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Disparity in Health Infrastructure Supporting Pregnancy and Childbirth

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I Introduction

I Introduction

Not only is Korea's birth rate dropping, but its health infrastructure for pregnancy and childbirth is shrinking as well. The number of obstetrical (and gynecological) specialists per 1,000 newborns has been declining in recent years in Korea, to 11.79 in 2013, fewer by 1.14 than the OECD average of 12.93.[1] On the other hand, the maternal mortality rate in Korea has been rising steadily, and consistently hovers above those of most other OECD member states. The rapid aging of the population coupled with the declining birth rate has also been accompanied by an increasing number of late-age births. As a matter of fact, high-risk mothers, including those less than 20 years old, older mothers (aged 35 or older), mothers at risk of premature birth (less than 37 weeks into pregnancy), and mothers who have given birth multiple times, make up 27 percent of all mothers in Korea, calling for urgent improvements to be made to the related health infrastructure (Statistics Korea, 2012). Older and multiple-birth mothers, in particular, will likely increase due to the growing tendency of women to get married later in life and increasing prevalence of infertility. However, Korea's health infrastructure for pregnancy and childbirth re-

1) As of 2013.

mains largely incapable of providing these women with the services they need, as intensive care facilities for mothers and newborns and specialized facilities catering to high-risk mothers and babies are lacking.

As the declining birth rate is now a serious social issue in Korea, the Korean government has begun actively addressing the situation, starting with the enactment of the Framework Act on Low Birth Rate in an Aging Society (FALBR) in 2005. The central and local governments in the country have implemented diverse childbirth support measures. The policy measures for pregnancy and childbirth can be divided into three types: policies for expanding the related health infrastructure; those for subsidizing the costs of pregnancy and childbirth; and the remainder for increasing social services for mothers and newborns. Of these, the policies for expanding the health infrastructure form the fundamental bedrock of all pregnancy and childbirth policies. Nevertheless, the Korean government has so far measured the success of its infrastructure policy in terms of the increases in the numbers of facilities or budget amounts, rarely taking into account the effectiveness and equity of these measures, factors that are crucial to maintaining social support. In response to this deficiency, this study analyzes and evaluates the current status of the health infrastructure for pregnancy and childbirth in Korea in terms of accessibility, utilization, adequacy of utilization, and

outcomes so as to help policymakers develop a more equitable and socially inclusive system of support for childbearing women and their infants.

II

Literature Review

II Literature Review

The Standard Unabridged Korean Dictionary, published by the National Institute of Korean Language, defines *hyeong-pyeongseong*, the Korean word for "equity," as "the quality of being balanced." Equity, along with efficiency, is a philosophical concept often mentioned in social and policy discourses, and is a favored concept in welfare economics, which views social welfare as a matter of efficiently and fairly distributing resources. In economics, equity is seen as having four dimensions: namely, equality, rights, fairness, and desert.[2] Equality in economics demands that income and wealth be distributed evenly among all members of society, who are entitled to live free of discrimination due to outward differences. Rights entail guarantees of fair and legitimate ownership for everyone, and fairness requires that economic decisions be made according to pre-defined rules based on societal consensus. Desert refers to the qualifications one has for claiming wealth, services, or benefits as one's own. Generally, people are considered undeserving of wealth if they have accumulated it through illegal, unethical, or other socially unacceptable means.

The requirement of equity is satisfied when all of these four

2) Lee (2001). See "III. Welfare Economics."

dimensions are satisfied. Emphasizing one or more of these dimensions at the expense of the others may ultimately serve to undermine equity. If one were to pursue the extreme position that everyone should be given an equal share of social wealth regardless of rights, fairness, and desert, such equality would not be equity. Extreme egalitarianism may require individuals to return almost all of their wealth and property to society, leaving shares for themselves equal to those of others, no matter how much work they put into acquiring such wealth by exercising their rights justly. Equity, in other words, demands that resources be distributed not only equally but also fairly and legitimately to those who deserve them.

An appropriate and feasible economic policy is one that meets not only this requirement of equity but also that of efficiency. Economics is, in essence, a discipline focused on finding the most efficient and equitable distribution of resources. Okun (1975) views redistribution policy as inefficient because it values the equity of distribution above all else. Blank (2002) and Blinder (1987), on the other hand, argues that there are distribution policies that satisfy both equity and efficiency requirements. Redistribution policies may generate inefficiencies in the short term, but it is possible to find policies that have only minimal impact on efficiency. Such policies would pursue both efficiency and equity.

Some view social equity as entailing the need to allocate

maximum benefits to those who are the most socially disadvantaged (Hart, 1974, and Harmon, 1974, quoted in Lim, 2009, p. 1). Equity would demand that income, as a societal resource, be redistributed to the socially vulnerable. The economic cost of such redistribution, however, may outweigh the social benefit thereof (Okun, 1975, quoted in Jang, 2012), thereby compromising efficiency. Therefore, it may be difficult, if not impossible, to pursue both principles simultaneously.

If equity at the level of policymaking concerns the redistribution of social resources, it may support selective welfare policies. The general consensus is that selective welfare policies are efficient but inequitable, while universal welfare policies are equitable yet inefficient (Lee, 2004; Gustaffson and Staffort, 1998, quoted in Jang, 2012, p. 128). Equity and efficiency can be mutually complementary, but also exclusive and contradictory. Social equity consists in giving all members of society their due (Lim, 2009, p. 11), based on a comparison of the similarities and differences among individuals. Equity in policymaking thus requires the definition of social needs, and ensuring the fair distribution of resources, wealth, benefits, or services according to the needs thus defined.

Equity in health policies is understood as the absence of inequities or unjustifiable disparities. In its report, titled Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care, the Institute of Medicine of the U.S. National Academies

defines "disparities in healthcare" as "differences in the quality of healthcare that are not due to access-related factors or clinical needs, preferences, or appropriateness of intervention" (quoted in Kim et al., 2013, p. 44). More specifically, we may understand equity in health as the absence of disparities on a number of dimensions: namely, (1) disparities in access to medical care; (2) disparities in utilization of medical care; and (3) disparities in outcomes of access, i.e., the state and conditions of health. These disparities may arise due to sex, age, socio-economic status, such as income and education, and/or location (urban vs. rural).

The equity of healthcare for pregnancy and childbirth is therefore achieved when society guarantees equal changes of access to and utilization of the medical infrastructure needed by all childbearing and pregnant women, fetuses, and infants with the same medical needs so as to ensure fairness in the health outcomes of these beneficiaries. Accessibility is the primary precondition for ensuring the equal utilization of health services and equal health outcomes (i.e., birth outcomes). An equitable healthcare system would thus require that the access of mothers and children to healthcare and medicine be guaranteed as a right to equal opportunity for utilizing medicine (Mooney, 1983).

There are two main types of obstacles that serve to hinder access to healthcare. The first arises with respect to the ability

of beneficiaries to afford the healthcare they seek. The other has to do with the availability of healthcare personnel, facilities, and infrastructure. The most important part of the infrastructure for pregnancy and childbirth is the health infrastructure supporting pregnancy and childbirth, the core elements of which are personnel and facilities (AHRQ, 2012 and 2013). The overall number, region-by-region distribution, and quality of healthcare personnel—who are the providers of health services and who account for the largest share of healthcare costs--are decisive factors of the accessibility of healthcare (Sinoens et al., 2005). Medical facilities, encompassing personnel, equipment, and technologies, also have a decisive impact on the distribution and utilization of medical resources (Oh et al., 2006). Much of Korea's medical and healthcare resources are concentrated in urban areas, in accordance with the market principle of purchasing power. While this regional gap in the availability of medical resources is prevalent across Korea (Jang, 2015), there are a number of regions in the country that can easily be categorized as pregnancy- and childbirth-risk areas. This state of healthcare in Korea warrants further consideration in terms of equity.

Pregnancy and childbirth are personal affairs, but they are also major life events that require healthcare policy intervention. Pregnancy and childbirth are a natural process, but they are also critical events that have the potential to

gravely endanger the health and lives of mothers and infants. There is extensive literature demonstrating the involvement of various social and economic factors in maternal and infantile deaths, thereby affirming the need for policy intervention. Korea's Framework Act on Health and Medical Services (FAHMS, Statute No. 9847) states that "national and local government organizations shall do their best to satisfy the basic medical and healthcare needs of the public equitably." This study thus assesses the accessibility, utilization, and quality of the pregnancy and childbirth health infrastructure in Korea by region in order to determine how equitably the healthcare resources supporting pregnancy and childbirth are distributed in the country. More specifically, this study first surveys the region-by-region distribution of medical institutions (OB/GYN hospitals, clinics, and specialist and general hospitals), public healthcare institutions (public healthcare centers, local healthcare outlets, and public diagnostic centers), and midwifery facilities, and assesses whether the current distribution of such facilities and resources is appropriate in consideration of the distribution of demographic factors (e.g., number of childbearing-age women, birth rates, etc.). The goal is to determine how accessible these resources are from the perspective of availability. Second, this study surveys the utilization of the health infrastructure for pregnancy and childbirth and uses indices, such as the Adequacy of Prenatal Care Index (APCI), to

determine the adequacy and equity of use of the existing infrastructure. Third, this study measures the equity of healthcare outcomes for pregnant women, mothers, and children by surveying adverse birth outcomes, such as the incidence of underweight newborns and premature births. Based on these assessments, this study makes policy suggestions for improving the equity of the health infrastructure for pregnancy and childbirth in Korea.

III

Results

1. Accessibility of health infrastructure
2. Utilization and adequacy of use
3. Outcomes (birth outcomes)

III Results

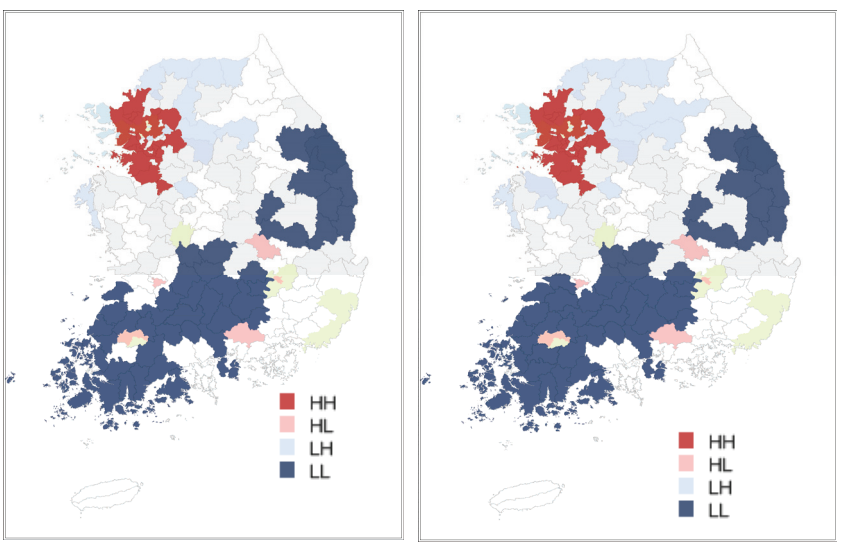
1. Accessibility of health infrastructure

In order to analyze the accessibility of Korea's health infrastructure for pregnancy and childbirth in terms of availability, this study first surveyed the region-by-region distribution of medical institutions (OB/GYN hospitals and clinics and specialist and general hospitals), public healthcare institutions (public healthcare centers, local healthcare outlets, and public diagnostic centers), and midwifery facilities. In a similar manner, Gam et al. (2007) attempted to gauge the accessibility of health services in terms of physical accessibility. This study tries to ascertain how equitable the current region-by-region distribution of such facilities is based on the given distribution of demographic factors, i.e., number of childbearing-age women and number of babies born. This follows the approach of Lee (1998), which defines "accessibility" as "opportunities for individuals who desire services to use the services or related facilities they need." This study then adopts a spatial econometrics approach to determining the appropriateness of the balance between supply and demand in health services for pregnancy and childbirth, which requires the identification of the spatial characteristics pertaining to the supply and demand

of the health infrastructure.

For the demand side, this study calculated the local Moran indices based on the populations of the cities, counties, and boroughs of Korea in order to perform a spatial analysis. A cluster analysis was performed on the total female populations and populations of childbearing-age women (aged 15 to 49) among the mid-year populations of cities, counties, and boroughs, as counted by Statistics Korea (2013). Figure 1 presents the results of this analysis.

[Figure 1] Local Moran's I Analysis of the Female Populations and Childbearing-Age Women in Korean Cities, Counties, and Boroughs



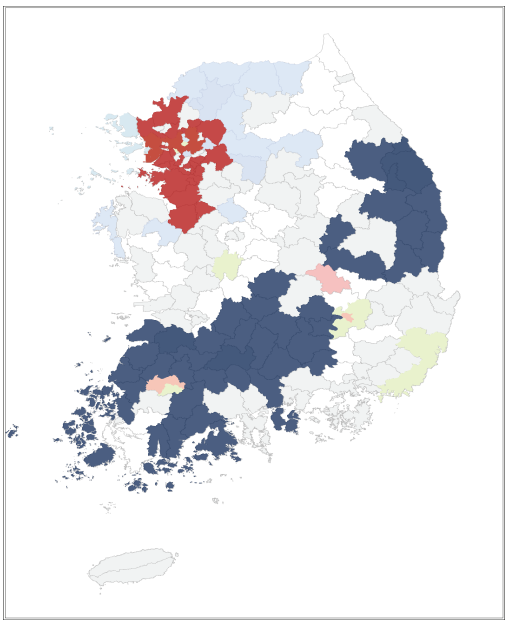
(a) Female populations (b) Childbearing-age women populations

Note: "HH" stands for "hot spot clusters"; "LL," for "cold spot clusters"; "HL," for "outlier hot spots"; and "LH" for "outlier cold spots."
Source: Lee et al. (2015), p. 100.

The distribution of childbearing-age women in Korea closely overlaps with that of the overall female population of the country. The high clusters are concentrated in the Seoul-Gyeonggi region, while the low clusters are found in the Honam region (Jeollabuk-do and Jeollanam-do), Gangwon-do, and Gyeongsangbuk-do. Even in these low-cluster provinces, however, a few cities, such as Jeonju, Gumi, and Jinju, boast high clusters.

Figure 2 shows the demographic characteristics of each province based on the numbers of newborns registered in the birth statistics from January 2013 to April 2014. The birth statistics encompass a total of 435,900 cases, excluding those with unknown or uncertain birth locations, birth weeks, weights of newborns, and ages of mothers. The analysis again revealed considerable overlap between the distribution of newborns and distribution of the female population, with high clusters found in the Seoul-Gyeonggi region, Gumi, and Gwangju.

[Figure 2] Local Moran's I Analysis of the Newborn Population



Source: Lee et al. (2015), p. 107.

Table 1 presents the results of the cluster analysis based on the populations of childbearing-age women and newborns, and shows the numbers of high and low clusters. The parentheses indicate the numbers of "HL" (low clusters in high-cluster provinces) and "LH" (high clusters in low-cluster provinces).

〈Table 1〉 Cluster Analysis on Populations of Childbearing-Age Women and Newborns

Metropolitan city / province	Childbearing-age women		Newborns	
	High Cluster	Low Cluster	High Cluster	Low Cluster
Nationwide	59(6)	71(50)	55(4)	66(45)
Seoul	21(0)	1(0)	21(0)	2(0)
Busan				
Daegu	1(1)		1(1)	
Incheon	6(0)	4(0)	6(0)	4(0)
Gwangju	2(2)		2(2)	
Daejeon				
Ulsan				
Sejong				
Gyeonggi-do	25(0)	7(0)	22(0)	8(0)
Gangwon-do		9(4)		8(4)
Chungcheongbuk-do		2(1)		2(1)
Chungcheongnam-do	1(0)	4(1)	2(0)	2(0)
Jeollabuk-do	1(1)	10(10)		9(9)
Jeollanam-do		18(18)		15(15)
Gyeongsangbuk-do	1(1)	9(9)	1(1)	9(9)
Gyeongsangnam-do	1(1)	7(7)		7(7)
Jeju-do				

The distribution of the health infrastructure for pregnancy and childbirth[3] by city and province, as of 2015, is shown in Table 2 below. Whereas metropolitan cities, in general, have greater numbers of OB/GYN hospitals and/or general and specialist hospitals with OB/GYN departments than do provinces, provinces clearly have more public healthcare centers, outlets, and diagnostic centers than do metropolitan cities. In particular, only six metropolitan cities and provinces had between one and five specialist hospitals each.

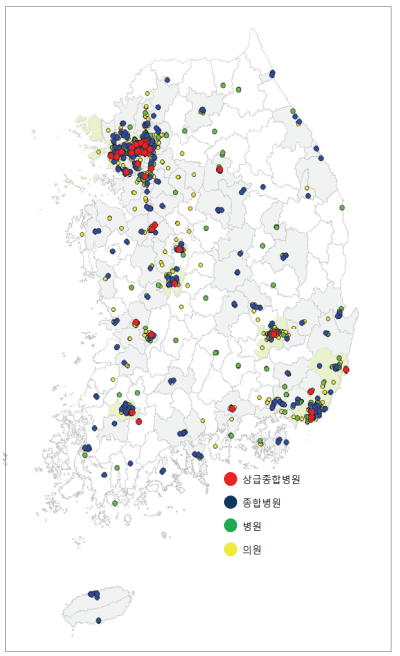
3) Health Insurance Review and Assessment Service (HIRA).

〈Table 2〉 Availability of OB/GYN Care in Korean Cities and Provinces

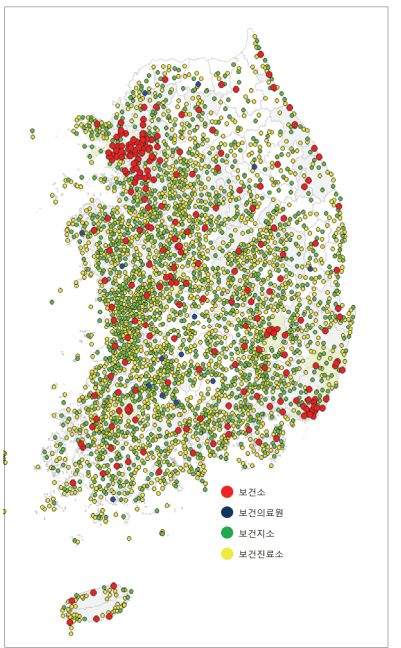
Type	Private medical institutions				Public medical institutions			Midwifery facilities	Total
	OB/GYN hospitals	OB/GYN clinics	General hospitals	Specialist hospitals	Public healthcare centers	Local healthcare outlets	Public diagnostic centers		
Seoul	48	390	54	4	25	4	0	5	530
Busan	29	76	27	2	16	11	5	6	172
Daegu	18	85	11	0	8	9	9	1	141
Incheon	10	65	15	1	10	27	25	2	155
Gwangju	9	43	14	2	5	1	10	1	85
Daejeon	6	50	10	0	5	8	8	1	88
Ulsan	8	31	5	0	5	8	11	0	68
Sejong	0	4	0	0	1	9	6	0	20
Gyeonggi-do	52	276	52	5	45	124	162	9	725
Gangwon-do	11	33	13	0	18	96	129	2	302
Chungcheongbuk-do	5	47	10	0	13	95	158	1	329
Chungcheongnam-do	5	45	12	0	14	150	235	0	461
Jeollabuk-do	10	54	12	0	10	149	239	0	474
Jeollanam-do	12	22	21	0	19	215	329	4	622
Gyeongsangbuk-do	11	55	19	2	23	220	313	0	643
Gyeongsangnam-do	25	64	19	0	20	171	219	1	519
Jeju-do	0	20	6	0	6	10	47	1	90
Nationwide	259	1360	300	16	243	1307	1905	34	5424

Figure 3 presents the distribution of medical and health facilities, divided among private OB/GYN hospitals and clinics, specialist hospitals, general hospitals, and advanced general hospitals, and public institutions (public healthcare centers, outlets, and diagnostic centers) by city and province. The green dots, grey zones, and white zones represent the metropolitan cities, cities, and counties, respectively, of the Korean administration system, as of 2013.

[Figure 3] Distribution of Private and Public Health Facilities in Korea



(a) Private medical institutions with OB/GYN departments



(b) Public health institutions

Source: Lee et al. (2015), p. 109.

The global Moran's I values, based on the number of available facilities in each city, county, and borough in Korea, are listed in Table 3 below. All of the facilities, except for general hospitals, have spatial autocorrelation tendencies that affirm the spatial dependency of those facilities.

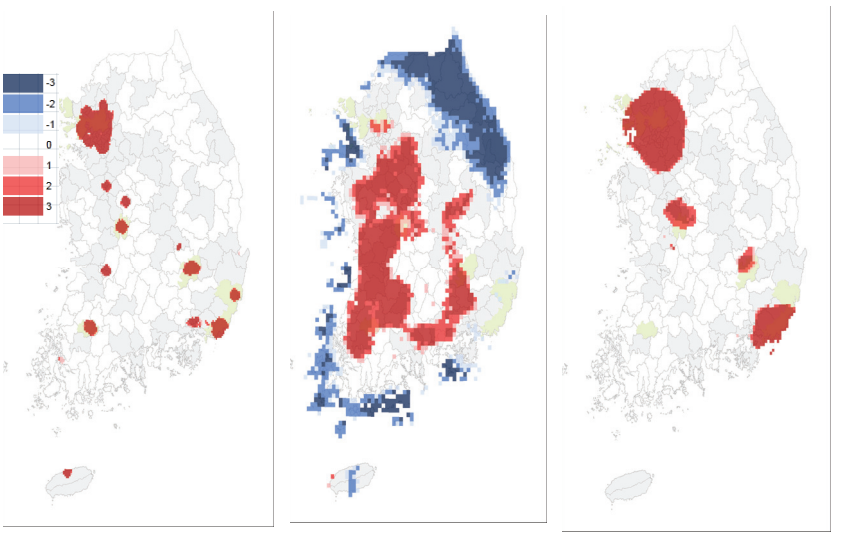
〈Table 3〉 Results of the Global Moran's I Analysis

	Moran's I Index	Z-Score	P-Value	Significance
All facilities	0.16	13.2	0.00	〈1%
Advanced general hospitals	0.03	2.6	0.01	〈5%
General hospitals	0.01	1.2	0.22	Random
OB/GYN hospitals	0.06	5.1	0.00	〈1%
OB/GYN clinics	0.18	15.7	0.00	〈1%
All public institutions	0.33	27.3	0.00	〈1%
Public healthcare centers	0.10	8.9	0.00	〈1%
Public healthcare clinics	0.03	2.8	0.01	〈5%
Local healthcare outlets	0.30	24.4	0.00	〈1%
Public diagnostic centers	0.34	27.4	0.00	〈1%

Figure 4 shows the Getis-Ord statistics analysis of the spatial characteristics of private and public healthcare institutions for pregnancy and childbirth. Private medical institutions with OB/GYN departments are found mainly in the Seoul-Gyeonggi region and metropolitan cities, as well as in a few large cities in which province-wide urban resources are concentrated, such as Jeonju, in Jeollabuk-do, and Gumi, in Gyeongsangbuk-do. Public health institutions, on the contrary, form hot spots across much wider areas, such as the Chungcheong and Jeolla provinces, as well as cold spots in the mountainous areas of Gangwon-do, coastal areas, and islands off the west coast. In other words, given the geographical characteristics of Korea (e.g., abundance of mountains and islands), public health institutions appear to be evenly distributed. Nevertheless, larger

numbers of specialized medical facilities are still concentrated in the Seoul-Gyeonggi region and metropolitan and urban cities, while public facilities are densely distributed across Chungcheong and Jeolla provinces. Medical institutions capable of performing caesarian sections feature a distribution similar to that of private medical institutions with OB/GYN departments, with hot spots found particularly in the Seoul-Gyeonggi region, Busan, and Gyeongsangnam-do.

[Figure 4] Health Infrastructure for Pregnancy and Childbirth



(a) Private medical institutions with OB/GYN departments

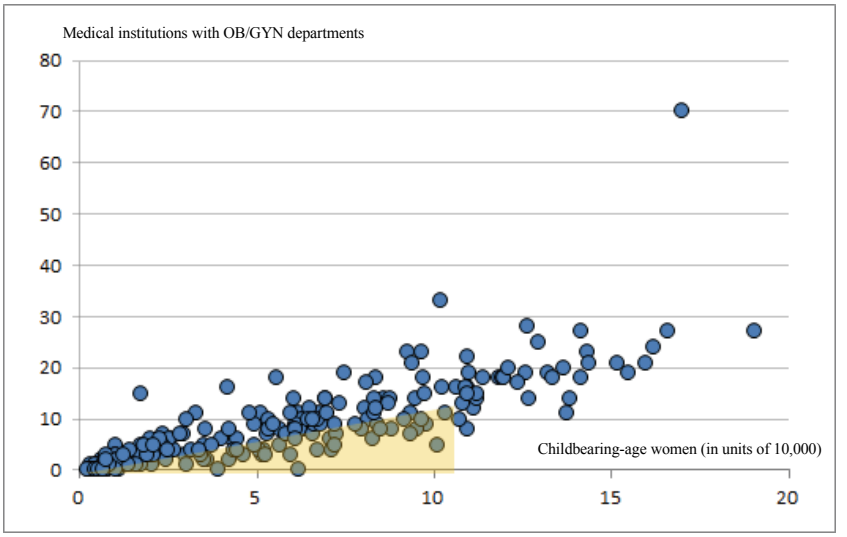
(b) Public medical institutions

(C) Medical institutions capable of performing C-sections

Source: Lee et al. (2015), p. 113.

Figure 5 shows the distributions of childbearing-age women (aged 15 to 49) and medical institutions with OB/GYN departments by city, county, and borough.

[Figure 5] Population of Childbearing-Age Women and Medical Institutions with OB/GYN Departments



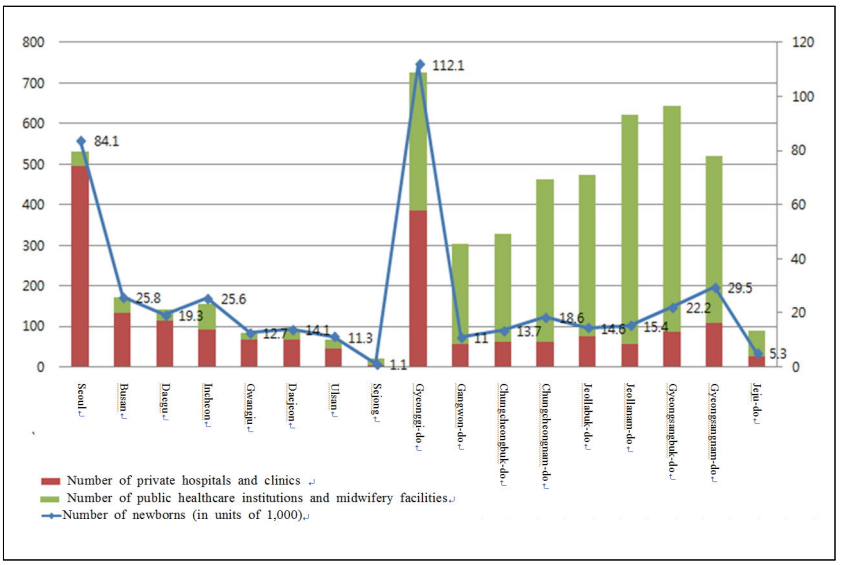
Source: Lee et al. (2015), p. 117.

As Figure 5 shows, there is a clear correlation between the distribution of childbearing-age women and the number of medical institutions with OB/GYN departments. This seems to reflect the basic principle of supply and demand. Regions that fall within the shaded area on the graph, however, are likely to face a shortage of pregnancy and childbirth infrastructure. The shaded area encompasses cities, counties, and boroughs in

which the number of medical institutions with OB/GYN departments falls below 10, although they serve less than 100,000 childbearing-age women. The shortage of medical institutions in these regions should be understood not as a mere function of the lack of demand, but as a shortage of facilities catering to considerable potential demand.

Figure 6 presents the total numbers of newborns, medical institutions with OB/GYN departments, and midwifery facilities by city and province, showing a positive correlation between the number of facilities available and the number of newborns. In other words, the supply of these resources closely follows demand. Nevertheless, not all regions with large numbers of newborns have an adequate number of these facilities. Daegu and Incheon are both metropolitan cities. However, although Incheon has approximately 6,300 more newborns, Daegu has 24 more medical institutions with OB/GYN departments. Gwangju and Daejeon are also both metropolitan cities; and although Daejeon has 1,400 more newborns, both cities have about equal numbers of medical institutions with OB/GYN departments.

[Figure 6] Distribution of Newborns and Medical Institutions with OB/GYN Departments



In an effort to more precisely analyze the correlation between the supply and demand of pregnancy and childbirth infrastructure, the counties of Ongjin, in Incheon, and Ulleung, in Gyeongsangbuk-do, were omitted, as these counties are made up mostly of islands. The straight-line distances between the centers of the remaining cities, counties, and boroughs, on the one hand, and the nearest facilities with OB/GYN departments and C-section capabilities were measured and listed in Table 4. The average distance varied significantly from region to region, particularly among cities and counties. The nationwide average distance from a county to a facility with delivery capabilities

was 24.1 kilometers, about five times the average distance (4.8 kilometers) from a city.

〈Table 4〉 Accessibility of Nearest Pregnancy and Childbirth Facilities

(Unit: km)

Region		OB/GYN departments	C-section capability
Nationwide	Cities	0.4	4.8
	Counties	0.4	24.1
Seoul	Cities	0.3	1.1
Busan	Cities	0.4	2.0
	Counties	1.1	4.5
Daegu	Cities	0.5	2.2
	Counties	0.5	7.2
Incheon	Cities	0.3	3.4
	Counties	0.6	20.6
Gwangju	Cities	0.5	3.6
	Counties	N/A	N/A
Daejeon	Cities	0.4	3.4
	Counties	N/A	N/A
Ulsan	Cities	0.5	2.9
	Counties	0.3	9.4
Sejong	Cities	0.4	10.0
	Counties	N/A	N/A
Gyeonggi-do	Cities	0.3	3.4
	Counties	0.3	18.4
Gangwon-do	Cities	0.3	19.3
	Counties	0.4	37.7
Chungcheongbuk-do	Cities	0.4	5.1
	Counties	0.4	17.3
Chungcheongnam-do	Cities	0.4	6.2
	Counties	0.6	21.5
Jeollabuk-do	Cities	0.4	5.0
	Counties	0.4	24.5
Jeollanam-do	Cities	0.3	10.5
	Counties	0.4	21.5
Gyeongsangbuk-do	Cities	0.3	10.7
	Counties	0.4	26.1
Gyeongsangnam-do	Cities	0.4	7.1
	Counties	0.4	26.2
Jeju-do	Cities	0.3	7.6
	Counties	N/A	N/A

The analysis reveals considerable regional disparities in the distribution of health infrastructure for pregnancy and childbirth. On the whole, the supply of medical facilities seems to follow demand, but disparities are noted in the conspicuous shortages of medical resources in regions with sizable actual or potential demand. The distribution of the population of child-bearing-age women and the distribution of medical institutions with OB/GYN departments overlap to a certain extent, as the market principle of supply and demand would dictate. Nevertheless, quality care provided by private, specialist, or general hospitals with OB/GYN departments or services is more concentrated in large cities rather than in rural counties of provinces.

2. Utilization and adequacy of use

Another way this study attempts to assess the equity of the distribution of pregnancy and childbirth health infrastructure is by measuring the utilization of the infrastructure and the adequacy of such use. Healthcare accessibility and healthcare use are indissolubly intertwined. Much of the established literature regards the utilization of health services as the manifestation of the accessibility of such services (Levesque et al., 2013). In order to assess the utilization of pregnancy and childbirth infrastructure and the adequacy thereof, this study uses the statistics

provided by the 2012 National Survey on Fertility, Family Health, and Welfare in Korea and 2012 Korea Healthcare Panel Study (KHPS). More specifically, this study analyzes the use of the health infrastructure by 1,055 women aged 15 to 49 who had experienced childbirth since January 1, two years prior to the launch of the National Survey (2012), which included married women aged 15 to 49 in 15,000 sample households. Additionally, this study also examines the use of the health infrastructure by 137 women who had experienced childbirth as of 2012 and who had been included in the 2012 KHPS, which is based on a separate questionnaire focused on the use of the health infrastructure for pregnancy and childbirth and the health of women.

The analysis of equity in this section begins by examining the disparities in the use of pregnancy and childbirth care by age, education, household income, and region of residence. In addition, this study uses the data of the National Survey to establish the Adequacy of Prenatal Care Index (APCI), providing a means of measuring the adequacy of women's use of the health infrastructure for pregnancy and childbirth in different regions across Korea.

Table 5 shows the distribution of the health infrastructure (private and public medical institutions) that women used at the time of childbirth, according to the 2012 KHPS, by women's age and region of residence. The older the mother, the more

likely she is to use general hospitals than OB/GYN hospitals or clinics. The health risks of pregnancy and childbirth are generally thought to increase with age. Older mothers may thus feel greater pressure to choose general hospitals in case of possible emergencies. Seoul, Daegu, Jeollanam-do, and Gyeongsangbuk-do were the only regions out of the 17 regions surveyed in which general hospitals were the most favored childbirth venues. In Ulsan, Gyeonggi-do, and Jeju-do, by contrast, over 14 percent of childbirths took place at public health institutions.

〈Table 5〉 Childbirth Venues in Relation to Mothers' Age and Region

(Units: number of institutions, percentage)

Variable		Total	OB/GYN hospitals	General hospitals	Public health institutions, etc.
Mother's age	24 or younger	2	100.0	-	-
	25 to 29	26	88.5	7.7	3.8
	30 to 34	67	89.6	7.5	3.0
	35 to 39	39	84.6	12.8	2.6
	40 or older	3	66.7	33.3	-
Region	Seoul	21	71.4	28.6	-
	Busan	9	100.0	-	-
	Daegu	8	75.0	25.0	-
	Incheon	15	100.0	-	-
	Gwangju	7	100.0	-	-
	Daejeon	5	100.0	-	-
	Ulsan	6	66.7	-	33.3
	Gyeonggi-do	24	87.5	8.3	4.2
	Gangwon-do	6	100.0	-	-
	Chungcheongbuk-do	-	-	-	-
	Chungcheongnam-do	7	100.0	-	-
	Jeollabuk-do	5	100.0	-	-
	Jeollanam-do	5	80.0	20.0	-
	Gyeongsangbuk-do	6	66.7	33.3	-
	Gyeongsangnam-do	6	100.0	-	-
	Jeju-do	7	85.7	-	14.3

Table 6 shows women's use of health infrastructure (OB/GYN hospitals and clinics, specialist and general hospitals, and public health institutions), as presented in the 2012 KHPS, in relation to women's socioeconomic status, including education, income, and access to health insurances. The use of general hospitals reveals a clear tendency: namely, women in the upper socioeconomic classes are more likely to use general hospitals.

〈Table 6〉 Childbirth Venues and Mothers' Education, Income, and Health Insurance Types

(Units: number of institutions, percentage)

Variable		Total	OB/GYN hospitals	General hospitals	Public health institutions, etc.
Mothers' education	Middle school or below	4	100.0	-	-
	High school graduate	35	94.3	5.7	-
	University or above	98	84.7	11.2	4.1
Annual household income (in KRW)	Less than 24 million	13	92.3	7.7	-
	24 to 35.99 million	43	88.4	9.3	2.3
	36 to 47.99 million	32	93.8	3.1	3.1
	48 to 59.99 million	21	81.0	19.0	-
	60 million or more	28	82.1	10.7	7.1
Health insurance type	Medical benefits, etc.	2	100.0	-	-
	Local health insurance	33	87.9	9.1	3.0
	Workplace health insurance (including that for teachers and government employees)	102	87.3	9.8	2.9

Based on the findings of the 2012 National Survey, Table 7 shows women's choice of childbirth venues in relation to their region, age, education, and income. Much of the list overlaps

with the earlier two tables, which are based on the findings of the 2012 KHPS. In particular, women aged 35 or older are much more likely to choose general hospitals as the venues for childbirth, most likely due to their concern about possible emergencies and health risks associated with childbirth at an older age. The choice of general hospitals also increased with education and income. While mothers in most regions used hospitals, those in Gangwon-do and Jeju-do were more likely to use clinics.

〈Table 7〉 Childbirth Venues and Mothers' Region, Age, Education, and Income

(Unit: %)

	General hospitals	Hospitals	Clinics	Public health institutions	Total	(N)
Region						
Seoul	22.0	67.0	11.0	0.0	100.0	(91)
Busan	11.3	83.0	3.8	1.9	100.0	(51)
Daegu	12.7	81.8	5.5	0.0	100.0	(55)
Incheon	12.3	71.2	15.1	1.4	100.0	(73)
Gwangju	5.3	93.4	1.3	0.0	100.0	(76)
Daejeon	5.7	88.7	5.7	0.0	100.0	(52)
Ulsan	6.5	80.4	13.0	0.0	100.0	(46)
Gyeonggi-do	8.6	86.8	4.6	0.0	100.0	(151)
Gangwon-do	21.9	21.9	56.3	0.0	100.0	(32)
Chungcheongbuk-do	6.4	78.7	14.9	0.0	100.0	(47)
Chungcheongnam-do	10.0	70.0	20.0	0.0	100.0	(69)
Jeollabuk-do	9.0	62.8	26.9	1.3	100.0	(78)
Jeollanam-do	4.0	92.0	4.0	0.0	100.0	(50)
Gyeongsangbuk-do	15.4	73.9	9.2	1.5	100.0	(65)
Gyeongsangnam-do	9.1	72.7	18.2	0.0	100.0	(77)
Jeju-do	18.9	35.1	43.2	2.7	100.0	(37)
Age						
Under 35	8.6	77.0	14.0	0.5	100.0	(834)
35 or older	19.9	68.5	11.1	0.5	100.0	(216)

	General hospitals	Hospitals	Clinics	Public health institutions	Total	(N)
Education						
High school or below	10.0	77.1	12.2	0.6	100.0	(317)
Vocational college	10.1	71.7	18.2	0.0	100.0	(246)
University or above	11.9	75.9	11.7	0.6	100.0	(487)
Monthly income (in KRW)						
Less than 2.5 million	7.7	80.3	10.9	1.1	100.0	(181)
2.5 to 3.5 million	7.5	78.6	13.6	0.3	100.0	(331)
3.5 to 4.5 million	11.3	74.1	14.2	0.5	100.0	(212)
4.5 to 5.5 million	17.5	68.8	13.1	0.6	100.0	(158)
5.5 million or greater	14.0	70.7	15.2	0.0	100.0	(164)
Total	10.9	75.3	13.4	0.5	100.0	(1,055)

Next, this study sought to determine the adequacy of use of the health infrastructure for pregnancy and childbirth in Korea by region, again referring to the findings of the 2012 National Survey, in relation to mothers' region, age, education, and income. This analysis involved the use of the Kessner Index of Adequacy of Prenatal Care,[4] which takes into account prenatal care initiation, the frequency of visits received after initiation, and gestational age.

Table 8 shows the distribution of women who received "adequate" prenatal care, as measured by the Kessner Index, in relation to their age, education, and income. Thanks to the governmental subsidization of the expenses involved, almost 90 percent of all women received adequate prenatal care. More specifically, 89.8 percent of all women received "adequate care," meaning that almost every woman had at least one pre-

4) IOM (1974), quoted in Lee et al. (2013), p. 81.

natal care visit.

While the age and education of mothers were not found to be significant factors, older women with more than a high school education were slightly more likely to receive adequate prenatal care. Income, however, was a significant protective factor. The likelihood of receiving adequate prenatal care clearly increased with income.

〈Table 8〉 Adequate Prenatal Care and Mothers' Age, Education, and Income

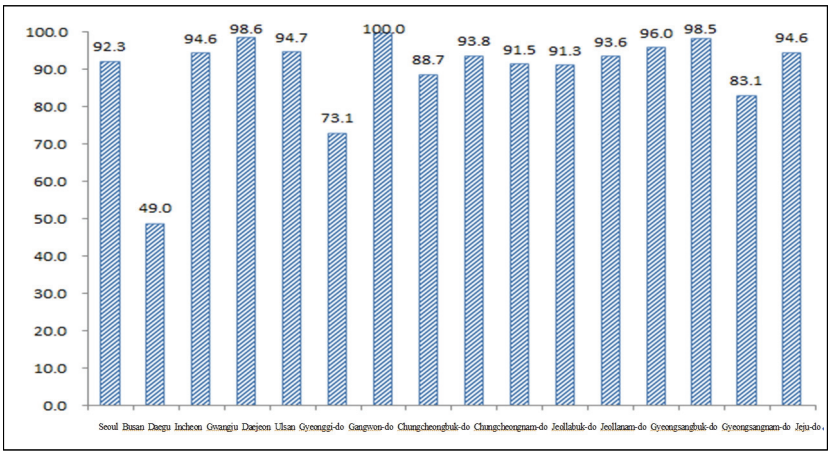
(Unit: %)

Variable	Adequacy of prenatal care
Mothers' age	
Under 35	89.7
35 or older	90.3
Education	
Below high school	89.0
High school or vocational college	90.7
University or above	89.9
Monthly income (in KRW)	
Less than 2.5 million	85.1
2.5 to 3.5 million	88.8
3.5 to 4.5 million	89.6
4.5 to 5.5 million	93.0
5.5 million or greater	94.5
Total	89.8

Figure 7 presents the proportions of women who received adequate prenatal care in the 17 cities and provinces surveyed. While the proportions exceed 90 percent in most regions, they are as low as 49.0 percent in Busan, 73.1 percent in Daejeon, 83.1 percent in Gyeongsangnam-do, and 88.7 percent in Gyeonggi-do.

[Figure 7] Proportions of Mothers Receiving Adequate Prenatal Care by Region

(Unit: %)



Source: Lee et al. (2015), p. 138.

3. Outcomes (birth outcomes)

This study also measured the equity of the health infrastructure for pregnancy and childbirth in Korea in terms of its outcomes, i.e., by low weight (birth weight less than 2,500 grams) and premature birth (birth at a gestational age of less than 37 weeks), as reported in the 2012 National Survey. In addition, Table 9 presents the distribution of low birth weight and premature birth by the age, education, and income of mothers.

Giving birth at an advanced age is a risk with proven medical ties to low birth weight and premature birth. Mothers aged 35 or older were more likely to give birth to underweight or premature infants than were younger mothers, by 2.0 to 4.1 per-

centage points. The significantly high proportion of low birth weight and premature birth among older mothers therefore appears to be more closely related to mothers' age than to the availability of related health infrastructure.

In the meantime, mothers with less than a high school education were also significantly more likely to give birth to underweight or premature infants. Moreover, mothers in the higher income groups, earning KRW 4.5 million a month or more, were also more likely to give birth to underweight or premature infants than were mothers with lower monthly income. In this case, income and other income-associated factors could play a role, and therefore require more in-depth analyses.

〈Table 9〉 Low Birth Weight and Premature Birth in Relation to Mothers' Age, Education, and Income

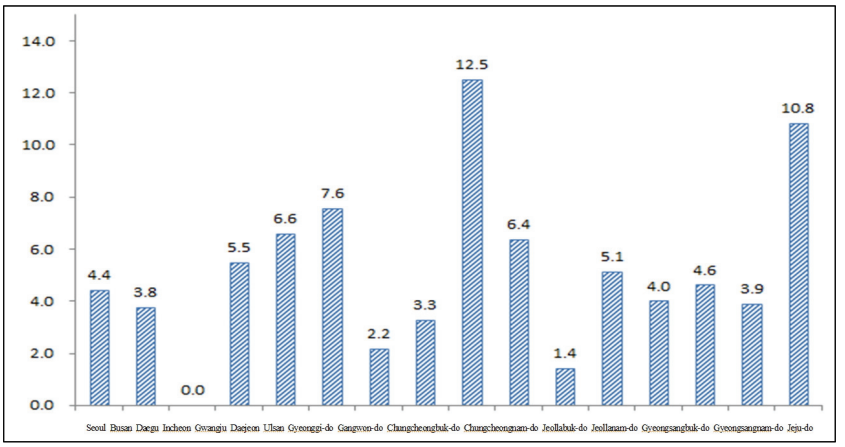
(Units: %, number of newborns)

	Low birth weight	Premature birth	(N)
Mothers' age			
Under 35	3.8	5.4	(834)
35 or older	7.9	7.4	(216)
Education			
Below high school	5.3	6.6	(317)
High school or vocational college	4.5	4.9	(246)
University or above	4.3	5.8	(487)
Monthly income (in KRW)			
Less than 2.5 million	3.8	2.8	(181)
2.5 to 3.5 million	3.6	4.8	(331)
3.5 to 4.5 million	3.8	5.2	(212)
4.5 to 5.5 million	6.9	8.8	(158)
5.5 million or greater	6.1	8.6	(164)
Total	4.6	5.8	(1,050)

Figure 8 shows the distribution of underweight newborns across 15 cities and provinces.

[Figure 8] Proportions of Underweight Newborns by Region

(Unit: %)



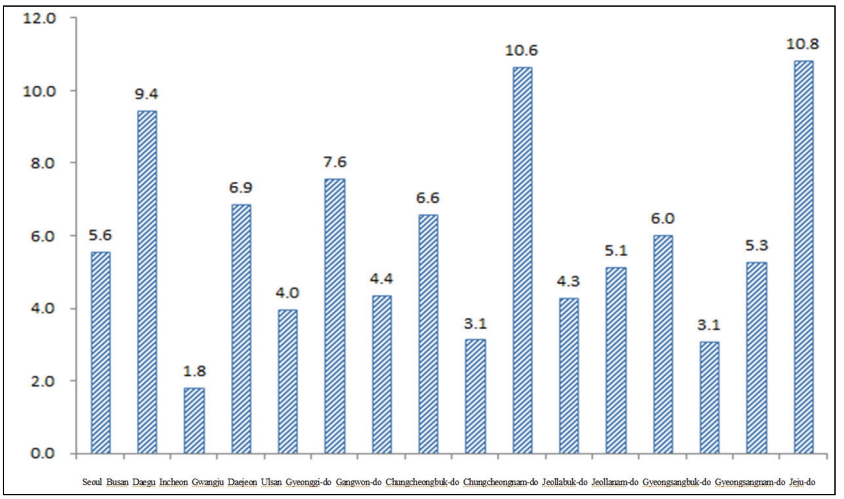
Source: Lee et al. (2015), p. 139.

While the rate of low birth weight is at around five percent or so in most regions, it spikes to 12.5 percent and 10.8 percent in Gangwon-do and Jeju-do, respectively. On the other hand, Daegu has the lowest rate of underweight newborns, at zero percent.

Figure 9 shows the distribution of premature births by region. The proportions are relatively higher, at around 10 percent, in Busan, Chungcheongbuk-do, and Jeju-do. Daegu, the region with the lowest rate of underweight newborns, is again the region with the lowest premature birth rate, at 1.8 percent.

[Figure 9] Proportions of Premature Births by Region

(Unit: %)



We can sum up the regional disparities in birth outcomes as follows. First, while the rate of underweight newborns remains at around five percent in most regions, Gangwon-do and Jeju-do, with rates of 12.5 percent and 10.8 percent, respectively, were found to be particularly vulnerable regions. The premature birth rate, ranging between 1.8 percent and seven percent in all other regions, spiked to 10.8 percent in Jeju.

The equity of the health infrastructure for pregnancy and childbirth means achieving fair and equal health outcomes for mothers and newborns by guaranteeing equal and fair access to and utilization of the health infrastructure.

The findings from the spatial econometrics analysis of the accessibility (measured in terms of availability) of the health in-

frastructure for pregnancy and childbirth can be summarized as follows. First, the private sector's supply of pregnancy and childbirth infrastructure, including prenatal care and natural birthing services, is directly proportional to the number of babies born. Second, lower-level institutions of the public healthcare system provide the majority of prenatal and delivery services in rural areas. OB/GYN hospitals and specialist and general hospitals that provide quality, high-end care are concentrated more in cities than in counties of provinces. Third, there are significant disparities between urban areas (cities) and rural areas (counties and provinces) in terms of the availability of resources necessary for providing emergency medical services during pregnancy or childbirth. The analysis on women's utilization of the existing health infrastructure for pregnancy and childbirth and the adequacy of prenatal care, along with the examination of low birth weight and premature birth rates, reveals that women of higher socioeconomic status are more likely to use higher-level medical institutions and receive adequate prenatal care than women of lower socioeconomic status. While the proportion of women receiving adequate prenatal care reaches 90 percent in most regions, the proportion falls drastically to 49.0 percent in Busan, 73.1 percent in Daejeon, 83.1 percent in Gyeongsangnam-do, and 88.7 percent in Gyeonggi-do. As for birth outcomes, Gangwon-do and Jeju-do, regions where women give birth in clinics more often

than in hospitals, were also the two regions with the highest rates of low birth weight and premature birth. In other words, the regional disparities noted in the accessibility of the health infrastructure were again present in the utilization and outcomes of the health infrastructure.

IV Policy Implications

Ⅳ Policy Implications

This study examines the equity of the health infrastructure for pregnancy and childbirth in Korea, which, measured in terms of accessibility, utilization, adequacy of use, and outcomes, concurs to a large extent with the analyses on the utilization of and demand for the health infrastructure in Korea. Certain associations are noted among accessibility, utilization, and outcomes. Gangwon-do and Jeju-do, regions with relatively fewer hospitals and that lack specialist hospitals, showed higher rates of women using clinics as opposed to hospitals as the venues for childbirth. The disparity in the accessibility and utilization of the health infrastructure between these two regions and the rest of Korea again yielded disparities in birth outcomes, with Gangwon-do and Jeju-do again emerging as the two provinces with the highest rates of low birth weight. Jeju-do showed a particularly high premature birth rate.

These findings suggest the following. First, policymakers need to ensure a more even distribution of the health infrastructure across various regions. The market mechanism dictates that private medical resources with advanced technology and quality services be concentrated in urban areas, compelling the government to provide healthcare in rural areas

through public healthcare centers, outlets, and diagnostic centers. Toward this end, the Korean government has launched a delivery support program for families in rural areas particularly lacking in pregnancy and childbirth support facilities. The program provides aid based on the local birth rate, proportion of childbearing-age women in the local population, and absence of OB/GYN or delivery services within a 60-minute distance. Such programs are crucial to satisfying the basic need for pregnancy and childbirth services in underdeveloped areas. The central and local governments in Korea have been making various efforts to address the disparity in the availability of health infrastructure for pregnancy and childbirth throughout all regions of the country, and should continue with their efforts despite the criticism.

However, Korean policymakers now need to realize that it is equally important to ensure the equitable distribution of quality care over and beyond physical facilities and resources. In doing so, policymakers will need to base their decisions concerning the expansion of the health infrastructure not only on the size of the population of childbearing-age women and number of births, but on maternal age and other factors that require specialized care. In addition, policymakers should establish a monitoring system designed to help ensure and improve the quality of the health infrastructure for pregnancy and childbirth. If left alone, the market will address this issue according only to the

logic of profitmaking. However, as healthcare services during pregnancy and childbirth are basic and essential services to which citizens are entitled, the government needs to support these services with an appropriate monitoring system.

This study confirms significant regional disparities in the health infrastructure for pregnancy and childbirth in Korea. The experience of the US state of Arkansas may provide meaningful lessons in this regard. In an effort to improve the quality of its healthcare services for pregnant women and childbirth in rural areas, the University of Arkansas for Medical Sciences launched the Antenatal and Neonatal Guidelines, Education, and Learning System (ANGEL) to educate doctors and nurses working in rural areas on the health risks to which mothers and newborns are vulnerable. Korea could learn from this example and launch programs for educating and training rural medical practitioners at university-affiliated hospitals.

Furthermore, policymakers need to consider introducing telemedicine programs, which have been shown to improve the equity and outcomes of prenatal and childbirth services at numerous hospitals and public healthcare clinics across the United States and in other countries as well. Such programs would enable doctors in rural areas of Korea to communicate more effectively with specialists in cities, and such collaboration among medical practitioners would help satisfy the needs of mothers in rural areas for more professional and specialized care. In addi-

tion, policymakers will need to establish and expand networks for maintaining and repairing the medical systems and transportation and logistics infrastructure involved in childbirth.

In expanding the health infrastructure for pregnancy and childbirth, policymakers should first ascertain the movements of pregnant women across municipal borders and make available a greater range of services and care for neighboring cities, counties, and boroughs as well. This will require the expansion and improvement of the public transportation infrastructure so as to assist mothers in regularly accessing medical services. Policymakers could also consider transforming existing hospitals into transportation and service hubs for mothers living in rural or remote areas.

In order to ensure the equity of the health infrastructure for pregnancy and childbirth in Korea, basic services need to be made available throughout all regions. Moreover, effort is needed to make quality and specialized care available across regional borders as well. With the Korean government about to launch its third master plan for increasing the birth rate, policymakers need to shift their attention from the quantitative side of equity to focus more equity in providing quality care. Only through such efforts will the healthcare environment in Korea become more favorable to childbirth and childcare, which will in turn allow Korea to finally begin achieving substantial improvements in its fertility rate.

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