Title	Selection and concentration of obstetric facilities in Japan: Longitudinal study based on national census data
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Citation	The Journal of Obstetrics and Gynaecology Research , 41 (6) : 919 - 925
Issue Date	2015-06-02
DOI	10.1111/jog.12663
Self DOI	
URL	https://ir.lib.hiroshima-u.ac.jp/00048620
Right	This is the peer reviewed version of the following article: Masatoshi M., Soichi K., Shigeki M., Saori K., Hiroo I. and Hideo Y. (2014), Selection and concentration of obstetric facilities in Japan: Longitudinal study based on national census data. Journal of Obstetrics and Gynaecology Research, 41: 919-925, which has been published in final form at https://doi.org/10.1111/jog.12663. This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for Use of Self-Archived Versions.
Relation	

TITLE:

Selection and concentration of obstetric facilities in Japan: a longitudinal study based on national census data.

RUNNING TITLE

Obstetric facilities in Japan

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Selection and concentration of obstetric facilities in Japan: a longitudinal study based on national census data

Abstract

Aim: A shortage of obstetricians with an increased workload is a social problem in Japan. The government and professional bodies are trying to cope with this problem by accelerating “selection and concentration” of obstetric facilities. The aim of this study is to evaluate the recent trend of selection and concentration.

Methods: We used data on the number of deliveries and of obstetricians in each hospital and clinic in Japan, according to the Static Survey of Medical Institutions in 2005, 2008 and 2011. To evaluate the inter-facility equity of the number of deliveries, number of obstetricians and number of deliveries per obstetrician, Gini coefficients were calculated.

Results: The number of obstetric hospitals decreased by 20% and the number of deliveries per hospital increased by 26% between 2005 and 2011. Hospital obstetricians increased by 16% and the average number of obstetricians per hospital increased by 19% between 2008 and 2011. Gini coefficient of deliveries has significantly decreased. In contrast, Gini coefficient of deliveries per obstetrician has significantly increased. The degrees of increase in obstetricians and of decrease in deliveries per obstetrician were largest at the hospitals with the highest proportion of cesarean sections. The proportion of obstetric hospitals with the “optimal volume” of deliveries and obstetricians defined by Japan Society of Obstetrics and Gynecology was 4% in 2008, and it had doubled to 8.1% three years later.

Conclusion: The selection and concentration of obstetric facilities is progressing rapidly and effectively in Japan.

Key words

Health policy; health resources; Japan; obstetric delivery; workload

Introduction:

A shortage of obstetricians and subsequent demand-supply mismatch of obstetric care has recently emerged as a social and medical problem in Japan.[1-3] For the past 30 years, the number of obstetricians and gynecologists (OB-GYNs) has decreased by 5% while the total number of physicians has increased by 116%.[4] Of even greater concern is that the number of new medical graduates who chose OB-GYN has been steadily decreasing.[4] The number of obstetric facilities is also decreasing; between 1993 and 2008 the number of obstetric hospitals dropped by 37% and the number of clinics by 42%.[5] The national and prefectural governments have implemented various policies and invested substantial amounts of money to increase the number of OB-GYNs.[6-10] As a short-term trend, the number of OB-GYNs has turned to a slight increase; between 2006 and 2012 it rose by 8%.[11, 12]

Japan Society of Obstetrics and Gynecology and Japan Association of Obstetricians and Gynecologists have pointed out that heavy workloads and long duty hours are reasons for the shortage of OB-GYNs.[13, 14] They have advocated expanding the scale of each delivery hospital and having obstetricians work in shifts.[13] The Society claims that more than 500 deliveries per year and more than 6 or 8 obstetricians per 500 deliveries as the optimal volume of an obstetric hospital and has set a goal that most hospitals attain these optimal volumes by 2030.[15]

The Japanese government also recommends accelerating the selection and concentration of delivery hospitals,[16] and has earmarked funds to do so.[17, 18] For example, in 2007 alone, the government has subsidized 1251.7 million yen (12.5 million US dollars) to selected delivery hospitals to support their finances.[6] Selection and concentration of hospitals and subsequent upsizing of selected hospitals are certainly a rational option for making the best use of finite human resources. It is unknown, however, if these policies are effective and the selection and concentration of delivery hospitals is progressing in reality.

The aim of this study is to reveal the recent trend in the selection and concentration status of deliveries and obstetricians among delivery facilities in Japan, based on national census data. We also analyze a change in the inter-facility equity of delivery volume and obstetrician volume, which is potentially accompanied by selection and concentration. Based on the results, we discuss the effectiveness of current selection and concentration policies and the proposals of professional bodies.

Material and methods:

Data used in this study were from the Static Survey of Medical Institutions (hospitals and clinics) in 2005, 2008 and 2011, provided with permission to use for research by Ministry of Health, Labour and Welfare. The Static Survey of Medical Institutions is conducted by the Ministry every three years. All clinics and hospitals in Japan are obliged by national law to report their activities and resources in the Survey. In Japan, a hospital is defined as a medical facility with 20 or more beds, and a clinic as one with fewer than 20 beds. The 2011 Survey did not cover all the facilities in Fukushima and some of the facilities in Miyagi prefecture because of the Great East Japan Earthquake.

Data on the number of deliveries and of obstetricians in each hospital or clinic were used. The number of vaginal and cesarean deliveries in September of each year was used. The number of obstetricians in the data was expressed as the number of full-time equivalent doctors, and the number was that on October 1 of the year. Data on the number of obstetricians in 2008 and 2011 were used because there was no obstetrician data in 2005 dataset. In order to estimate the capture rate of the

Survey, i.e. the rate of captured deliveries in the Survey among all the deliveries, the data were compared with the number of births in September of the year in the Vital Statistics conducted by the government based on Family Registration Law, which enumerates all births and deaths in Japan.[19]

As basic statistics, the following was calculated for all obstetric clinics and for all obstetric hospitals: the total number of obstetric facilities, total number of deliveries, average number of deliveries per facility, total number of obstetricians, average number of obstetricians per facility, and the average number of deliveries per obstetrician. Facilities with one or more obstetricians were regarded as obstetric facilities in this study. In each year, the number of obstetric facilities that either stopped or started providing delivery services was calculated.

For evaluating the inter-facility equity of the number of deliveries, Gini coefficient was calculated. In the calculation, all of the obstetric facilities were ranked by number of deliveries, and the cumulative proportion of deliveries and that of individual obstetric facility were plotted onto the plane of coordinates. The plotted line is the Lorenz curve, and the Gini coefficient is the area between the Lorenz curve and the 45 degree line which is divided by the triangle under the 45 degree line. Gini coefficient ranges from 0 (complete equity) to 1 (complete inequity), according to the variation in deliveries. A similar procedure was conducted for the number of obstetricians and the number of deliveries per obstetrician. Significance test was conducted to examine the difference in Gini coefficient between two different years. This was done by calculating the bootstrapped standard errors for the Gini coefficient.[20]

To ascertain how the inequity is created, we classified all hospitals into equal-size tertiles (low, medium and high) according to the proportion of cesarean sections among all deliveries (CS rate) at each hospital in each year. We assumed, although indications for cesarean sections are sometimes relative rather than absolute,[21, 22] that hospitals with a higher CS rate tended to be hospitals to which larger numbers of high-risk deliveries/pregnancies were referred. In the Static Survey of Medical Institutions used in this study, for example, the average CS rates of advanced treatment hospitals (*tokutei-kinou-byouin*), community center hospitals (*chiiki-iryou-shien-byouin*) and others in 2011 were 39.9%, 29.3% and 21.6% respectively. The average number of deliveries, obstetricians, and deliveries per obstetrician in each tertile of hospitals was calculated, and the differences in these values between two years were compared.

In its "Grand design for improving obstetric health system 2010 version 1.21," the Japan Society of Obstetrics and Gynecology proposed the volume of a obstetric hospital be 500 or more deliveries per year and obstetrician-delivery ratio be 6 or more (necessary level), or 8 or more (sufficient level) per 500 deliveries in order to standardize the working hours and workload of obstetricians.[15] Based on the optimal volumes, the numbers and proportions of obstetric hospitals with more than 500 deliveries in which the obstetrician:delivery ratio was 6/500 or more (necessary volume) were calculated. The numbers and proportions of obstetric hospitals with more than 500 deliveries in which the obstetrician:delivery ratio was 8/500 or more (sufficient volume) were also calculated. Then the change of the proportion of the hospitals with the necessary or sufficient volume between 2008 and 2011 was obtained.

All of these statistical analyses were conducted using SPSS version 21 (IBM-SPSS Japan, Tokyo), except for calculation of Gini coefficients and significance test for their differences; these were done with STATA software (version 12, College Station, TX, USA). The Ethics Committee, Graduate School of Medicine and Faculty of Medicine, The University of Tokyo has assessed and given permission for this study (assessment number 10128).

Results

Based on the birth data in Vital Statistics, the capture rate of delivery in the Static Survey of Medical Institutions was estimated to be 91.8% in 2005, 93.8% in 2008, and 92.3% in 2011.

Table 1 should be here

Basic statistics of obstetric hospitals are shown in Table 1. The number of obstetric hospitals in Japan decreased by 15% between 2005 and 2008 and by 7% between 2008 and 2011. The number of deliveries was almost unchanged between 2005 and 2011, thus the number of deliveries per hospital increased by 26% indicating the progression of concentration of deliveries at fewer hospitals. The number of hospital obstetricians increased by 16% and the average number of obstetricians per hospital increased by 19% between 2008 and 2011, indicating the growing concentration of obstetricians. The number of deliveries per obstetrician decreased by 16% over the three-year period. Basic statistics of obstetric clinics are shown in a supplementary table (Table 1s) (link to Table 1s). In clinics, the concentration of deliveries likewise increased, but that of obstetricians was unchanged.

Table 2 should be here

Equity level of deliveries, obstetricians, and deliveries per obstetrician among obstetric hospitals is shown in Table 2. Gini coefficient of delivery decreased between 2005 and 2011. This indicates the number of deliveries at each hospital is increasingly equalized. Gini coefficient of obstetricians increased among hospitals from 2008 to 2011, suggesting the distribution of obstetricians among hospitals is increasingly skewed, though the trend was not statistically significant. Gini coefficient of deliveries per obstetrician increased among hospitals between 2008 and 2011, indicating a widening disparity of the delivery volume per obstetrician among hospitals. The results for clinics are shown in a supplementary table (Table 2s) (link to Table 2s). A similar trend was found in clinics.

Table 3 should be here

The average numbers of deliveries, obstetricians and deliveries per obstetrician in the tertile (low, medium and high CS rate) groups of hospitals are shown in Table 3. Between 2008 and 2011 the number of deliveries increased most in the low CS tertile, while the number of obstetricians increased most rapidly in the high CS tertile. As a result, the most pronounced decrease in the number of deliveries per obstetrician was found in the high CS group.

Table 4 should be here

The number and proportion of hospitals that ceased or started delivery service is shown in Table 4. In both 2005-2008 and 2008-2011, the number of hospitals that ended delivery service exceeded the number of those that began offering this service. The gap, however, narrowed in 2008-2011 compared with 2005-2008 due to the decrease in the number of hospitals that stopped performing deliveries. The results for clinics are shown in a supplementary table (Table 4s) (link to Table 4s). A similar trend was observed in clinics.

Table 5 should be here

Table 5 shows the number and proportion of hospitals with optimal delivery and obstetrician volumes set by the Japan Society of Obstetrics and Gynecology. The proportion of obstetric hospitals with 500 or more annual deliveries slightly increased between 2008 and 2011. The proportion of the hospitals that have both 500 or more deliveries and obstetrician-delivery ratio 6/500 or more was only 4% in 2008, but doubled to 8.1% bby 2011. Similarly, the proportion of the hospitals with 500 or more deliveries and 8/500 or more obstetrician-delivery ratio has doubled over the three-year period from 2.0% to 4.2%.

Discussion

Results of this study showed the concentration of deliveries and of obstetricians progressed rapidly. Equity of obstetrician volume among hospitals has potentially decreased and disparity of delivery volume per obstetrician has widened. The growing disparity, however, might be attributable to the increasing concentration of obstetricians at secondary and tertiary referral hospitals that have a larger proportion of high-risk deliveries. The work environment of hospital obstetricians overall is likely to be improving. The number of hospitals with the optimal volume of deliveries and obstetricians has increased quite rapidly. These trends accord with governmental policies and plans of professional bodies.

The national government is putting forth concrete policies that facilitate selection and concentration of obstetric hospitals. For example, a preferential fee schedule of social health insurance has been given to hospitals that have a neonatal intensive care unit (NICU), that accept patients with obstetric emergency, or that perform high-risk deliveries.[18] Subsidies are provided to general perinatal medical centers and community perinatal medical centers, both of which are designated by prefecture government.[17] Another subsidy has been earmarked to construct a network system among obstetric facilities within a prefecture.[17] These policies have potentially advanced the concentration of deliveries at some selected, large-scale hospitals. Evidence showed high-volume labor units, compared with low-volume ones, had less neonatal mortalities and morbidities.[23-26] This suggests that the selection and concentration policies, not only lightened the workload of hospital obstetricians, but also improved the safety of delivery.[27] In contrast, the selection and concentration can cause closure of low-volume obstetric facilities and subsequent worsening of patients' access to obstetric service. The results of this study showed the number of facilities ceasing to deliver exceeded that of facilities starting to deliver. The national government therefore subsidizes small obstetric facilities in rural and remote areas.[17] At a time of rapid growth of selection and concentration, it seems important to balance centralization of resources with equitable access. Policies should focus on providing access to women residing in remote or rural areas, while making the most of the advantages of high-volume labor units.

Effective placement of obstetricians seems to be progressing. The worsening of equity indicators for obstetricians and obstetricians' workload shown in this study does not necessarily mean a worsening of their distribution and workload. The inequity seems to have evolved in a way that has concentrated obstetricians most rapidly at tertiary referral hospitals, meaning that obstetricians are increasingly distributed among the facilities that are in greatest need of their services. Appropriate distribution of obstetricians should be consistently pursued with the cooperation of the national and local governments, professional bodies, and above all, medical schools which traditionally have the largest physician-placement function in Japan.

The proportion of hospitals with optimal delivery and obstetrician volume defined by the Japan Society of Obstetrics and Gynecology has doubled for the past three years. Although the progression was rapid, the proportion was still low (8.1 or 4.2%). Political support from the national and prefectural governments and initiative by professional bodies should be continued, and the optimal volume needs to be revised by the Society based on the reality. Also the shrinking number of deliveries per obstetrician at tertiary referral hospitals might make it difficult for obstetricians to maintain their clinical skills. It is thus necessary for obstetricians, particularly young obstetricians in training, to rotate through hospitals of different levels in order to assist with an adequate number of deliveries, including high-risk ones.

In interpreting the results, the following needs to be accounted for. Deliveries range from low- to high-risk. High-risk deliveries, sometimes threatening fetal, neonatal and maternal lives, add to the workload of obstetricians; low-risk deliveries may be safely performed by midwives without requiring the presence of an obstetrician. Thus, the workload of each obstetrician depends on the presence or absence of complications. The "number of deliveries per obstetrician" in this study thus may not necessarily reflect the real workload of an obstetrician. The trend of workload and workload disparity focused in this study, however, would be less influenced by this problem. Some of the gaps in Gini coefficients were statistically insignificant, possibility because of the short observation period (3 years). To confirm the gaps, a longer-term study is needed.

In conclusion, the selection and concentration of deliveries and of obstetricians is progressing rapidly and effectively in Japanese hospitals. Continuous support from the national and local governments, professional bodies, and medical schools is recommended to maintain this trend.

Acknowledgements

This study was supported by Health Labour Sciences Research Grant of the Ministry of Health, Labour and Welfare, Tokyo, Japan (H25 - Research on Region Medical - 006).

Disclosure

The authors declare no potential conflicts of interest.

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Tables

Table 1. Basic statistics of obstetric hospitals in Japan.

		Year		
		2005	2008	2011
Obstetric hospitals	Total	1321	1126	1051
Deliveries	Estimated annual total*	514216	532328	511810
	Total in September	44865	46404	45052
	Average per hospital	34.0	41.2	42.9
	SD	28.7	33.2	32.9
Obstetricians	Total		4910	5689
	Average per hospital		4.7	5.6
	SD		3.7	4.6
Deliveries per obstetrician			9.5	7.9

*Estimated based on the study data and birth data in Vital Statistics.

SD: standard deviation

Table 2. Gini coefficients of delivery, obstetrician and deliveries per obstetrician among obstetric hospitals.

	2005	2008	2011	P1	P2
Delivery	0.425	0.402	0.395	**0.01**	0.536
Obstetrician		0.375	0.389		0.27
Deliveries per obstetrician		0.330	0.357		**0.022**

Gini coefficient ranges between 0 (complete equity) and 1 (complete inequity) according to variation in the values of each variable among facilities.

P1: p value for 2005-2011 difference

P2: p value for 2008-2011 difference

Table 3. Average number of deliveries, obstetricians and deliveries per obstetrician at hospitals classified according to the proportion of cesarean sections among all deliveries (CS rate)

	CS tertile*	Average (SD) 2005	2008	2011	2011-2005 Difference %	2011-2008 Difference %
Deliveries	Low	31.7 (32.0)	37.9 (36.0)	40.7 (37.3)	28.4	7.4
	Medium	40.4 (29.6)	47.7 (32.7)	48.6 (32.0)	20.4	1.9
	High	29.9 (22.7)	39.4 (28.5)	40.2 (28.6)	34.1	1.9
Obstetricians	Low		3.4 (2.3)	3.9 (2.8)		16.8
	Medium		4.6 (3.0)	5.4 (3.6)		16.2
	High		6.1 (4.9)	7.5 (6.0)		21.6
Deliveries per obstetrician	Low		11.2 (7.2)	10.8 (7.9)		-3.6
	Medium		11.1 (5.9)	10.2 (5.9)		-8.2
	High		7.5 (4.6)	6.8 (5.0)		-10.3

*All hospitals were classified to equal-size tertiles in each year according to the CS rate at each hospital.
All values are counts for September.
SD: standard deviation

Table 4. Hospitals that ceased or started to deliver

	2005 -> 2008 n	%	2008 -> 2011 n	%
Cease	240	18.2	116	10.3
Start	45	4.0	41	3.9

Table 5. Hospitals with optimal volume of deliveries and obstetricians*

	2008 (N=1126) n	%	2011 (N=1051) n	%
Annual deliveries 500 or more	408	36.2	403	38.3
and obstetrician-delivery ratio 6/500 or more	45	4.0	85	8.1
and obstetrician-delivery ratio 8/500 or more	23	2.0	44	4.2

*Optimal volume is defined by the Japan Society of Obstetrics and Gynecology as more than 500 deliveries per year and more than 6 or 8 obstetricians per 500 deliveries per hospital.

Supporting Information (supplementary tables that are hosted online)

Table 1s. Basic statistics of obstetric clinics in Japan.

		Year		
		2005	2008	2011
Obstetric clinics	Total	1612	1441	1327
Deliveries	Estimated annual total*	461287	490893	457928
	Total in September	40247	42792	40309
	Average per clinic	25.0	29.7	30.4
	SD	19.3	21.1	20.8
Obstetricians	Total		2240	2126
	Average per clinic		1.7	1.7
	SD		1.0	1.1
Deliveries per obstetrician			19.1	19.0

*Estimated based on the study data and birth data in Vital Statistics.

SD: standard deviation

Table 2s. Gini coefficients of delivery, obstetrician and deliveries per obstetrician among obstetric clinics.

	2005	2008	2011	P1	P2
Delivery	0.410	0.376	0.366	**<0.001**	0.304
Obstetrician		0.272	0.285		0.153
Deliveries per obstetrician		0.349	0.343		0.524

Gini coefficient ranges between 0 (complete equity) and 1 (complete inequity) according to variation in the values of each variable among facilities.

P1: p vavule for 2005-2011 difference

P2: p vavule for 2008-2011 difference

Table 4s. Clinics that ceased or started to deliver

		2005 -> 2008		2008 -> 2011	
		n	%	n	%
Clinic	Cease	430	26.7	326	22.6
	Start	258	17.9	211	15.9