

How Infant Mortality Was Reduced in the Early Twentieth Century in Osaka

Emiko Higami^a, Ken'ichi Tomobe^b

Abstract

In 1983, the Vice Secretary-General of United Nations Children's Fund (UNICEF), Karl Knutsson, visited Japan and remarked that the method of reducing the Japanese infant mortality rate (IMR) was a model for every country. In the early twentieth century, Osaka and at the time of UNICEF's plan in the 1980s, diarrhea was the cause of most babies' deaths, so we consider infant nutrition to be the central issue. The average IMR was 155.4 in rural areas in Japan, and IMR in Osaka city was 231.6 during 1906 to 1910. IMR in Osaka city might have been influenced by somewhat negative urban factors, which we can call the "urban penalty". Dr. Hiroshi Maruyama discovered the α -index in 1938. The α -index represents infant mortality number divided by neonatal mortality number. After all, Maruyama set one month after birth as a boundary to divide endogenous and exogenous. The α -index shows a qualitative measure of infant mortality. Post neonatal mortality was increased due to acquired diseases such as diarrhea, pneumonia, and beriberi. This shows that the effect of the urban penalty was raising the α -index. The α -index of the industrial zones shows that bad maternal conditions affected endogenous factors. Most mothers suffered from a deficiency of breast-feeding capability.

Keywords

Infant mortality rate (IMR), breast-feeding, α -index, IMR from diarrhea, visiting nurses

In 1983, the Vice Secretary-General of United Nations Children's Fund (UNICEF), Karl Knutsson, visited Japan and remarked that the method of reducing the Japanese infant mortality rate was a model for every country. He then asked the Japanese Government to cooperate in the child health care plans of UNICEF, which included: (1) oral rehydration salts that prevent dehydration from diarrhea; (2) the spread of vaccines; (3) the promotion of breastfeeding; and (4) nutrition management through the mass use of growth charts (United Nations Children's Fund [UNICEF] 1983). The reduction in Japan's infant mortality rate (IMR) made through the cooperative efforts of Osaka City Government and Osaka Prefectural Government made a good case study, because, despite the fact that the city had the highest IMR in all of Japan until 1918,

from 1919, its IMR was lower than the figure for all of Aomori Prefecture and it had reduced its IMR to 143.1 (the national average), by 1928. The purpose of this paper is, first, to examine in detail the causes of the comparatively high IMR of Osaka City. Second, the authors examine how the city has managed to reduce its IMR in the 1920s. At the time of UNICEF's plan in the 1980s in Osaka, diarrhea was the cause of the most babies' deaths, so the authors consider infant

^aIndependent researcher, Japan

^bOsaka University, Japan

Correspondent Author:

Emiko Higami, 33-7 Chiyodaminamicho Kawachinagano
Osaka, Japan
E-mail: mge805he@gmail.com

nutrition to be the central issue. Scott and Duncan (2002) note that humans produce milk with a very low nutrient density and have low stress of lactation. They state, "It is usually assumed that this lactation strategy has been determined by the very slow growth rate of the human infant, which in turn has been naturally selected as providing the optimal time for the growth, development, and training of a large brain" (Scott and Duncan 2002). Also, according to Vogeles, feeding practices were the key determinant of infant mortality in the early twentieth century Germany, when the transition to so-called artificial nutrition took place and more than 70% of all infant deaths resulted from gastro-intestinal disorders (Vogele 2001).

In 1938, Dr. Hiroshi Maruyama introduced the α -index, which divides the number of infant deaths by the number of neonatal deaths (Maruyama 1940). At that time, the majority of neonatal deaths were caused by endogenous factors and congenital feebleness, such as preterm birth, congenital weakness, malformation and peculiar disease, and death occurred immediately after birth. Post-neonatal deaths, on the other hand, were caused by exogenous factors such as diarrhea, infectious, and respiratory diseases. Accordingly, Maruyama set one month after birth as the dividing line between endogenous and exogenous factors. Thus, the α -index is a qualitative measure of infant mortality.

Ito (1998) also reported post-neonatal mortality was increased by diarrhea, pneumonia, and the acquired disease beriberi (Ito 1998). Thus, an urban penalty would likely increase the α -index score. Between 1907 and 1932, he conducted infant nutrition surveys and found a low breastfeeding rate associated with the highest IMR in cities. For example, infants fed artificial milk had an IMR 1.8 times higher than that for infants fed breast milk. Table 1 shows the IMR, neonatal mortality rate (NMR, per 1,000 live births) and the α -index scores for Japan and Osaka City. The IMR of Osaka City as a whole was above the national average for one period during the early

Showa era (1926-1945), while the city's α -index score was considerably higher than the national average. When comparing the α -index of Osaka City and the national average, the α -index for Osaka City peaked at 4.3 in 1922, which was in the Taisho era (1912-1926), when the α -index scores were the highest in Japan generally and indicated urban penalty.

The purpose of this paper is, firstly, to examine in detail the cause of the comparatively higher IMR of Osaka City. Figure 1 shows the IMR from diarrhea (per 1,000 live births) of Tokyo, Osaka, Nagoya, and the national average. Between 1908 and 1926, the IMR from diarrhea in Osaka fluctuated from 40 to 70, and diarrhea accounted for most deaths, namely, one-fifth to one-fourth of all infant deaths. The α -index was larger than national average because of these infant deaths from diarrhea. The average IMR of Osaka City was 219.3 during that period, with the IMR from diarrhea playing a major role in the overall IMR. As many mothers in Osaka were unable to breastfeed their babies, they were fed bottled milk, and some suffered malnutrition and consequently died of diarrhea. Women's labor issues might have contributed to the decreased rate of breastfeeding. There were many spinning factories in the Osaka area around 1,900. A female employee generally started work at the factory at 12 or 13 years of age and continued working there for around 10 years or so before getting married and becoming a mother. In this research, the researchers look first at how working practices in the factories may have negatively affected breastfeeding practices, and second, they examine how Osaka City managed to reduce its IMR in the 1920s so that it fell to 143.1 by 1928, which was comparable with the national average.

VARIATIONS IN INFANT MORTALITY BETWEEN DIFFERENT AREAS OF OSAKA CITY

In 1870, the Ministry of Defense built *Hohei Kosho*,

Table 1. Changes in IMR, NMR, and α -index (IMR/NMR) of Osaka City and Japan (1906-1939)

	1906-1912	1913-1919	1920-1926	1927-1933	1934-1939	Average
IMR of Osaka City	226.0	238.6	201.5	142.6	108.8	166.8
NMR of Osaka City	77.4	66.0	53.5	45.5	40.5	52.1
α -index of Osaka City	2.9	3.6	3.8	3.1	2.7	3.2
IMR of Japan	157.9	167.7	156.9	130.7	112.4	145.3
NMR of Japan	73.9	73.4	64.1	52.0	46.3	61.3
α -index of Japan	2.1	2.3	2.4	2.5	2.4	2.4

Note: Source: *Jinko Dotai Tokei* (Vital Statistics of Japan).

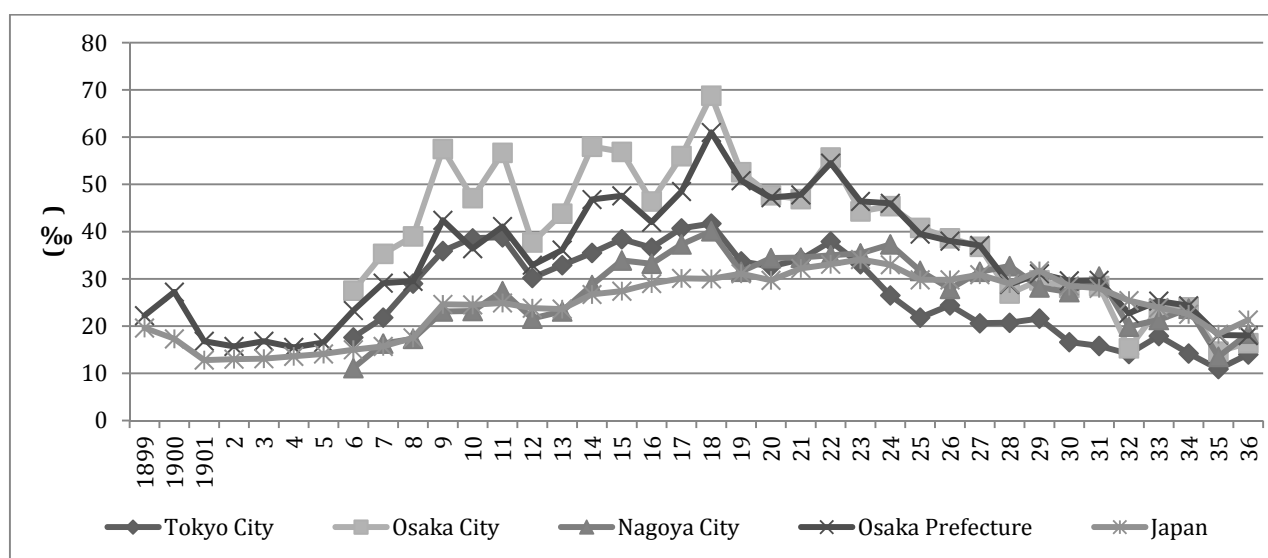


Figure 1. IMR From Diarrhea of Osaka City, Tokyo City, and Nagoya City (1906-1936), Osaka Prefecture and Japan (1899-1936). Sources: *Jinko Dotai Tokei* (Vital Statistic of Japan), *Shiin Tokei* (Cause-Specific Death Statistics of Japan).

the army arsenal, to the east of Osaka Castle, and the plant started producing ammunition and ironware. The following year, the Osaka Mint Bureau was established in Tenma to produce coins and manufacture sulfuric acid and caustic soda. In 1881, the Osaka Steel Company was founded on the northern bank of Aji River. Osaka City was formed in 1889 with four wards (*ku*)—Kita, Higashi, Nishi, and Minami—which were all affluent commercial wards. Outside of the city by Osaka Bay, Nishinari district (*gun*) had some areas with high IMRs. These areas overlapped with the industrial part of the city, and in 1897, 28 outlying towns and villages, including

Konohana (Nishikujo and Nishinoda), Minato, and Taisho were incorporated by the city. At this time, Nishinari district was divided into two areas, Nishinari and Yodogawa, and the Bay area was included in Nishi ward in order to develop its trade. Later, in 1925, Osaka City incorporated Higashinari district and Nishinari district (see Figure 2).

Table 2 shows the IMR, IMR from diarrhea and the α -index in 1920 and 1935 for each Osaka City district and the difference between the two years. In 1920, Konohana, Minato, and Taisho, others all in the Bay area, were industrial zones, and Nishinari district had been industrializing during World War I. The

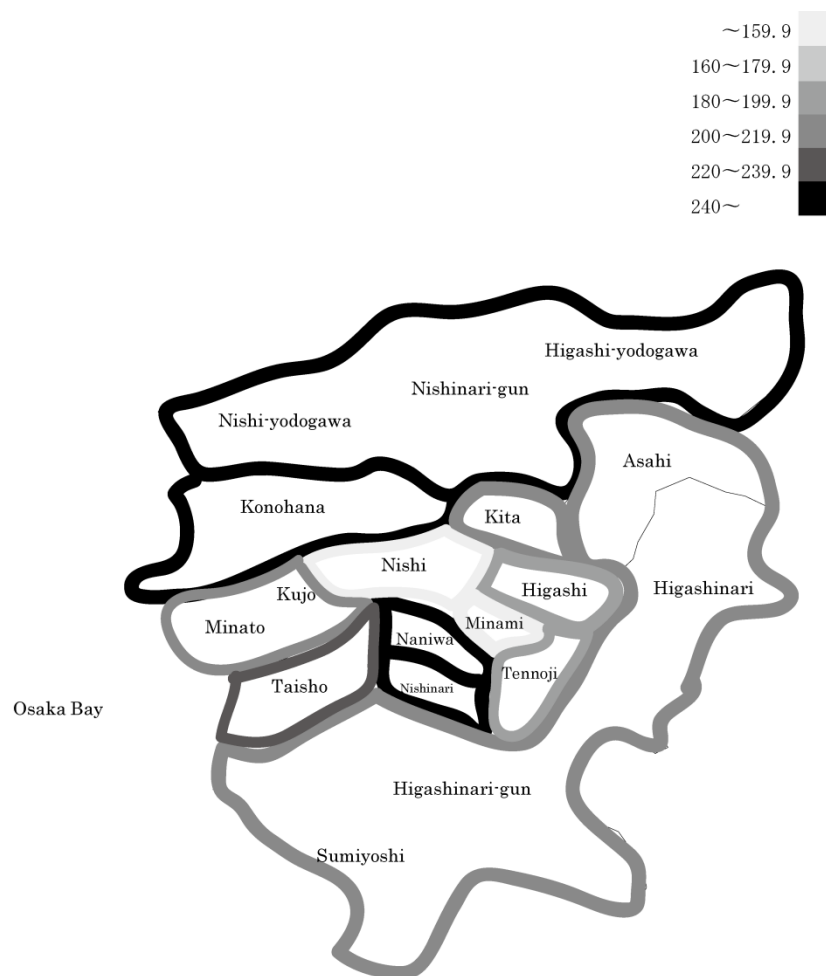


Figure 2. Map (IMRs of Districts in Osaka City, Nishinari-gun and Higashinari-gun, 1920). Source: *Osaka-fu Keisatu-bu* (Osaka Prefecture Police) (1924).

Note: The authors use the average IMR of 1914-1918 in Nishinari and Higashinari districts.

IMR and IMR from diarrhea in these places were higher than in many others and their α -index scores were also high. Next, Higashi and Minami wards were on the lower end of the scale: Most of the workers at the city's arsenal lived in Tamatukuri in Higashi ward and there was a small scale metal industrial zone in Minami ward. The rates for Nishi ward were the lowest, as it had only commercial areas. They were also relatively low for Kita ward, which despite its many chemical factories operating from the northern part of Kita ward to Toyosaki and Nakatu in Higashi-yodogawa, most of the district formed a new

commercial area around Osaka station. Overall then the biggest slums were in Naniwa, in the northern part of Nishinari and the western part of Tennoji. From 1920 to 1935, the eastern part of Tennoji changed to a residential area for salaried workers and Higashinari formed a new small-scale industrial zone. Sumiyoshi and Asahi still had relatively large areas of farmland. Overall, the IMR, IMR from diarrhea and the α -index of slum and industrial areas were higher than commercial, agrarian and salaried workers' residential areas.

Next, comparing Naniwa which had the highest

Table 2. Comparison of α -Index, IMR, and IMR From Diarrhea of Each District in Osaka City (1920 and 1935)

Ward/District	1920(1)			1935(2)			(2)-(1)	
	IMR (‰)	Diarrhea IMR (‰)	α -Index	IMR (‰)	Diarrhea IMR (‰)	α -Index	Diarrhea IMR (‰)	α -Index
Kita	204	45.6	3.10	104	14.9	2.84	30.7	.26
Konohana	271	61.8	3.21	122	15.2	2.87	46.6	.34
Higashi	185	44.8	3.04	99	8.7	2.49	36.1	.55
Minami	176	48.6	3.38	103	10.4	2.61	38.2	.77
Naniwa	275	65.9	3.80	129	19.1	2.73	46.8	1.07
Tennoji	226	63.3	3.47	102	13.0	2.54	50.3	.93
Nishi	133	34.4	2.98	82	8.6	2.28	25.8	.70
Minato	217	58.1	3.28	126	21.0	2.61	37.1	.67
Taisho	223	57.2	3.15	130	18.8	2.93	38.4	.22
Nishinari				140	22.1	2.74	39.6	
Nishi-yodogawa	254*	61.7	n.a.	138	24.7	2.71	37.0	
Higashi-yodogawa				127	22.4	2.81	39.3	
Asahi				120	16.5	2.62	34.6	
Higashinari	213**	51.1	n.a.	144	23.8	2.96	27.3	
Sumiyoshi				96	13.0	2.55	38.1	
Osaka City	209	52	3.27	122	18.1	2.73	33.9	.54

Notes: (1) * Nishinari-gun, ** Higashinari-gun. The authors use the IMR from diarrhea of Nishinari-gun and Higashinari-gun in 1916; (2) The statistics of Osaka City in 1920 did not record the number of births, so the authors calculate it from the population and birth rate recorded for each district. They estimate IMR from the number of births and the number of infant deaths; and (3) Osaka City was composed of 13 wards in the period 1925-1932, 15 wards in the period 1932-1943. Sources: (1) *Osaka-fu Keisatu-bu* (Osaka Prefecture Police) (1924: 20-29); (2) *Osaka-shi Hoken-bu and Osaka Nyuyoji Hogo Kyokai* (Osaka City Health Bureau and Osaka Infant Protection Association) (1937: 19-49).

IMR and Konohana which had the second highest IMR, Naniwa had a high IMR and a high α -index score, whereas Konohana had a high IMR but a low α -index score. This tendency in infant mortality was also seen in the industrial Bay area, such as Taisho. The low α -index score indicates that neonatal mortality was high, where infants died from congenital feebleness. The industrial zones had the worst two indices scores, indicating maternal conditions were the poorest. Naniwa had considerably more infant deaths from beriberi and meningitis caused by breastfeeding and thus its α -index was high.

The IMR of Naniwa was more than twice that of Nishi which had the lowest IMR. However, 15 years

later, the differences between two districts had shrunk to a 1.57 times difference. Moreover, the α -index score for all districts had reduced to less than three. The IMR and α -index values had been equalized. This occurred because an Osaka Prefecture survey had clarified the cause of high infant mortality, and the prefecture and Osaka City actively introduced measures to reduce infant mortality.

PARENTS' OCCUPATION AND IMR

The first national census in 1920 showed that 63% of the population of Osaka City was composed of people who originated from another prefecture. Working women accounted for 23% of the city's female

population aged 14 to 59. The main occupations among the female workforce: Thirteen percent were employers, 7% were employees, and 80% were workers. Employees and workers were different by type of wages and status. Most employers were selling goods and were around 40 to 44 years old. While retailing goods at stores in their houses, they were able to keep house at the same time. Women engaged in commerce could add to their workload and advance to more responsible positions as their children grew. This meant that when a woman working in commerce had to care for her baby, she generally did not have to work hard. When she was under 35 years of age, she was likely an unemployed subordinate, but tended to be a working woman between 35 and 40 years old. In terms of women who were employees, most were public employees like teachers. The majority of female teachers were aged 25 to 29 [*Naikaku Tokeikyoku* (The Cabinet Statistic Bureau) 1926].

The distribution of occupations in Osaka City in 1930 can be broken down as follows: The industrial sector employed 40.36% of workers, the commercial sector employed 37.88% of workers, the public sector and self-employed employed 8.26% of workers, the transportation sector employed 6.36% and primary industry employed 1.63% of workers. Table 3 shows a comparison between the working population rates in industry and business (commercial) in each administrative ward and compared IMR. The researcher presumed that most of immigrant had become an industrial employment. Therefore, he conducted regression analysis with the gap of industrial and business employment rates of each ward as the dependent variable and the immigrated rates as the independent variables. The result reveals partial regression coefficient (.881), t-value (5.137), and R^2 (.6700), and the immigrated rates correlate positively with the gap of industrial and business employment rates with 1% level of statistical significance. This shows the fact that many immigrants turned into

industrial employees. Next, regression analysis, the IMR of each ward as the dependent variable and the industrial and business employment rates as the independent variables, reveals that the business employment rates correlate negatively with the IMRs. Retailing goods in a shop accounted for 60% of commercial employment. As the national census mentioned, women engaged in retail from a shop in their house could continue working while also caring for their baby and keeping house. The other group for whom this trend was clear were salaried business men employed in offices whose wives were homemakers and could therefore breastfeed their babies. It was for these reasons that the IMR among commercial families became low (see Table 4).

Not surprisingly then, industrial employment rates correlated positively with IMRs. If factory laborers became mothers and preferred to continue working, it was hard for them to do so, as there were no day nurseries in the factories. Because they had to work 10 to 12 hours a day, the babies had to have artificial milk while the mothers were working [*Osaka-shi Shakai-bu* (Osaka City Social Research Bureau) 1923]. Moreover, because many laborers' wives working in the spinning factories came from other prefectures, they did not carry on the traditional child care practices of their own mothers.

FEMALE SPINNING FACTORY WORKERS AND NUTRITIONAL FACTORS

In 1883, Osaka Spinning Limited went into business at Sangenya in Nishinari district and started spinning manufacturing with 10,000 bobbins. The company had high dividend yielding stocks. The company introduced nightshifts to fully utilize the machines and maintain good profits, and it was soon joined by many other spinning factories built in the same district or in the Bay area.

A recruiter for the spinning company recruited poor farmers' daughters in the rural prefectures of Western

Table 3. The Working Population Rates of Industrial/Business Activities and IMR (1930)

Ward	Industrial employment rate (1) (%)	Business employment rate (2) (%)	A gap (1)-(2)	Immigrated rate (3) (%)	IMR(4) (‰)
Kita	37.46	41.81	-4.35	31.5	139
Konohana	48.27	31.23	17.07	50.1	122
Higashi	28.27	50.22	-21.95	21.3	95
Nishi	21.78	59.05	-37.27	11.4	113
Minami	25.07	58.15	-33.08	6.0	109
Naniwa	43.28	42.17	1.11	20.1	131
Tennoji	34.81	39.91	-5.10	26.9	144
Minato	40.29	32.24	8.05	59.4	122
Taisho	40.29	32.24	8.05	59.4	134
Nishinari	44.98	35.66	9.32	63.6	132
Nishi-yodogawa	53.98	24.90	29.08	52.5	134
Higashi-yodogawa	51.38	26.50	24.88	54.0	138
Asahi	54.62	27.15	27.47	59.5	124
Higashinari	54.62	27.15	27.47	59.5	143
Sumiyoshi	28.97	39.97	-11.00	53.4	115
Osaka City	40.36	37.88	2.48	43.8	128

Note: Sources: (1) (2) *Naikaku Tokeikyoku* (The Cabinet Statistic Bureau) (1936), (3) *Osaka-shi* (Osaka City) (1933), (4) *Osaka-shi Eisei Sikennsho* (Osaka City Hygiene Laboratory 1931) (1933).

Table 4. The Co-Relationship Between Working Population Rates and IMR (Industry and Business)

Y = IMR	Industrial employment rate	Business employment rate
Occupation rates	.782*	-.783*
t-value	2.8596	-2.8614
R ²	.3861	.3864

Note: * 5% significant (OLS).

Japan. Some spinning companies had a textile weaving factory where over 1,000 employees worked, 78% of who were girls or young women. Female workers under the age of 14 accounted for 10% of all spinning factory workers, 15-20 years old accounted for 36% of all the workers, 20-25 years old accounted for 20% of all the workers, and over 25 years old accounted for 12% of all the workers [*Noshomusho Shokokyoku* (Industrial Bureau of Commerce and Agricultural Ministry) 1903]. Single women lived in dormitories at the factory, and they worked 11 hours per day, from six in the morning to six at night or did a nightshift, with only a one-hour break. Nightshifts were particularly hard for the women workers and many lasted only one year in the factories. Some of them suffered from tuberculosis

(Hanashima and Tomobe 2012). Those who stayed in Osaka often changed jobs to other spinning factories or other types of factories. It was not long before there were shortages in the spinning factories and the recruiters would need to start looking again. This rapid turnover ultimately forced the companies to improve the meals and laundry services for workers so that they could retain them. However, until then, the meals did not contain enough protein and fat, and the workers were not taught how to cook, launder, or keep house by the dormitory staff. They therefore lacked knowledge not only on child-rearing and women's hygiene, but also on breastfeeding (Uno 1915). In 1926, the Factory Law was amended to prohibit women working nightshifts and went into effect in 1929.

When Osaka Prefecture released a report in 1923 on infant nutrition over the past six years in Kujo, 58.6% of infants who died from diarrhea had been fed artificial milk or mixed artificial and breast milk, despite infants fed by artificial milk or mixed artificial and breast milk amounting to only 34.9% of all infants (Kunisawa 1926). Even though, artificial or mixed nutrition clearly carried more risks to infants than breastfeeding, 674 mothers were recorded as changing from breast milk to artificial or mixed milk during that period. Of these 674 cases, 296 of the infants survived and 378 died. As reasons for this change in nutritional behavior, 49.8% of the mothers who switched to artificial or mixed milk did so because they had insufficient breast milk or the infants did not suckle properly. Women in the spinning factories worked so hard that they gradually became weak and anemic (Konishi 1928), causing a lack of breast milk, so the infant would become malnourished [*Osaka-shi Shakai-bu* (Osaka City Social Research Bureau) 1922: 51].

In the early twentieth century in Japan, the nutrient content of artificial milk, such as the amount of protein or carbohydrate, was not always homogeneous. Moreover, because proper dilution was difficult, when a mother switched milk formulations, she should have received instruction from a doctor, but many poor mothers who could afford to see a doctor and so received no such instruction. They diluted milk in their own way, and their infants often suffered malnutrition as a result. The Women Pharmacists Association held a national conference in Osaka in 1925 and proposed the regulation of homogeneous artificial milk to the Secretary of State for the Home Department. It was not until in 1941 that the regulation of homogeneous milk became a reality. In addition, mothers were not knowledgeable about breastfeeding. When they had their first or second baby, their breast milk was often limited because they did not know about the physiology of breastfeeding. Sixty-three percent of mothers whose infant died had given their child diluted condensed milk merely based

on their intuition and did not know that the mammary gland needed suckling stimulation from the infant to give sufficient milk. As an example, although mothers needed to persevere letting the baby suckle the breast for 7-10 days, they often gave up breastfeeding within 2-3 days and started using condensed milk, which was sweet and easy to feed. Babies preferred the condensed milk and stopped suckling the mother's breast. If the mother did not breastfeed for 2-3 weeks, she would no longer lactate. Almost all mothers were found to have changed their feeding method within one month after giving birth (Kunisawa 1926).

The survey also found that 258 mothers (38.3%) changed the way they fed their infant due to illness. Table 5 shows a breakdown of the mothers' illnesses: Eighteen mothers were suffering from possible mastitis and 141 from beriberi, the most prevalent illness, which accounted for 54.7% of all maternal illnesses. Beriberi is caused by a shortage of thiamin and could not be treated. Once it became widely known that beriberi could be transmitted to the suckling infant, a woman who had swollen legs because of light kidney trouble after childbirth often hastily judged herself that she had beriberi and stopped breastfeeding (Higami and Tomobe 2013). So, many mothers did not have accurate knowledge about child-rearing. Infants continued to die because the mothers were not being educated in child care, housekeeping or hygiene by anyone in their families or dormitory staff.

CHILD-REARING AMONG SPINNING FACTORIES WORKERS

The children of factory workers were generally looked after at a day nursery inside the factory. An Osaka Municipal Government survey in 1919 revealed that there were only six factories with a day nursery among 39 textile dyeing and spinning factories with more than 100 employees [*Osaka-shi Shiyakai-bu* (Osaka City Social Research Bureau) 1919]. Six

Table 5. The Survey of Diseases Coming From Nutritional Change in Kujo (1923)

	Died infant's mother	Grown infant's mother	(%)
Beriberi	80	61	54.7
Mastitis	9	9	7.0
Digestive disease	7	7	5.4
Nephritis	7	3	3.9
Heart disease	5	4	3.5
Tuberculosis	1	5	1.9
Other	36	61	23.6
Total	138	120	100.0

Note: Source: Kunisawa (1926: 129-132).

factories chose female workers who liked children to work as dry nurses in the factory day nursery; they did not have a child-rearing schedule. Nevertheless, working mothers could breastfeed during breaks, so their babies were able to avoid malnutrition. Godo Spinning Company recruited temporary female workers with the following offer: To work as a day laborer with 10 hours of work and up to two children could be cared for by nurses at the factory nursery. Many former workers who lived near the factory applied (Uno 1912).

The Factory Law, which mandated a period of five weeks of postnatal maternity leave and one hour of breastfeeding time, was first enforced in 1916. For example, Settsu Spinning Company gave maternity leave for five weeks and 50% wages for the first three weeks. Kanegafuchi Spinning Company workers enjoyed a higher welfare standard than others. The company began to station a midwife in the factory's hospital in 1915. The expectant mother was not only able to give birth in the hospital, but also received prenatal and postnatal midwife check-ups. The company accepted prenatal maternity leave for 30 days and postnatal maternity leave for 45 days, and the mutual aid society paid 70% of total wages (Kanegafuchi Spinning Company 1919). From 1926 to 1931, a maternity list from one factory run by Kanegafuchi Company records 71 deliveries, two stillbirths, and three early neonatal mortalities. The

factory's perinatal mortality rate was 72.5 per mil, which was lower than the average rate of Osaka City (78.9 per mil). This shows the beneficial effect of Kanegafuchi Company's special maternal welfare program. Nevertheless, 14 pregnant workers had only 5.7 days of average prenatal leave, which might have caused premature deliveries. The rate of these premature births amounted to 20% of all 71 deliveries. Moreover, one mother died from acute nephritis after childbirth (The Maternity List of Yodogawa Factory was not printed). Her baby was fed artificial milk, and babies whose mothers had beriberi or nephritis were fed mixed milk. The other infants were fed mother's milk. The mothers were instructed on how to breastfeed during hospitalization. Thirty mothers retired from work after giving birth and 22 returned to work.

In 1927, came medical insurance, and the number of female workers who retired from work after giving birth went down. With insurance, workers were provided maternity leave of 70 days, with 60% wages and childbirth expenses covered. Maternity leave after childbirth was required for an average of 73.8 days. There were no day nurseries in the factory of Kangafuchi Company. When a mother needed to suckle her baby, a babysitter brought the baby to the mother's factory for breastfeeding three times a day. Kanegafuchi Company charged two yen a day for day care. Because nightshift work for women was

prohibited by the Factory Law in 1929, half of new mothers returned to work that year. In 1930, when a labor dispute in Yodogawa Factory was opposing any wage cuts, nine mothers left their jobs. The average age of new mothers was 22.3 years. The company provided the best benefits in the spinning industry to skilled female workers who were experienced. However, more employees retired than returned. This was because female workers were able to live on only their husband's wage. Fortunately, the level of real wages for workers rose during the 1920s. As a result, both their living conditions and living standards were much improved. Some wives of working families did not need to work at a factory any longer, leaving more of them to cook and take care of their children instead. Although all spinning companies should have employed midwives at their clinic, only Kanegafuchi Company did so. Why was employee's welfare at Kanegafuchi Company better than others? Other spinning companies had the marked tendency which gave priority to the dividend to stockholders over employees' wage and treatment. Kanegafuchi Company took the management policy of extended family principle which regarded the employee of the company as a family. By hospitable distribution of profit to workmen including welfare, the company was trying to maintain the stock price by the evaluation of the stability of management (Kuwahara 1993).

EDUCATION FOR POOR MOTHERS

Hikoichi Motoyama, then President of Osaka Mainichi Newspaper, formed the Osaka Mainichi Newspaper Charity Organization to promote medical care in 1911. He learned that many pregnant women among the poor did not receive care from a midwife during childbirth. In 1914, the organization started to offer free midwifery services to poor pregnant women who did not otherwise have access to a midwife. The women who applied needed to ask the police department for a ticket to use the midwifery services.

The midwife conducted prenatal check-ups and provided care during the delivery. Osaka Prefecture also appointed Shigejiro Ogawa as an adviser in 1918 and he established a regional nongovernmental relief service system. This service supported elderly people and handicapped persons who either had no caregivers or were not able to support themselves. Also, poor families earning less than 25 yen per month could receive the service even if all family members worked [*Osaka-fu Naimu-bu* (Osaka Prefecture Home Affairs Bureau) 1921]. In 1920, he began assistance for pregnant women who would not be able to provide care for their infants. These women were malnourished and did not have access to a midwife or treatment. In 1923, the charity, in cooperation with the relief service system, employed 40 midwives, arranging for one part-time midwife to work in each district. The midwife helped bathe the newborns for seven days after birth, took care of the newborn's umbilical cord and when a mother found it difficult to obtain enough breast milk, taught the mother to easily dilute a bottle of milk, and sold the mother milk at low cost.

The charity's midwives handled 373 cases, and in 1929 for example, of the 333 babies born, 171 celebrated their first birthday. Notably though, 100 other infants moved with their mothers, often with the family slipping out of town quietly, although some were adopted and some went to the mother's home town. Of the 373 infants delivered, 62 died: twenty-one died from a congenital defect, 19 died from diarrhea (two were breastfed and the remaining 17 babies were fed artificial or mixed milk), six died from pneumonia, and seven died from unknown causes. If we assume that all the 100 babies that moved away with their family survived, then the IMR of babies whose mothers used the charity were 186, which was actually higher than the IMR of 161 for Osaka City in 1929. The extremely poor housing conditions in which these babies were born and raised; were overcrowded, dark, and draughty, with poor sanitation. Parturient women visited the charity's

midwife to deliver the baby without having any prenatal checkups. Women who were nine months' pregnant accounted for approximately half of all who used the free midwifery service. They were employed as maids or factory workers. Women who were factory workers had usually worked hard, having a side job not only before childbirth but also soon afterwards. The charity's midwives helped with 2,132 babies (2,107 pregnancies) during the period 1914-1930: normal deliveries 1,751, preterm deliveries 174, 41 miscarriages, and 141 stillbirths.

Osaka City established the Osaka City Child Guidance Clinic in 1918. The head of the Clinic, Hiraku Sandaya, regarded infants as being included in the term "child" and clinic instructors, therefore, visited homes where mothers did not know how to care for their babies and provided them instruction. The clinic was reorganized into Osaka City Nursery in 1924. The visiting nurses chose houses that appeared poor and unable to access medical care. They visited five times within the first 100 days of birth, instructing mothers how to breastfeed or how to safely feed milk to infants who could not breastfeed. The visiting nurses had to break down the superstitions surrounding child care. For example, superstition meant that a newborn's first drink was not his mother's milk but an infusion of medicinal herbs, saffron, rice gruel, salt water, sugar water, raw milk, and so forth. Only one-fourth of all mothers gave her newborn her own breast milk. They taught nutritional improvement and prevention of beriberi and meningitis. If they found the babies were sick, they suggested the mothers use a free ticket they provided (available to families earning less than 800 yen a year) to go to the clinic in Osaka City Nursery. These early treatments saved the lives of many infants (Mino 1926).

In 1927, Naoaki Okubo, a pediatrician at Osaka Hospital of the Japan Red Cross, and Kan'ichi Kawakami, a social manager from Osaka Prefecture, established the Osaka Infant Protection Association

aimed at reducing infant mortality in cooperation with social work organizations and medical institutions. The association announced a minimum standard of social facilities for infant protection. This standard included maternity protection for female factory workers and legal measures for single-mother households with a low-income earner. The association held an infant protection week to educate citizens and waged a campaign called "Let us reduce the infant mortality rate as the first step". The association had the Osaka Prefecture's governor as chairman and its mayor as vice president. They appealed for infant protection through a radio broadcast. Some of the association's directors taught child-rearing or first-aid for sick babies at lectures in women's clubs in 17 areas in the city. Pediatricians also cooperated with a request from the Osaka Medical Association and performed infant medical examinations in four department stores [*Osaka Nyuyoji Hogo Kyokai* (Osaka Infant Protection Association) 1927].

In January 1928, the association established Oga Infant Health Center in Ichioka. The center's nurses registered 500 babies in the area, visited their homes, and instructed the mothers on breastfeeding and child-rearing. The association began distributing milk to babies of the poor every morning that was bought through fundraising efforts during infant protection week to prevent babies from suffering malnutrition. Since maternal malnutrition or job pressures were the reasons for the limited number of babies' breastfed, the association offered mothers nutritional goods and livelihood assistance. Over the next decade, infant health centers were built in 12 areas where workers and day laborers lived.

Table 6 lists the families to whom milk was distributed in Nagara, which had the most milk distributions in the 12 areas. Also, Saint John's School attached to an orphanage began providing medical checkups in the area once a week and had a visiting nurse. There were five facilities that cooperated with this program and 10 facilities that helped with milk

Table 6. List of Families Who Received Milk From the Nagara Infant Health Center (1930)

Infant	Parent			Notes
Age (months)	Age of father/mother or dead/divorced status	Occupation of father/mother	Income (yen)	
9	36/24	Glass worker/Paper peddler	2.2/day	
3	44/38	Day laborer/—	1.5/day	Welfare commissioner supports family
4	42/40	Heaver laborer/ Home knitter	45.0/month	Elder brother earns
12	36/32	Day laborer/—	20-30/month	Twins
5	Divorced/22	Barmaid	20-25/month	Grandparent raising infant
7	25/Divorced	Wheat-gluten bread maker	2.0/day	Aunt raising infant
9	37/37	Vegetable peddler/ Knitting finisher	.9/day	
17	Divorced/23	Sewing machinist	30.0/month	Infant is weak
5	26/Dead	Candy peddler	1-.8/day	
6	31/29	Barber’s employee/—	20.0/month	Back rent owed: 70 yen

Notes: Nagara was located in Higashi-yodogawa Ward. Source: Hibi and Honda (1931: 22-23).

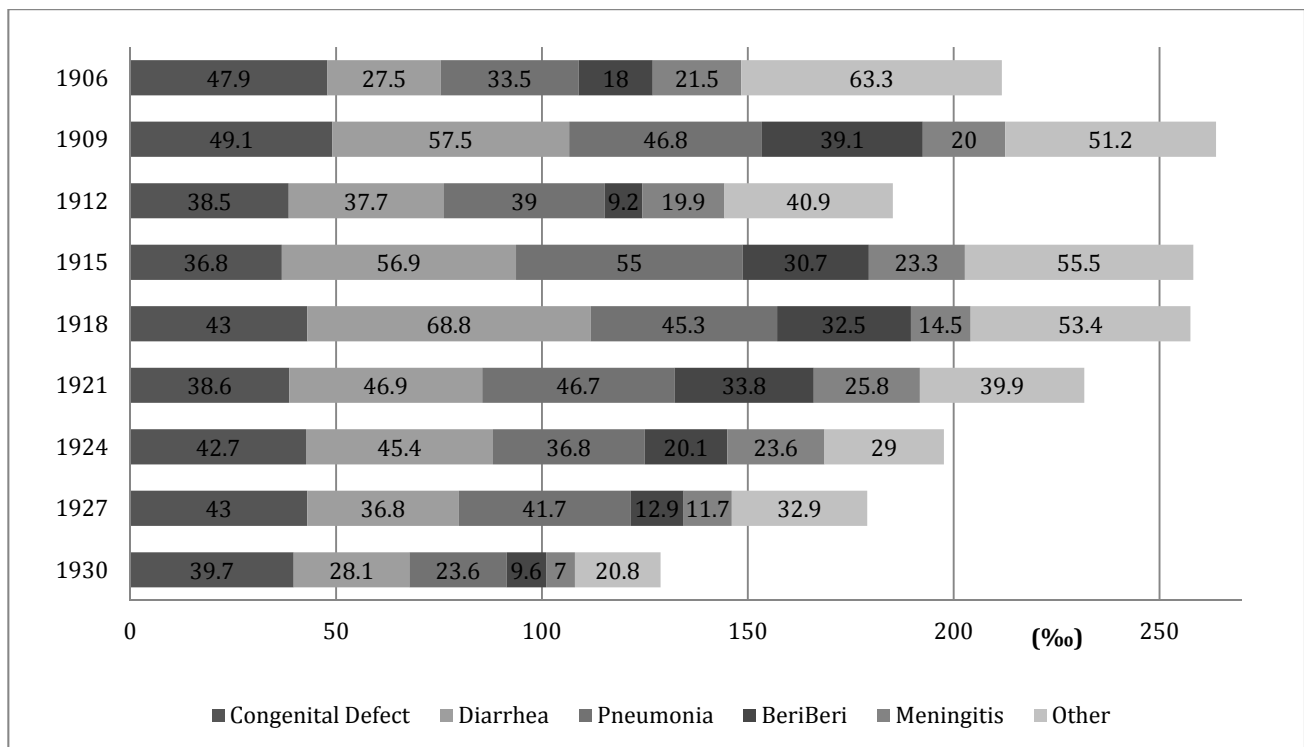


Figure 3. The Distribution of Causes of Infant Deaths in Osaka City (1906-1930, unit: %). Sources: *Jinko Doutai Tokei* (Vital Statistics of Japan), *Shiin Tokei* (Cause-Specific Death Statistics of Japan), and Tomobe and Suzuki (2006) (<http://www.rekishow.org>).

distribution. The health nurse’s everyday activities and the campaign for infant protection gradually

promoted awareness about infant protection among Osaka residents.

Thus, as it can be seen in Figure 3, the IMR from diarrhea of Osaka City was reduced from 68.8 in 1918 to 28.1 in 1930, a drop of 40.7. The midwives provided by the newspaper's charity and the visiting nurse of Osaka City Nursery were proactive in the prevention of infantile diarrhea. Mothers needed to have knowledge about nutrition and child-rearing, especially how to breastfeed and dilute artificial milk safely and hygienically. The nurse of Osaka Infant Protection Association participated in not only distribution of milk in the early morning but also supplying nutrition goods and livelihood assistance so that the infant of the poor who were not breastfed might not suffer malnutrition.

CONCLUSIONS

The industrialization of Osaka occurred mainly through growth of the textile industry. Young women from rural areas joined the spinning factory workforces. Once there, they worked long hours and had poor diets, which caused illnesses like anemia. After childbirth, their poor general health condition often meant they found breastfeeding difficult. In addition, long hours of standing while pregnant at work tended to cause premature delivery. The young women's mothers tended to live far away, unable to teach them how to raise children, maintain hygiene, and keep house. For these reasons, they did not understand the physiology of breastfeeding—a desperate problem since their baby's lives depended on them having such knowledge. The IMR in the industrial areas was higher than in other areas and the α -index was lower than in the slum, indicating poor maternal health conditions associated with endogenous factors and congenital feebleness. In addition, most mothers could not produce enough breast milk and had to depend on bottle-feeding without any knowledge of handling artificial milk. It was not until in 1941 that the regulation of homogeneous milk became a reality. Therefore, it was difficult to dilute milk properly.

Their babies died from diarrhea or pneumonia because they were malnourished. However, once charitable and later municipal efforts began in Osaka, the IMR rate gradually improved as care and instruction for the mothers improved infant survival rates. The midwives offered prenatal checkups, childbirth assistance, bathing the newborns, milk at low cost. Visiting nurses instructed the mothers how to breastfeed, prevent beriberi, and free clinic access. Nurses of the infant health center distributed milk and improved babies' nutrition. These early treatments and efforts saved the lives of many infants.

From 1926 to 1931, a maternity list from the factory run by Kanegafuchi Company records 71 deliveries. The rate of these premature births amounted to 20% of all. But the mothers were instructed on how to breastfeed during hospitalization. Almost infants were fed by mother's milk. Also, the company provided the best benefits in the spinning industry to skilled female workers. However, more employees retired than returned. This was because female workers were able to live on only their husband's wage. Fortunately, the level of real wages for workers rose during the 1920s. Later as the standard of living gradually rose, households could manage on the husbands' wages and wife's wages for piecework done at home, and the women rarely returned to the factory work. The lives of the infants depended on their mothers having adequate knowledge of nutrition and child-rearing. Therefore, Ogawa and Sandaya's administrative talents and Motoyama's organizational skills were crucial in the fight to reduce infant mortality. Okubo and Kawakami established the Osaka Infant Protection Association aimed at reducing infant mortality in cooperation with social work organizations and medical institutions. The association held an infant protection week to educate citizens. As a result of all these efforts, the IMR from diarrhea of Osaka City was reduced in a relatively short space of time from 68.8 in 1918 to 28.1 in 1930, it was 40.7.

References

- Hanashima, M. and K. Tomobe. 2012. "Urbanization, Industrialization and Mortality in Modern Japan: A Spatio-temporal Perspective." *Annals of GIS* 18(1):57-70.
- Hibi, K. and C. Honda. 1931. "Shoni hokensho no gyunyu haitatu" (Milk Distribution by Infant Health Centers). *Nyuyoji-Kenkyu (Infantile Research)* 5(2):17-26.
- Higami E. and K. Tomobe. 2013. "Infant Mortality and Beriberi in Osaka City Between the World Wars: Impact of the Mother's Diet on Health." In *Environmental History in East Asia: Interdisciplinary Perspectives*, edited by Tsui-jung Liu. London: Routledge.
- Ito, S. 1998. "Senzen Nippon ni okeru nyujishibo mondai to sono taisaku" (The Decline Infant Mortality in the Pre-war Japan). *Shakai-Keizaishigaku (Socio-Economic History)* 63(6):725-752.
- Kanegafuchi Spinning Company. 1919. "Jugoin kofuku zosin ni kansuru sisetu oyobi toriatukai" (*Facilities for Employee's Welfare and Treatment*). Tokyo: Kanegafuchi Spinning Company.
- Konishi, Y. 1928. "Fujin Rodosha no hinketsu sono genin ni tuite" (The Cause of Anemia of Textile Female Workers). *Rodo Kagaku Kenkyu (Labor Science Research)* 5(4):65-91.
- Kunisawa, T. 1926. "Nyuyoji hogo ni kansuru hokoku" (*Reports on the Protection of Infants and Children*). Tokyo: Naimusho Eiseikyoku (Hygiene Bureau of Home Affairs Ministry).
- Kuwahara, T. 1993. "Nippon ni okeru kindaiteki kojo kanri no keisei ge" (Formation of the Modernistic Factory Management in Japan). *Kyoto Sangyo University. Keizai Keiei Ronso (The Economics and Business Administration Review)* 28(1):17-43.
- Maruyama, H. 1940. *Nyuji shibo Kenkyu note I (Infant Mortality Research Note. 1)*. Osaka: Osaka Nyuyoji Hogo Kyokai (Osaka Infant Protection Association).
- Mino, Y. 1926. "Nyuji-in jigyo no jissai-mondai" (The Practical Problem of Nursery Project). *Shakai Jigyo Kenkyu (Research of Social Projects)* 14(5):5-27.
- Naikaku Tokeikyoku (The Cabinet Statistic Bureau). 1899-1938. "Shiin tokei" (*Cause-Specific Death Statistics of Japan*). Tokyo: The Cabinet Publishing Bureau.
- . 1899-1939. "Jinko dotai tokei" (*The Vital Statistics of Japan*). Tokyo: The Cabinet Publishing Bureau.
- . 1926. "Dai 1-kai kokusei chosa fuken no bu Osaka-fu Dai 3" (*The First National Census Part of Prefecture No. 3 Osaka*). Tokyo: The Cabinet Publishing Bureau.
- . 1936. "Rokudai Tosh chukan jinko" (*Daytime Population in Japanese Six Main Cities*). Tokyo: The Cabinet Publishing Bureau.
- Noshomusho Shokokyoku (Industrial Bureau of Commerce and Agricultural Ministry). 1903 (1998). "shokko jijo" (*The State of Laborer*). Tokyo: Iwanami Shoten.
- Osaka Mainichi Shinbun Jizen-dan (Osaka Mainichi Newspaper Charity Organization). 1931. "Osaka Mainichi Shinbun Jizen-dan 20nen-shi" (*The History Between Twenty Years of Osaka Mainichi Newspaper Charity Organization*). Osaka: Osaka Mainichi Newspaper Charity Organization.
- Osaka Nyuyoji Hogo Kyokai (Osaka Infant Protection Association). 1927. "Hogo shisetsu saitei kijun" (The Minimum Standard of Protecting Facilities). *Nyuyoji (Infantile Research)* 1(3):93-94.
- Osaka-fu Keisatu-bu (Osaka Prefecture Police). 1924 (2007). "Osaka-fu eisei siryo 2" (*Osaka Prefecture Hygiene Report, Vol. 2*). Tokyo: Kingendai Siryo Kankou-kai (Publication of Modern Date).
- . 1925. "Osaka-fu eisei siryo 3" (*Osaka Prefecture Hygiene Report, Vol. 3*). Tokyo: Kingendai Siryo Kankou-kai (Publication of Modern Date).
- Osaka-fu Naimu-bu (Osaka Prefecture Home Affairs Bureau). 1921. "Osaka-fu Homen iin Jigyo nenpo Taisho 9nen" (*An Annual Report of Regional Relief Service Commissioner in Osaka Prefecture 1920*). Osaka: Osaka Prefecture Social Department.
- Osaka-shi (Osaka City). 1933. *Osaka-shi tokei-sho (The Annual Statistics of Osaka City 1932)*. Osaka: Osaka Municipal Office.
- Osaka-shi Eisei Sikensho (Osaka City Hygiene Laboratory). 1933. "Osaka-shi eisei sikensho jigyo seiseki gaiyo" (*Achievement Report of Hygiene Laboratory 1931*). Osaka: Osaka City Hygiene Laboratory.
- Osaka-shi Hoken-bu and Osaka Nyuyoji Hogo Kyokai (Osaka City Health Bureau and Osaka Infant Protection Association). 1937. "Osaka-shi eiseikumiai-betu syusan shibo nyuji-shibo chosa" (*Survey of Births, Deaths and Infant Deaths by Hygiene Districts of Osaka City*). Osaka: Osaka City Health Bureau and Osaka Infant Protection Association.
- Osaka-shi Shakai-bu (Osaka City Social Research Bureau). 1919 (1981). "Rodo chosa hokoku 3, Kojo ni okeru fukuri zoshin shisetsu" [*Labor Research Series Report (LRSR) No. 3: Facilities for Laborer's Welfare in Each Factory*]. Osaka: the Bureau of History in Osaka City.
- . 1922 (1981). "Rodo chosa hokoku 13, Shokko hoken" (*LRSR, No. 13: Labor's Health*). Osaka: the Bureau of History in Osaka City.
- . 1923 (1981). "Rodo chosa hokoku 22, Koyo kankei" (*LRSR, No. 22: An Employment Relationship*). Osaka: the Bureau of History in Osaka City.
- Scott, S. and C. J. Duncan. 2002. *Demography and*

Nutrition: Chap. 8. Infancy: Evidence From Historical and Contemporary Population. Oxford: Blackwell publishing.

Tomobe, K. and A. Suzuki. 2006. "Shiin-betsu shibousya-subetu Tokei data besu" (*Cause-specific Death Statistics Database in Japan*). Retrieved (<http://www.rekishow.org>).

UNICEF (United Nations Children's Fund). 1983. *The State of the World's Children 1983*. New York.

Uno, R. 1912. *Shokko mondai shiryō. I* (*Date on the Factory Worker's Problem I*). Osaka: Kogyo Kyoikukai Syupan (Factory Education Press).

—. 1915. *Shokko Yugu-ron Soron dai-1* (*Problem of Treatment to Factory Worker: General Remarks, Part I*). Osaka: Kogyo Kyoikukai Syupan (Factory Education

Press).

Vogele, J. 2001. *Sozialgeschichte städtischer Gesundheitsverhältnisse während der Urbanisierung (The Social Class in Some Cities Maintained Their Health in Their Urbanization)*. Berlin: Duncker & Humblot.

Bios

Emiko Higami, Ph.D. of economics, independent researcher, Osaka University (completed); research fields: infant mortality, history of women and gender equity.

Ken'ichi Tomobe, Ph.D., professor, Faculty of Economics, Osaka University, Japan; research fields: economic history, historical demography, and social history of medicine.