

Unequal Accessibility of Nurseries for Sick Children in Over- and Under-Populated Areas of Japan

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Infants and toddlers are prone to rapidly contracting illnesses, which are usually attributed to infectious diseases. Most nurseries and schools in Japan, however, refuse to accept children even with mild illnesses. For working parents, a sick child may therefore create new problems as the situation requires new day-care arrangements. To support such families, the Japanese government subsidizes construction and management of nurseries that operate especially for sick children. However, it has not been known whether most families are able to access such nurseries. To clarify the accessibility of these services, I calculated the distance to the nurseries from each of the 211,012 “blocks” (small residential areas with a median of 0.18 km²) in Japan and determined the proportion of children aged 0-4 years who lived within 3, 5, 10, 20 or 30 km of the nearest such nursery. Overall, 82.1% of these children lived within 10 km. However, the proportion was lower in northern parts of Japan such as Hokkaido and Tohoku, which have expansive land areas and low population and pediatric department densities. The proportion of children who lived within that same distance of the nearest nursery was also much lower in small towns and villages with 10,000 or fewer residents. Nurseries for sick children were not evenly distributed, and children and their caregivers in under-populated areas had to travel further to access these facilities. As the national government subsidizes such services, children and caregivers throughout Japan should have equal access to them.

Keywords: child care; Japan; nurseries for sick children; social environment; spherical trigonometry
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Introduction

Infants and toddlers often suddenly fall ill with infectious diseases. However, most nurseries and schools in Japan refuse to accept children even with mild illnesses. For working parents of such a child, the situation can rapidly introduce new problems because it necessitates new day-care arrangements. If alternative day-care services are not readily available, one parent—in Japan usually the mother—may have to take leave from work to address the situation and care for the child. One study found that the main cause of workers’ absence in the United States was illness in children (Jordan 1986), though there have been no studies of this sort in Japan.

According to the 2015 Yearly Average Results of the Labour Force Survey, 90.0% of men and 72.1% of women aged 25-34 years were permanently or temporarily employed in Japan (Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2016a). A total of 62.4% of babies in Japan were born to women in this age group (Ministry of Health, Labour and Welfare 2016). Each day, about 6.7% of children in Japan aged 0-4 years

visit medical facilities with complaints of disease or injury (Ministry of Health, Labour and Welfare 2015a), which means that on average each child does so about 24 times/year (365 days × 6.7%). This number of such visits exceeds the mean paid days off taken by male (8.6 days) and female (9.8 days) workers per annum (Ministry of Health, Labour and Welfare 2015b). To avoid taking time off work, parents may ask relatives and friends to provide day care when their children are sick. However, because relatives and friends may not always be available, professional provision of temporary day-care services for sick children is also essential.

To support families with children, the Japanese government has since 1994 subsidized management of nurseries for sick children (Ministry of Health, Labour and Welfare 2009), and expanded the subsidy to include construction of these nurseries and employment of nurses who pick up sick children to take them to such facilities in 2016 (Nihon Keizai Shimbun 2016). This expansion of subsidizing is part of a wider approach by the cabinet of Prime Minister Shinzo Abe to promote the support of these families as well as gender equality in both work and child rear-

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ing. As the subsidies are national, children and caregivers throughout Japan should be equally able to access the services that result. In this study, I calculated the distance between 787 nurseries for sick children and 211,012 “blocks,” which in Japan are small residential areas sized a median of 0.18 km². The calculation could then be used to clarify access to the nearest day-care provider.

Methods

Reference was made to the Ministry of Health, Labour and Welfare’s list of subsidized day-care providers for sick children in Japan as of March 31, 2016. As the list only includes the names and host municipalities of the nurseries, the addresses and ages of children accepted were obtained from the websites of local governments (cities, towns and villages) where these nurseries are located.

Four types of subsidized day-care services for unhealthy children are included in the Ministry’s list: nurseries for sick children (n = 787), nurseries for convalescent children (n = 606), services dispatching child-care professionals to the homes of sick children (n = 9) and nurseries for healthy children that are prepared to care for children who become sick during the day until their usual pick-up time (n = 822). There was no unified definition of “sick,” but it was generally accepted that these children were not so ill that they needed inpatient care.

It may be permissible for nurseries for sick children to care for more severe illnesses compared with other types of day-care services because these nurseries can only accept sick children under a physician’s guidance. In the present study, I therefore analyzed the accessibility of the nearest nursery for sick children, rather than other types of day care.

Japan is divided into 211,012 blocks under the Act on Indication of Residential Address (<http://law.e-gov.go.jp/htmldata/S37/S37HO119.html?sess=5c729dbec39155983>). The respective mean and median areas for these blocks were 1.72 and 0.18 km² as of 2010 (latest data as of January 2, 2017; Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2012).

Details of the child population in each block were available in the 2010 Population Census, and split into three groups by age: 0-4, 5-9 and 10-14 years (Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2012). Because 82.7% of children who used these nurseries in fiscal year 2012 were under 5 years old (Council for Gender Equality of Cabinet Office, Government of Japan 2013), I calculated the proportion of children aged 0-4 years who

lived within particular distances of the nearest nursery. This allowed me to show an index of access to these services.

Latitude and longitude of nurseries for sick children and all blocks in Japan (Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2012) were determined from their locations by a geographic information system using ArcGIS version 10.4 software (Esri, Redlands, CA, USA). The straight-line distance to all nurseries for sick children from the geographic center of each block (determined as the mean latitude and longitude of each) was calculated by spherical trigonometry (Todhunter 2013) using:

$$\text{Distance} = \text{Radius of the Earth (6,378.14 km)} \times \cos^{-1} [\sin(\text{Latitude of Block}) \times \sin(\text{Latitude of Nursery}) + \cos(\text{Latitude of Block}) \times \cos(\text{Latitude of Nursery}) \times \cos(\text{Difference of Longitude between Block and Nursery})].$$

The calculation was run 166,066,444 times (211,012 × 787) using Microsoft Excel 2013 (64 bit version; Microsoft Corporation, Redmond, WA, USA). The proportions of children aged 0-4 years who lived within 3, 5, 10, 20 or 30 km of the nearest nursery were calculated and compared among eight Japanese regions (Table 1, Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2016b).

Population density in Japan was 341 persons/km² as of 2014 (Table 1, Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2016b). Among eight regions, density was higher in Kanto (1,320 persons/km²), Chubu (321 persons/km²), Kinki (759 persons/km²), and Kyushu and Okinawa (325 persons/km²), while it was lower in Hokkaido (69 persons/km²), Tohoku (135 persons/km²), and Shikoku (206 persons/km²). Hokkaido and Tohoku respectively accounted for 21.0% (78,421 km²) and 17.9% (66,947 km²) of the total land area of Japan, while only 4.2% (5,400,000 persons) and 7.1% (9,036,000 persons), respectively, of the total national population lived in these regions (Table 1, Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2016b). The employment rate of women aged 25-34 years was lower than that of men of the same age group. However, among the eight regions, there was no significant difference (Table 2, Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2016a), and there was much lower density of pediatric departments in Hokkaido and Tohoku (Table 3, Ministry of Health, Labour and Welfare 2015c; Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2016b).

Further, to compare accessibility in over- and under-populated municipalities, I classified them into eight groups based on population

Table 1. Social indicators of eight Japanese regions.

Region	Total population		Total land area		Population density	Live birth	Total households
	(persons)	(%)	(km ²)	(%)	(persons/km ²)	(persons)	
Year	2014		2014		2014	2014	2014
1 Hokkaido	5,400,000	4.2%	78,421	21.0%	69	37,058	2,424,317
2 Tohoku	9,036,000	7.1%	66,947	17.9%	135	64,206	3,398,719
3 Kanto	42,797,000	33.7%	32,429	8.7%	1,320	337,976	18,185,563
4 Chubu	23,305,000	18.3%	72,582	19.5%	321	183,841	8,836,129
5 Kinki	20,750,000	16.3%	27,351	7.3%	759	163,397	8,644,585
6 Chugoku	7,436,000	5.9%	31,921	8.6%	233	59,695	3,011,093
7 Shikoku	3,878,000	3.1%	18,804	5.0%	206	28,661	1,605,565
8 Kyushu & Okinawa	14,480,000	11.4%	44,514	11.9%	325	128,640	5,844,533
Total	127,082,000	100.0%	372,969	100.0%	341	1,003,474	51,950,504

Total land area excluding the northern territories and Takeshima Island.

Table 2. Employment rate of men and women aged 25-34 years in eight Japanese regions in 2015.

Region	Employment rate (%)	
	Men	Women
1 Hokkaido	88.9	70.6
2 Tohoku	90.4	75.9
3 Kanto	90.1	73.0
4 Chubu	92.9	70.9
5 Kinki	87.8	69.0
6 Chugoku	90.9	71.9
7 Shikoku	88.1	75.4
8 Kyushu & Okinawa	90.4	72.4
Total	90.0	72.1

Nagano and Yamanashi (in the Chubu region) were included in the Kanto region for the purposes of this table because the data for the northern Kanto region, Nagano and Yamanashi were shown as summed by the labor authorities.

Table 3. Number and density of pediatric departments in eight Japanese regions.

Region	Total land area (km ²)	Department of Pediatrics		Department of Pediatrics / Land area	
		Hospitals	Clinics	Hospitals (/1,000 km ²)	Clinics (/1,000 km ²)
Year	2014	2014	2014	2014	2014
1 Hokkaido	78,421	154	604	2.0	7.7
2 Tohoku	66,947	213	1,262	3.2	18.9
3 Kanto	32,429	672	6,992	20.7	215.6
4 Chubu	72,582	523	4,396	7.2	60.6
5 Kinki	27,351	392	3,590	14.3	131.3
6 Chugoku	31,921	202	1,304	6.3	40.9
7 Shikoku	18,804	138	587	7.3	31.2
8 Kyushu & Okinawa	44,514	362	2,137	8.1	48.0
Total	372,969	2,656	20,872	7.1	56.0

(Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2012) and calculated the proportion of children in each group who lived within 3, 5, 10, 20 or 30 km of the nearest nursery.

This study did not require ethical approval from the Medical Research Ethics Committee of Hiroshima International University because only previously published data from the Japanese government were used.

Results

The locations of 787 nurseries for sick children were plotted on the map of Japan (Fig. 1). All these nurseries provided day-care services for sick children aged 0-4 years. They were distributed unevenly, and there were fewer nurseries in northern parts of Japan such as Hokkaido and Tohoku, which had much lower population and pediatric department densities, though there was no significant regional difference in the employment rate.

The proportion of children aged 0-4 years who lived within 3, 5, 10, 20 or 30 km of the nearest nursery varied by region (Table 4). Overall, 82.1% lived within 10 km. This proportion was lower in Hokkaido (21.1%) and Tohoku (56.5%), and higher in Kanto (89.6%), Kinki (91.4%) and Chugoku (86.6%).

The proportion of children who lived within 3, 5, 10, 20 or 30 km of the nearest nursery also varied between

over- and under-populated municipalities (Table 5). In cities with populations of 301,000-734,000, 95.7% of children lived within 10 km. This figure was 94.6% in the 23 metropolitan wards of Tokyo and the 19 major cities in Japan. However, only 25.2% lived within 10 km in towns and villages with populations of 10,000 or fewer, and 50.4% within the same distance in those with populations of 11,000-30,000.

Discussion

It was previously reported there were few nurseries for sick children in the northern part of Japan (Ministry of Health, Labour and Welfare 2009). However, no studies have analyzed whether children and caregivers in each region were equally able to access these nurseries. This warranted examination of the accessibility of these day-care services. In this study, I thus calculated the distance to the nearest nursery for sick children from each aforementioned block of residential addresses.

Children cared for in childcare centers were found to have an increased incidence of infectious illness (Landis et al. 1991), therefore, it appears preferable to care for children at home to prevent further complications when they are ill. Children aged 0-4 years with complaints of disease or injury visited outpatient clinics in Japan on average

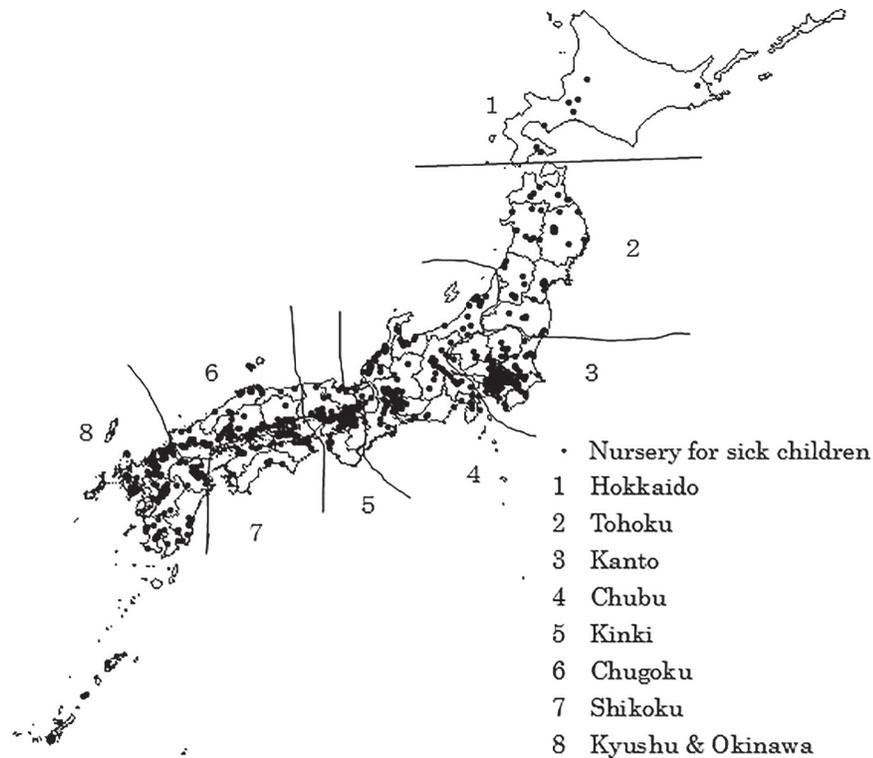


Fig. 1. Locations of nurseries for sick children in Japan.

Japan can be divided into eight regions: 1. Hokkaido; 2. Tohoku; 3. Kanto; 4. Chubu; 5. Kinki; 6. Chugoku; 7. Shikoku; and 8. Kyushu & Okinawa.

Table 4. Proportion of children aged 0-4 years in each region who lived within the stated distance of the nearest nursery.

Region	Distance					Total
	≤ 3 km	≤ 5 km	≤ 10 km	≤ 20 km	≤ 30 km	
	Percentage					
1 Hokkaido	7.2	10.6	21.1	54.4	67.8	100.0
2 Tohoku	25.7	40.4	56.5	74.0	84.5	100.0
3 Kanto	53.9	71.4	89.6	97.6	99.5	100.0
4 Chubu	36.1	56.9	80.5	93.7	97.5	100.0
5 Kinki	58.1	78.4	91.4	96.9	99.2	100.0
6 Chugoku	52.8	71.5	86.6	95.8	98.5	100.0
7 Shikoku	49.0	68.0	82.0	91.4	95.1	100.0
8 Kyushu & Okinawa	51.3	67.7	82.7	91.8	95.9	100.0
Total	47.0	64.8	82.1	92.5	96.2	100.0

about 24 times/year as of 2014 (Ministry of Health, Labour and Welfare 2015a), but the mean duration of paid days off taken by male and female workers in Japan was less than 10 days/year (Ministry of Health, Labour and Welfare 2015b). To avoid taking time off work, many parents likely asked relatives and friends to care for their children when the children were sick. In fiscal year 2012, the capacity of nurseries for sick children in Japan multiplied by working days was 475,400 person-days, and the use of these facilities was 213,930 person-days; an occupancy rate of 45.0% (Council for Gender Equality of Cabinet Office, Government of Japan 2013); this indicates only a small number children used these facilities. However, temporary day-care services provided by childcare professionals for

sick children are essential to supplement care from relatives and friends, which may not always be available. Such day-care services should also be equally accessible anywhere in Japan because they are supported by national subsidies.

The present study found that children and their caregivers must travel longer distances to access the nearest nursery for sick children in northern parts of Japan such as Hokkaido and Tohoku, where only 21.1% and 56.5%, respectively, of children aged 0-4 years lived within 10 km of the nearest nursery. The employment rate of women aged 25-34 years in Hokkaido (70.6%) and Tohoku (75.9%) did not greatly differ from that in Kanto (73.0%), Chubu (70.9%), Kinki (69.0%), Chugoku (71.9%), Shikoku (75.4%) and Kyushu and Okinawa (72.4%; Table 2,

Table 5. Proportion of children aged 0-4 years who lived within the stated distance of the nearest nursery, grouped by population size of their home area (city, town or village).

Population of city, town or village (x 1000, whole age)	Distance					Total
	≤ 3 km	≤ 5 km	≤ 10 km	≤ 20 km	≤ 30 km	
	Percentage					
≤10	4.1	9.5	25.2	46.8	65.4	100.0
11–30	13.4	25.2	50.4	75.8	86.1	100.0
31–50	22.4	35.4	58.0	82.8	92.3	100.0
51–100	34.8	53.4	72.6	89.2	95.1	100.0
101–200	40.6	57.6	79.4	89.1	94.2	100.0
201–300	44.7	66.4	89.1	99.0	100.0	100.0
301–734	52.8	76.0	95.7	98.6	99.6	100.0
23 metropolitan wards of Tokyo & 19 major cities	70.9	87.6	94.6	99.4	100.0	100.0
Total	47.0	64.8	82.1	92.5	96.2	100.0

Cities, towns and villages were classified by population into eight groups.

As of 2010, the Japanese government had not designated Kumamoto as a major city.

Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2016a). However, population densities in Hokkaido and Tohoku were low (Table 1, Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2016b). Therefore, there may not be enough children in the area to justify opening more nurseries. There were also fewer pediatricians per capita (Ministry of Health, Labour and Welfare 2015d) and fewer pediatric departments in hospitals and clinics per 1,000 km² in these regions (Table 3, Ministry of Health, Labour and Welfare 2015c; Statistics Bureau, Ministry of Inner Affairs and Communication of Japan 2016b). It may therefore be harder to obtain the necessary guidance of a physician, mainly a pediatrician, required to enable acceptance of sick children. There may also be shortages of nurses, and of nursery school and kindergarten teachers. Seasonal fluctuations in demand are another potential factor limiting operation of more of these nurseries (Ministry of Health, Labour and Welfare 2009).

The unequal distribution of these nurseries needs to be improved and day-care services for sick children should be accessible anywhere in Japan. As the expansion of subsidizing these nurseries has been part of the Abe government's push to improve gender equality in the workplace, equal access to these facilities is important.

This study had a number of limitations:

- 1) Families may have access to other potential providers of childcare, such as relatives, but this was not taken into account herein. Families may also live closer together in rural areas, which could result in less demand for nurseries for sick children in these areas.
- 2) Distance to the nearest nursery from each residential address block was calculated as the straight-line distance, not road distance, and the time required to reach the nearest nursery was therefore not known.
- 3) The effects of traffic and weather on the time required to travel to the nearest nursery were also not considered,

but could make it more difficult to access nurseries in some areas.

- 4) The operating hours of nurseries, which could make them more or less accessible, were not taken into account.
- 5) It was not known whether each nursery was able to care for babies aged 3 months or younger, who may require a greater level of care, though all the nurseries stated that they accepted children aged 0-4 years.
- 6) The study did not consider whether all nurseries could manage all types of illnesses. The nearest nursery may therefore not always be suitable.
- 7) The socioeconomic status of caregivers was not taken into account.

In conclusion, overall, 82.1% of children were found to live within 10 km of the nearest nursery. However, the proportion was lower in northern parts of Japan such as Hokkaido and Tohoku, which had much lower population and pediatric department densities than in other parts of the country. The proportion was also lower in under-populated towns and villages as compared with big cities. Because the national government subsidizes such facilities, children and caregivers throughout Japan should be equally able to access these services.

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Conflict of Interest

The author declares no conflict of interest.

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