413,925,328 (94.9)	401,326,143 (95.0)	12,599,185 (93.8)	
	NHI	5,963,271,394 (14.4±41.7) (94.1)	5,846,211,008 (14.6±42.3) (94.1)	117,060,386 (9.3±12.4) (94.2)	<0.001
	No. of visits (%) †	22,068,668 (5.1)	21,231,166 (5.0)	837,503 (6.2)	
	Medica l Aid	375,725,263 (17.0±41.9) (5.9)	368,526,024 (17.4±42.6) (5.9)	7,199,239 (8.6±11.7) (5.8)	<0.001

\* Row percentage; † Column percentage; ‡ Revenues mean the total claim costs(mean [USD] ± standard deviation [USD]) (percentage of the total claim costs); § P values calculated with  $\chi^2$  test were significant at a 0.001 level; || P values were calculated with t test; ¶ P values were calculated with an ANOVA and Tukey's B (ad hoc test) test between annual average healthcare costs (total claim cost) and age groups. USD, US dollar; PHC, public health center; NHI, Beneficiary of National Health Insurance

<Table 3> The composition of visits and revenues between private clinics and PHCs by region and province

		Total	Private clinic	PHC	P-value	
Total	No. of visits(%)*	435,993,996 (100)	422,557,308 (96.9)	13,436,687 (3.1)		
	Revenues* †	6,338,996,657 (14.5±41.7) (100)	6,214,737,032 (14.7±42.3) (98.0)	124,259,625 (9.3±12.4) (2.0)	<0.001	
Region ‡	Metropolitan area	No. of visits (%)*	295,353,478 (100)	290,760,849 (98.4)	4,592,629 (1.6)	
		Total claim costs* †	4,352,532,147 (14.7±49.3) (100)	4,322,885,901 (14.9±49.7) (99.3)	29,646,247 (6.5±10.3) (0.7)	<0.001   ¶
	Non-metropolitan area	No. of visits (%)*	140,640,518 (100)	131,796,459 (93.7)	8,844,058 (6.3)	
		Total claim costs* †	1,986,464,509 (14.1±16.9) (100)	1,891,851,131 (14.4±17.1) (95.2)	94,613,378 (10.7±13.1) (5.0)	<0.001   ¶
Province ‡	Seoul	No. of visits (%)*	89,497,689 (100)	88,228,981 (98.6)	1,268,709 (1.4)	
		Total claim costs* †	1,339,145,388 (15.0±77.0) (100)	1,334,156,180 (15.1±77.5) (99.6)	1,268,709 (3.9±3.7) (0.4)	<0.001   ¶
	Busan	No. of visits (%)*	30,803,595 (100)	30,402,395 (98.7)	401,200 (1.3)	
		Total claim costs* †	462,765,251 (15.0±43.2) (100)	461,034,919 (15.2±43.4) (99.6)	1,730,332 (4.3±4.1) (0.4)	<0.001   ¶
Province ‡	Incheon	No. of visits (%)*	22,784,985 (100)	22,287,481 (97.8)	497,504 (2.2)	
		Total claim costs* †	311,370,920 (13.7±15.8) (100)	307,134,496 (13.8±15.8) (98.6)	4,236,424 (8.5±12.3) (1.4)	<0.001   ¶
	Daegu	No. of visits (%)*	23,236,983 (100)	22,986,378 (98.9)	250,604 (1.1)	
		Total claim costs* †	370,511,798 (15.9±23.1) (99.7)	369,321,931 (16.1±23.2) (99.7)	1,189,866 (4.7±5.7) (0.3)	<0.001   ¶
Province ‡	Gwangju	No. of visits (%)*	11,248,473 (100)	11,078,174 (98.5)	170,299 (1.5)	
		Total claim costs* †	177,646,742 (15.8±80.0) (100)	176,654,246 (15.9±80.6) (99.4)	992,497 (5.8±5.9) (0.6)	<0.001
	Daejeon	No. of visits (%)*	15,485,808 (100)	15,271,306 (98.6)	214,502 (1.4)	
		Total claim costs* †	234,579,198 (15.1±20.0) (100)	233,643,491 (15.3±20.1) (99.6)	935,707 (4.4±4.4) (0.4)	<0.001
Ulsan	No. of visits (%)*	9,149,756 (100)	9,006,556 (98.4)	143,200 (1.6)		
	Total claim costs* †	126,736,442 (13.9±16.7) (100)	125,852,619 (14.0±16.8) (99.3)	883,823 (6.2±8.9) (0.7)	<0.001	

Gyeonggi	No. of visits (%)*	93,146,189 (100)	91,499,578 (98.2)	1,646,611 (1.8)	<0.001
	Total claim costs* †	1,329,776,408 (14.3±18.3) (100)	1,315,088,019 (14.4±18.4) (98.9)	14,688,389 (8.9±14.3) (1.1)	
Gangwon	No. of visits (%)*	12,245,601 (100)	11,360,293 (92.8)	885,308 (7.2)	<0.001
	Total claim costs* †	177,154,298 (14.5±18.4) (100)	167,355,500 (14.7±18.6) (94.5)	9,798,798 (11.1±14.0) (5.9)	
Chungbuk	No. of visits (%)*	14,843,831 (100)	14,077,125 (94.8)	766,705 (5.2)	<0.001
	Total claim costs* †	214,539,403 (14.5±17.9) (100)	205,629,267 (14.6±18.1) (95.8)	8,910,136 (11.6±14.4) (4.3)	
Chungnam	No. of visits (%)*	20,885,671 (100)	19,289,661 (92.4)	1,596,010 (7.6)	<0.001
	Total claim costs* †	296,219,098 (14.2±16.3) (100)	274,069,805 (14.2±16.2) (92.5)	22,149,293 (13.9±17.1) (8.1)	
Jeonbuk	No. of visits (%)*	19,007,064 (100)	17,988,059 (94.6)	1,019,005 (5.4)	<0.001
	Total claim costs* †	268,772,510 (14.1±17.2) (100)	258,493,879 (14.4±17.5) (96.2)	10,278,632 (10.1±11.2) (4.0)	
Jeonnam	Total claim costs* †	230,213,889 (13.2±14.4) (100)	218,775,249 (13.6±14.6) (95.0)	11,438,640 (8.4±9.7) (5.2)	<0.001
Gyeongbuk	No. of visits (%)*	24,160,475 (100)	22,385,562 (92.7)	1,774,913 (7.3)	<0.001
	Total claim costs* †	348,423,804 (14.4±17.3) (100)	329,484,203 (14.7±17.6) (94.6)	18,939,601 (10.7±12.2) (5.7)	
Gyeongnam	No. of visits (%)*	26,092,990 (100)	24,850,681 (95.2)	1,242,309 (4.8)	<0.001
	Total claim costs* †	364,646,572 (14.0±17.2) (100)	352,796,788 (14.2±17.5) (96.8)	11,849,784 (9.5±10.8) (3.4)	
Jeju	No. of visits (%)*	5,903,539 (100)	5,705,141 (96.6)	198,398 (3.4)	

\* Row percentage; † Revenues mean the total claim costs (mean [USD] ± standard deviation [USD]) (percentage of the total claim costs); ‡ P values calculated with  $\chi^2$  test were significant at a 0.001 level; § P values were calculated with t test; || P values were calculated with an ANOVA and Tukey's B (ad hoc test) test between annual average healthcare costs (total claim cost) and provinces. USD, US dollar; PHC, public health center.



<Table 4> The estimated economic impacts on private clinics where PHC patients are redirected to clinics

		The total number of visits of PHC in 2011	The estimated increased number of visits per clinic in 2011	Total revenue increase due to patient redirection from PHCs to private clinics in 2011 (USD)	The average increase of revenue per clinic in 2011 (USD)
All disease groups	All Korean people	13,436,688	483	197,619,300	7,099
	Excluding Medical Aid beneficiary or persons aged 65 and over	4,781,049	172	70,694,295	2,540
Metropolitan region	All Korean people	12,599,185	453	183,535,248	8,994
	Excluding Medical Aid beneficiary or persons aged 65 and over	5,076,152	182	75,449,226	1,152
Non-metropolitan region	All visits	4,592,629	622	68,280,897	1,957
	Excluding Medical Aid beneficiary or persons aged 65 and over	376,204	51	6,058,784	6,179
Seoul	All Korean People	4,592,629	622	68,280,897	9,242
	Excluding Medical Aid beneficiary or persons aged 65 and over	376,204	51	6,058,784	820
Busan	All Korean People	8,844,058	4,230	126,950,618	60,713
	Excluding Medical Aid beneficiary or persons aged 65 and over	204,501	98	3,156,193	1,509
Incheon	All Korean People	1,268,709	937	19,184,804	14,169
	Excluding Medical Aid beneficiary or persons aged 65 and over	163,602	121	2,273,922	1,679
Daegu	All Korean People	401,200	262	6,083,972	3,974
	Excluding Medical Aid beneficiary or persons aged 65 and over	92,502	60	1,514,351	989
Gwangju	All Korean People	497,504	594	6,855,891	8,191
	Excluding Medical Aid beneficiary or persons aged 65 and over	69,601	83	1,170,306	1,398
Daejeon	All Korean People	250,604	260	4,026,456	4,172
	Excluding Medical Aid beneficiary or persons aged 65 and over	39,101	41	630,490	653
Ulsan	All Korean People	170,299	317	2,715,615	5,057
	Excluding Medical Aid beneficiary or persons aged 65 and over	65,301	122	971,747	1,810

Gyeonggi	All Korean People	214,502	38	3,281,778	575
	Excluding Medical Aid beneficiary or persons aged 65 and over	570,307	100	7,365,236	1,291
Gangwon	All Korean People	143,200	211	2,001,001	2,947
	Excluding Medical Aid beneficiary or persons aged 65 and over	385,404	568	5,389,291	7,937
Chungbuk	All Korean People	1,646,611	2,090	23,666,098	30,033
	Excluding Medical Aid beneficiary or persons aged 65 and over	263,702	335	3,482,526	4,419
Chungnam	All Korean People	885,308	858	13,042,024	12,638
	Excluding Medical Aid beneficiary or persons aged 65 and over	480,905	466	7,014,455	6,797
Jeonbuk	All Korean People	766,705	714	11,199,521	10,428
	Excluding Medical Aid beneficiary or persons aged 65 and over	392,102	365	5,712,274	5,319
Jeonnam	All Korean People	1,596,010	1,781	22,676,296	25,308
	Excluding Medical Aid beneficiary or persons aged 65 and over	479,506	535	6,844,023	7,638
Gyeongbuk	All Korean People	1,019,005	864	14,643,416	12,410
	Excluding Medical Aid beneficiary or persons aged 65 and over	727,507	617	10,373,840	8,791
Gyeongnam	All Korean People	1,361,409	925	18,453,767	12,537
	Excluding Medical Aid beneficiary or persons aged 65 and over	404,104	275	6,157,279	4,183
Jeju	All Korean People	1,774,913	5,744	26,124,242	84,544
	Excluding Medical Aid beneficiary or persons aged 65 and over	66,700	216	824,182	2,667

USD, US dollar; PHC, public health center

Based on our result, PHCs comprised 3.1 % of total visits and 2.0% of total revenues. Even though these shares may appear trivial, there could be different perspectives toward this issue depending on political stance. Some supporters may insist that the current functions of PHCs are limited and therefore outpatient services at PHCs

should be expanded in the near future. On the other hand, protestors against PHCs believe that PHCs are taking away a considerable amount of patient visits and revenues from PCs, pointing to the result of this study. In particular, the average claim costs per visit is cheaper in PHCs (9.3 UDS) than in PCs (14.7 USD), which may be viewed as a

solid evidence of unfair competition (Table 2). In sum, even though the proportions PHCs make up in terms of patient visits and revenues may appear very small, the interpretation should be approached more carefully.

Economic impacts, if all visits made at PHCs were to be switched over to PCs, were estimated to be ranging from 172 to 483 additional annual visits and from 2,540 to 7,099 USD annual revenue increases (Table 4). As noted, we calculated economic impacts in two ways: first, by including all Korean people because the main purpose of establishing PHCs within each district is to treat not only the vulnerable people but all people within the community; second, by excluding the vulnerable people from all Korean people because PHCs are actually perceived as an institution serving the vulnerable such as Medical Aid beneficiaries or persons aged 65 and over. For example, The low-income population are more frequently utilizing community health centers (CHC) compared with the higher income groups [15]. We believe these approaches were reasonable.

From this study, we had interesting findings that the proportion of Medical Aid recipients utilizing PHCs was 6.2% of total visits, slightly higher than PCs with 5.0% of total visits ( $P < 0.001$ ); and the proportion of patients using PHCs are revenues compared to 22% of visits and revenues in PCs, respectively ( $P < 0.001$ ) (Table 2). This phenomenon might be interpreted as the main users of PHCs may not be actually the entire group of vulnerable people such as beneficiaries of Medical Aid but just the elderly people of age 65 and over.

Lastly, according to our results, PCs located in rural areas observed larger economic impacts than PCs in urban area (Table 3), (Table 4). However, the doctors in Seoul are more fiercely against the outpatient services at PHCs than the physicians in

other regions. This may be due to the fact that the overall level of competition in the metropolitan area is higher than in other regions (i.e., the doctors of local clinics in Seoul area are competing with PHCs but also with hospitals.) and therefore, PCs in urban areas might react more sensitively to the overlapping activities of PHCs. Therefore, health authorities should carefully review the current health services provided by PHCs to determine whether PHCs have increased the volume of patients without considering the negative effects on PCs or whether they have provoked unnecessary misunderstandings among PCs, or whether they have increased the volume of free medical services for the elderly in order to help an incumbent mayor collect more votes in the election [6–9,14].

This study has some limitations. First, we assumed that if the visits to PHCs were switched over to PCs, each clinic will have additional annual visits and the increased annual revenue. However, some experts may criticize this approach as too radical. Nevertheless, we wanted to present the level of competition in monetary value. We believe our approach was not the perfect method but still a meaningful attempt to grasp the whole picture of financial losses incurred by PCs from the PHCs. Second, the estimated total financial losses could be increasing if we include the service fees which are not covered by National Health Insurance. However, including uncovered service fees is almost impossible and we only used total claim costs as revenues, which is a limitation of this study. In addition, the estimated financial losses per clinics could be also underestimated because we used the whole number of clinics as denominator. Among 27,837 PCs, the considerable number of clinics might be not competing with PHCs and might be not providing medical services. However, we assumed all clinics are primary care

institutions[16]. Therefore, the estimated financial losses could be treated as minimum effects. Third, while we estimated the financial losses, we did not judge whether these losses could be serious or acceptable. In order to overcome the limitations of this study, we suggest that some essential follow-up studies should be performed in the near future. First, we need to find the answers regarding who is a primary care physician? or how many local clinics are providing primary care? This will be very difficult but will be an essential process to normalize the primary care in Korea. Second, an in-depth study is need to analyze the characteristics of patients who utilize PHCs. For example, we need to determine who are the vulnerable patients that should be under the care of PHCs.

## V. Conclusion

From this study, we estimated the level of competition between PCs and PHCs using the proportion of visits and the proportion of revenue and calculated the potential financial losses of PCs due to PHCs. PCs and PHCs are the most important players providing primary care in Korea. Competitive relationship between PCs and PHCs does not serve to improve the primary care in Korea. Unfortunately, the primary care in Korea has been evaluated to be in poorer condition than the systems in other countries [2,4,17,18]. Health authorities should carefully review the current activities of PHCs. If there is a unnecessary or overlapping outpatient services provided at PHCs, these activities should be reduced and abolished to promote collaborative relationship between PCs and PHCs[19].

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